UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DiSTAR Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse

PhD Thesis in

Earth Sciences, Environment and Resources

XXXI° cycle

MACROEVOLUTIONARY ANALYSIS OF PRIMATES WITH SPECIAL REFERENCE TO THE GENUS *HOMO*

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2017/2018

Table of contents

Abstract

The present thesis focusses on fossil Primates, their ecological characterization, morphological evolution and diversification, and an array of new tools to study their anatomical features. The text is divided in three different parts, presenting a collection of either published or submitted manuscripts. The first part regards the morphological adaptation and diversification of Primates. The inaugural paper (*"Macroevolutionary trends of brain size in primates"*, Melchionna et al., under review) deals with the identification and the analysis of macroevolutionary trends in brain size evolution in Primates. We applied Phylogenetic Ridge Regression (RRphylo) to found possible shifts in morphological rates and their temporal trend. Furthermore, we computed diversification rates (DR). We found a significant increase in encephalization quotient (EQ) rates in the hominins group with an overall increase in EQ values. We found a significant correlation between DR and both EQ rates EQ values. There is also a linear relationship between speciation and extinction rates. Eventually, we found an increase in speciation rates and a reduction in extinction rates with an increase in EQ values. The second paper ("*Unexpectedly rapid evolution of mandibular shape in hominins*"; Raia et al., 2018) is about the evolution of mandibular shape from ancient primates to the genus *Homo*. We used the Geometric Mophometrics and the Phylogenetic Ridge Regression to compute evolutionary rates in mandibular morphology. We found that mandible shape evolution in hominins is exceptionally rapid as compared to any other primate clade.

In the second part of the thesis I introduce new advances in the field of the Virtual Anthropology. The first is a new protocol to obtain three-dimensional reconstruction of inner and outer surfaces of fossil specimens *("Reproducing the internal and external anatomy of fossil bones: Two new automatic digital tools"*; Profico et al., 2018). By using the R software platform, we developed two automatic tools to reproduce the internal and external structures of bony elements. The first method, Computer-Aided Laser Scanner Emulator (CA-LSE), provides the reconstruction of the external portions of a 3D mesh by simulating the action of a laser scanner. The second method, Automatic Segmentation Tool for 3D

objects (AST-3D), performs the digital reconstruction of anatomical cavities. Both methods are embedded in the packages "Arothron" (Profico et al., 2018) and "Morpho" (Schlager, 2017).

The second protocol presented in this section is about the reconstruction of the original shape of fossil bones damaged and deformed by taphonomical processes (*"A new tool for digital alignment in Virtual Anthropology"*; Profico et al., 2018). We developed a new, semi-automatic alignment R software, Digital Tool for Alignment (DTA). This tool uses the shape information contained in a reference sample to find the best alignment solution for the disarticulated regions.

The third part of the thesis focusses on *Homo*, and in particularl on the relationship between *Homo neanerthalesis* and *Homo sapiens*. The first paper of this section is about the status of the Neanderthal niche fragmentation toward their demise (*"Fragmentation of Neanderthals' pre-extinction distribution by climate change"*; Melchionna et al., 2018). By using Species Distribution Models, and a habitat fragmentation analysis, we reconstructed the ecological niche of both human species. We found *Homo sapiens* had greater ecological plasticity over Neanderthals, which probably allowed this species to better react to climatic worsening at 44 and then at 40 ka. However, Neanderthals potential habitat appears to be very reduced and fragmented during the last phase of their occupation.

The second paper of this last section regards the role of *Homo sapiens* in the Late Pleistocene megafauna extinction ("*The well-behaved killer: Late Pleistocene humans in Eurasia were significantly associated with living megafauna only*"; Carotenuto et al., 2018). Starting from a rich faunal and archaeological database, and by using SDMs, we obtained megafauna and humans occurrence probability maps over the last 40 ka in Eurasia. Then, we divided species in ecological groups (i.e., body size and feeding category combined). We evaluated their geographical overlap to human range and the species suitability in the core area of *Homo sapiens*. The results indicated that the extinct megafauna was rare within humans' range and Palaeolithic hunters had stronger association to extant rather than extinct herbivorous species.

Keywords: Primates, encephalization, Homo

Introduction

Primates origins and diversification

One of the most intriguing question in studying the diversification of mammals, is where we humans come from. In this perspective, to study the Primate evolution is by definition the starting point.

Mammalian species are known since the Mesozoic, but Primates made their appearance only between the Cretaceous and the Palaeocene periods (66 Ma). Relaxed molecular clock analyses of divergence times (Drummond et al., 2006) suggest that living Primates shared a common ancestor at 71–63 Ma (Springer et al., 2012), confirming the palaeontological data. The transition between Mesozoic and Cenozoic was marked by an intense geological change in continental organization and orogenetic processes, as best testified by the formation of the American Rocky Mountains and Andes. North America and Europe were closer than today and connected by intermittent land bridges. Africa and Europe were still separated by the Tethys Sea with no possibility of faunal migration. India had not collided with the mainland and the formation of the Himalayan mountain range had not started yet.

Traces of Primates origins can be found during the Cretaceous-Palaeocene transition. Among mammals, it has been proved that flying lemurs (Dermoptera) and tree shrew (Scadentia) can be the closest relative groups to primate and some shared adaptation could have been fundamental in their diversification and evolution (Fleagle, 2013).

Plesiadapiformes were long recognized as the first primates to appear on Earth, between the Palaeocene and the Eocene epochs (around 55 Ma). However, there is a vivid debate on the phylogenetic relationships among Plesiadapiformes, Primates and other Euarchontans (Silcox, 2007). Today, Plesiadapiformes are commonly identified as the stem group of Euriprimates (Bloch et al., 2007). They were well diffused in North America and Eurasia during the Palaeocene and the Eocene periods with almost 120 different species. They were largely diversified, both in terms of body size and dental adaptation, and represented a sizeable share of the Palaeocene mammal fauna. Plesiadapiformes were characterized by the very long snout, a flat skull with a small brain, and did not present a post-orbital bar, which is one of the most important features of the Euriprimates. Their demise is probably linked to competition with other mammals or climate stated to change (Fleagle, 2013).

Euriprimates diversified during the early Eocene, around 55 million years ago (Smith et al., 2006). The most remarkable climatic event at that time was a period of high temperatures, known as Paleocene-Eocene Thermal Maximum (PETM). This epoch was characterized by a marked change in North American and European faunas, where archaic types of mammals were replaced by some modern lineages. During this epoch, North America and Europe were still connected at high latitudes but became more distant through time. During this period there wasn't polar ice, due to the warm climate conditions. Both paleogeography and paleoclimate contributed to this faunal change and to the rise and to the diversification of Primates. Moreover, today the geographical distribution of non-human primates is tropical and pan-equatorial, from around 40°S to 40°N latitude. During the Eocene the geographic range of primates extended to about 60°N latitude (Gingerich, 2012).

The first primates were markedly different from the Plesiadapiforms, with a shorter snout, smaller infraorbital foramen and the postorbital bar. They also had larger rounded brain cases and a postcranial anatomy well suited for leaping. Their digits had nails, rather than claws and they also had opposable hallux. Vision became more important over other senses due to the arboreal life and the necessity to leap between branches.

The first primates are divided in two different groups: omomyids (Eocene) and adapiforms (Eocene-Late Miocene). The first recognizable genera of both groups are *Donrussellia*, *Cantius* and *Teilhardina*. The appearance of these early primates was thought to be simultaneous in North America and Europe (Genus *Teilhardina*; Smith et al. 2006). This is not surprising, considering the geographical and climatic homogeneity in the northern hemisphere. However, the presence of Early Eocene adapiformes in Mongolia (*Altanius orlovi*) and Morocco (*Altiatlasius koulchii*) make the interpretation of Primate evolution more difficult. Moreover, new adapiforms findings in Egypt continue to add pieces to this unsolved puzzle (Seiffert et al., 2018). About similarities with the extant Primates, both adapiformes and omomyids were attributed to the extant Strepsirrhines (lemurs, galago, pottos and lorises), due to their post-orbital bar and no post-orbital closure, opposable thumbs, nails, a grooming claw, and forward-facing eyes. However, today the adapiformes are closely linked with Strepsirhines, while omomyids are thought to resemble to the extant tarsiers because of the presence of large eyes and several similarities in cranial and post-cranial characteristics. During the Middle Eocene there were also primates attributable to the same families within the tarsiers. Because of these similarities, today omomyids are classified as a stem group of Haplorrhines (Rosenberger et al., 2011). However, there is not a general consensus about the phylogenetic relationship, the geographical origins, and the ancestor of the modern primate lineages, as different sources lead to different explanations.

The Oligocene (34-23 Ma) was a very important epoch in primate evolution. During this epoch, the continental disposition started to look like the actual mainland shape. India had joined the Asian mainland, the Thetys Seaway was closed off and both Australia and South America were separated from Antarctica. The Oligocene was characterized by cooler and drier climate condition. A dramatic decrease in the CO_2 levels in the atmosphere trigged a decrease in global temperatures and the formation of an ice-sheet at the south pole (Galeotti et al., 2016). This ice-sheet formation could have originated the Antarctic Circumpolar Current (ACC, Goldner et al., 2016) causing a severe decrease in sea levels. Due to these climate and geographical changes, there was a marked mammal faunal turn-over, including primate groups. There was the vanishing of the ancient groups as adapiformes and omomyids but, at the same time, Primates colonized tropical and subtropical biomes in both the New and the Old World (Harcourt et al. 2006; Poux et al. 2006; Schrago 2007). At the same time, anthropoids became dominant in Africa.

One of the richest fossiliferous deposits during the Oligocene comes from the Fayum Depression in Egypt. Evidences from sediment analyses show that the Fayum region was wet and warm at the time, with probable seasonality and mangrove-like plants (Fleagle, 2013). The stratigraphic sequence of the Fayum formation is rich of early anthropoid genera (*Quatrania*, *Oligopithecus*, *Propliopithecus*, *Parapithecus*, *Aegyptopithecus*). The Early Oligocene anthropoids were small to medium sized, they had teeth that indicate a frugivore diet, and seem to have been arboreal quadrupeds and leapers. Early anthropoid remains were also found in Asia (i.e. Eosimiids) ad some authors recognized them as basal members of the anthropoid clade (Beard and Wang, 2004).

The Late Oligocene is also characterized by the earliest occurrences of platyrrhines (New World Monkey) in the fossil record of South America. One of the major questions about the platyrrhine evolution is about how they arrived in South America. South America was an isolated continent, since the Eocene it begun to get further away from Africa and the connection between North and South America did not form until the Late Miocene. Evidence indicates that the first plathyrrines were anthropoids, more than prosimians (Fleagle, 2013). As there isn't any evidence of anthropoids in North America, the dispersal across the South Atlantic from Africa seems to be the most reasonable explanation but the debate is still open.

During the Miocene global temperature started to increase again. The Miocene warm climatic optimum lead to a peak in primates' taxonomic diversity and to their colonization of tropical and subtropical biomes in both the New and the Old World (Springer et al., 2012). From the Late Oligocene to the Middle Miocene there was an extensive radiation of the ape-like catarrhines (Fleagle, 2013; Shearer et al., 2015; Arbour and Santana, 2017) and the formation of two different lineages. The first originated the living Cercopithecoids, the latter the Hominoidea.

During the Late Miocene, Hominoidea evolved following three different lineages. The first originated the living gibbons (Hylobates), in a tropical forested environment in Asia. They developed brachiation as their main arboreal locomotion system and a dentition specialized on soft fruits. The second lineage lead to oraguntans (Pongine). Their ancestors developed in a more open environment as compared to hylobatids. The third lineage is the one including Homininae.

Living Primates (around 300 species) belong to either Strepsirhine or Haplorhine. Malagasy lemurs, galagos and lorises fall into the strepsirhini clade, whereas haplorhini include tarsiers and anthropoids (monkeys, apes and humans). Primates represent a very diversified group of mammals, and even the extinct species testify a great diversity in morphological and ecological characteristics. About body size, the first primates were very tiny yet during their evolution, Primates reached huge body masses, as for *Gigantopithecus blacki* (Pleistocene, China, around 300 kg). Also, extant primates show a wide range in body masses, ranging in body size from 30 g in Berthe's mouse lemur (*Microcebus berthae*) to 200 kg in male gorilla. Primates also show a variety of dietary adaptation. There are primates well-adapted to feed on soft fruit (*Macaca*, *Papio*, *Saguinus*, *Hylobates*), while others are mostly folivore (*Alouatta*). Other primates can feed on trees exudates, larvae, flowers, nectar, and bark. There are also some species adapted to feed on hard food (*Cacajao*). Primates that live in habitats with a marked seasonality are further able to change they diet based on food availability, switching from flesh fruits during the rainy season, to hard seeds or mature leaves during the dry season (Fleagle, 2013; Tang et al., 2016).

Primates stands out among mammals for their large brain volumes as compared to their body mass. The evolution of primate brain has always received great attention because of their peculiar cognitive abilities. The outstanding degree of encephalization in primates and its influence on physiological, ecological and social performance has been vividly discussed (Gould, 1975; Deacon, 1990; Dumbar et al., 2017). A very popular explanation for this increase in brain size in Primates is Aiello and Wheeler's Expensive Tissue Hypothesis (Aiello and Wheeler, 1995). This hypothesis suggests that the metabolic requirements of large brains relative to body size are offset by a corresponding reduction in terms of gut tissue. Gut is in fact a costly organ and in Primates appears to be reduced, as compared with the overall body size. Natural selection favours large brains, but this comes at the cost of forcing high-quality diets, because the brain tissue is one order of magnitude costlier than any other tissue in the mammalian body (Isler and Schaik, 2009). As such, only calories-rich food, easy to digest also by a small gut, can afford maintaining a particularly large brain.

Different views relate selection for increased brain size to diet (DeCasien et al., 2017), home range size and activity period (Powell et al., 2017) and terrestriality and dexterity (Heldstab et al., 2016). There is strong evidence that relative brain size correlates to cognitive performance (Deaner et al., 2007; Sol et al., 2015; MacLean et al., 2012). The cognitive demands imposed by sociality are thus commonly expected to produce selection for brain expansion. This hypothesis is known as the Social Brain Hypothesis (SBH; Kudo and Dunbar, 2001; Dunbar, 2009). According to this idea, there is a strong correlation between the neocortex size in Primates and the social group size, since a large brain could bring benefits in terms of social skills, which is relevant to species living in bonded groups as it permits increased cognitive skills and behavioural plasticity. This hypothesis was implemented by many works which are focused on the relationship between relative brain size, group size and mating system (Schillaci, 2006). However, patterns in brain size evolution are not always clear and even contradictory. The debate on ecological or social driven evolution of brain in Primates and humans remains open and strongly discussed (Street et al., 2017; González-Forero and Gardner, 2018).

Human evolution and clade diversification

During 1849, at Forbe's Quarry (Gibraltar) the first fossil hominid skull ever was found. Today that skull is known as Gibraltar 1 and is attributed to *Homo neanderthalensis*. However, at that time, the scientific community was far from recognize it as a species linked with the human lineage. The discovery of the notorious skullcap (Neanderthal 1) from the Feldhofer Grotto (Germany) in 1856 didn't changed this view. Fossils that belong to our lineage were considered "man of low degree of civilization" (as the same Huxley wrote) or ill individuals. This point of view didn't change for all 19th and 20th centuries. Despite this sceptical view about human origins, more and more human fossils came to light, both in Europe and Asia. In 1891, at Trinil, Java (Indonesia), Eugene Dubois found the calvaria that he attributed to a new species, *Pithecantropus erectus* (today know as *Homo erectus*). In 1907 at Mauer, in Germany, a single jaw was found and represent the specimen type of *Homo heidelbergensis* (Schoetensack, 1908). Discoveries of remains that claims at a more intricate human evolution history than previously thought continued to increase. The European scientific community started to feel an historical urgency to re-establish the integrity of the origin of the human species, especially in contrast with the rising idea of an African origin of *Homo sapiens*. During the first half of the 20th century, the widespread nationalism and racism brought to one of the most (in)famous archaeological fakes in history, the Piltdown man. The "discovery" of the Piltdown Man came in 1912. It consists in a composite skull with an admixture of pieces from human skull and an orangutan jaw. Scientists were searching for the 'missing link' between apes and humans, and the fact that this almost human ancestor was found in England didn't left room for further investigations. The Piltdown Man validity remained unquestioned until 1957, when further analyses on the remains proved it was a fake. Sadly, the Piltdown Man hoax caused a delay in human evolution investigation. Raymond Dart discovery of the Taung child (*Australopithecus afarensis*; Dart, 1925) and its linking with human lineage evolution were strongly criticised by the British scientific community, that continued to deny the affinity with the human ascent. After the Piltdown Man retraction, all hominid remains were re-examined, and an African origin of our species was finally established. The main question at this point is: where and when can the starting point of human origin be placed?

The separation of the lineages leading to the living African apes on the one hand and to humans on the other took place between 10 million and 5 Ma, during the Late Miocene (Fleagle, 2013). At that time, dramatic climatic and biotic turnovers took place. Tectonic events like the uplift of the Himalayas and the Tibetan Plateau, the closure of the Atlantic-Indian seaway throughout the Mediterranean, and the desiccation of Paratethys and Mediterranean seas (Agustì, 2007) are claimed to be related with this turnover. Moreover, the new geographical organization of lands brought to a different circulation system with the formation of a permanent Antarctic ice-sheet, the instauration of a monsonic regime and a general increase in seasonality (Zachos et al., 2001). The African continent maintained the woodland vegetation at West, while at East the vegetation became more open with an increase in bushes and C4 grassland.

These geographical and ecological changes are claimed to be the major explanation of the separation between African apes and humans. The first remain that can be undoubtedly ascribed to our lineage is *Sahelanthropus tchadensis* (6-7 Ma) in the site of Torros-Menalla, in western Djurab Desert of Chad, Central Africa (Brunet et al., 2002). It consists in a single partially deformed skull. Even if no post-cranial remains were found, the *foramen magnum* position clearly indicates that *S. tchadensis* was bipedal. Other early evidence of bipedalism is to be found in *Orrorin tugenensis* and *Ardipithecus* (6-5 Ma; Richmond and Jungers, 2008). There are different theories about the origin of bipedalism. Whatever the truth, bipedalism represents an unquestionable evolutive advantage. Being able to stand upright frees the hands from locomotor duties and allows to carry things and use tools. Moreover, with the progressive opening of the vegetation, bipedal position allows to see over the tall grass as a defence from predators.

From 4 to 2 Ma two different hominin genera were present in Central, East and South Africa, *Australopithecus* and *Paranthropus*. *Australopithecus* genus was at base of evolution of both *Paranthropus* and *Homo*. The major characteristic of Australopiths are a bigger brain in relation to body size, compared to the extant non-human Primates, large molars with thick enamel and a thick mandible with high ascending ramus. Australophits were able to walk in an upright position, as testified by the Laetoli footprints (3,7 Ma; Raichlen et al., 2010) and by the postcranial evidences (elongate forelimbs, flat feet, enlarge hip bones). However, Australopiths were also able to climb trees if necessary. A recent re-analysis of Lucy (*Australopithecus afarensis*, Hadar, Ethiopia, 3,18 Ma) one of the best-known samples of *Australopithecus*, showed injuries resulting from a fall, probably out of a tall tree (Kappelman et al., 2016).

Paranthropus represent a widespread genus in both East and South Africa. Also known as the robust australopiths, they have larger molars and premolars combined with relatively smaller canines and incisors (Fleagle, 2013). Their powerful jaws were claimed to be useful for feed on a variety of hard seeds. Recent evidences on dental isotopes (Cerling et al., 2011) suggest that, except for *Paranthropus boisei*, both Australopiths and Paranthrops had a C3-based diet. This difference can represent an adaptive divergence between the eastern and southern African *Paranthropus* populations. Contrary to previously thought, Australipiths and *Paranthropus* species were tools users. Both anatomical (Skinner et al., 2015) and archeological (Semaw, 2000; McPherron et al., 2010; Harmand et al., 2015) evidences support this view.

In 1960, at Olduvai Gorge (Tanzania) Jonathan and Mary Leakey found OH7, a fragment parts of the lower mandible. This fossil became the type specimen of a new species, *Homo habilis*. The main differences between early *Homo* and *Australopithecus* are the small molars and premolars, larger brains a more human-like limb proportion with longer legs, a narrowed thorax and straight phalanges.

Homo habilis appeared in East Africa around 2.5 Ma. The best-known sites of *H. habilis* are Olduvai Gorge (Tanzania) and Turkana Basin (Ethiopia). These early hominins were recognized to be the producer of the ancient and well-definable industry, the Oldowan. The Oldowan industry consist in choppers and scrapers which were probably used for butchering small animals and crushing the largest bones to reach the bone-marrow.

In 1984, at Lake Turkana (Kenya) the notorious Turkana boy (KNM-WT 15000; around 1.6 Ma) was found an almost complete skeleton of *Homo erectus.* The Turkana boy was an adolescent at the time of death. He was tall and the limb proportion appears to be similar to *Homo sapiens*. *Homo erectus* is associated with the Acheulean industries, which consist in hand-axes and bifacial tools. They had a mostly carnivorous diet and they were probably scavengers. The meat consumption was so marked that some authors hypnotized a large consumption of liver which could have caused hypervitaminosis A in *Homo erectus* (Walker et al., 1982). *Homo erectus* was the first human species that came out from Africa (Carotenuto et al., 2016). Moreover, the findings at Dmanisi (Georgia) prove that this earlier dispersal happened before than 1.75 Ma, which is the estimated age for the Dmanisi site (Vekua et al., 2002; Lordkipanidze et al., 2013). Archaeological evidences show that *Homo erectus* was present in Asia from 1.8 to 0.5 Ma and in Europe from 1.4 to 0.9 Ma (Joordens et al., 2005; Carotenuto et al., 2016). Because of the wide distribution of this species, there are several anatomical differences between the African and the Eurasiatic type. For that reason, some authors prefer a different nomenclature for the African (*Homo ergaster*) and the Eurasiatic remains (*Homo erectus*).

Homo heidelbergensis (700-130 ka) is an archaic hominid claimed to be the last common ancestor of *Homo sapiens* and *Homo neanderthalensis*. Fossils of *H. heidelbergensis* are known from South Africa (Broken Hill, Berg Aukas), East Africa (Bodo), Italy (Ceprano), Germany (Heidelberg) Greece (Petralona) and possibly China (Dali) (Fleagle, 2013). Cranial remains associated to *Homo heidelbergensis* show a mean brain size of 1,250 cm^3, a low and flattened frontal bone, a large and continuous supraorbital torus. Postcranial remains (Roberts et al., 1994) indicates that they were strong and tall. The status of *Homo heidelbergensis* is crontroversal and a debate on the attribution of his remains is still on (Mounier et al., 2009; Stringer, 2012; Manzi, 2016).

It is now accepted that the origin of *Homo sapiens* can be found in Africa, from the previously described *Homo heidelbergensis*. The oldest evidences of an African evolution of our species comes from a mandible found at Jebel Irhoud, in Morocco (Hublin et al., 2017), dated around 300 ka. Other evidences of such evolution are from the Kibish Formation in Ethiopia (Omo 1 and Omo 2, 200 ka; Shea et al., 2007) and Herto, in the Middle Awash region of Ethiopia (White et al., 2003). Our species is well-distinguished from other members of the genus *Homo*. Some of the main characteristics are the small teeth with a vertical mandibular ramus, the chin, a reduced brow ridge and a vertical forehead with a well-developed frontal cortex in comparison with the whole brain size. Archaic homo sapiens ventured out twice in their evolutionary history. The human remains at Skhul and Qafzeh at Mount Carmel, in Israel (120-90 ka, Grün et al., 2005) were retained the evidence of the first Out of Africa event. A recent discovery of archaic human remains at Misliya Cave (Israel; Hershkovitz et al., 2018) suggested that our species had already left Africa at 180 ka. However, there is no evidence of a stable human colonization of Europe until 40 ka (Mellars, 2006; Benazzi et al., 2015). Scientists usually refer to these modern Homo sapiens as anatomically modern humans (AMHs). At the end of the Pleistocene human populations begun their spread throughout the globe that would lead to a tenfold increase in population in over thousands of years (Mellars e French, 2011) and then to the actual distribution around the globe (Timmerman and Freidrich, 2016).

During the Late Pleistocene there was another species in Eurasia, *Homo neanderthalensis,* which stands alongside AMHs. The oldest evidence of a Neanderthal population was found at Zuttiyeh (Israel), with an age around 200.000 years ago, Tabun (Mount Carmel, Israel) around 150,000 years (Grun et al., 1991) and Altamura (Italy) at around 150,000 years (Lari et al., 2015). Neanderthals present unique morphological characteristics that make them very different from our species. They had a large nasal cavity, a large brow ridge and in general their skullcap is more elongated then Homo sapiens cranium. The short limb proportions suggesting a limited stature (Helmuth, 1998) with males estimated at 165.9 cm tall and 77.6 kg in body mass (Ruff et al., 1997). Moreover, Neanderthals had a wide chests and large lung volume (Franciscus & Churchill, 2002; Macias & Churchill, 2015). These features were long thought to represent an adaption to cold, in accordance with well-known ecogeographic Bergmann's and Allen's rules. Higham and colleagues (2014) statistically placed the extinction of *Homo neanderthalensis* around 40 ka, almost in coincidence with Heinrich Event 4 (HE4). This event consists in a sudden and global shift towards colder temperatures (Van Meerbeeck et al., 2009). It has been demonstrated that Neanderthal populations experienced major demographic contractions during the HE4 cold event in Northern Iberia and Southern France (d'Errico & Goñi 2003; Sepulchre et al., 2007). Contrary to the previous assumptions, this evidence shows that Neanderthals were not well-adapted to cold climate conditions. There are different studies that seem to support this hypothesis (Finlayson & Giles, 2000; Stewart, 2004; 2007; Bradtmöller et al., 2012). The late contraction of *H. neanderthalensis* range to southern Europe coincides with the spread of AMHs, suggesting a possible instance for competitive exclusion between the two (Banks et al., 2008; Mellars &; French, 2011). Negative interactions between Neanderthals and AMHs are often viewed as the potential drivers of *H. neanderthalensis* extinction, as an alternative to climate change hypothesis, or a combination of the two causes (Rey-Rodríguez et al., 2016).

The relationship between AMHs and Neanderthals could have been more complicate than expected. It is now demonstrated that Neanderthals share genetic variants with present-day humans in Eurasia, but not with sub-Saharan Africans, suggesting that gene flow from Neanderthals into the ancestors of non-Africans occurred before the divergence of Eurasian groups from each other (Green et al., 2010). Another evidence of a genetic admixture between Neanderthals and modern humans come from Peştera cu Oase (34-36 ka, Trinkaus et al., 2003) and Ust' Ishim (45 ka, Fu et al., 2014) specimens, which shows a close derivation from a Neanderthal individual. Particularly, the Peştera cu Oase specimen should have had a Neanderthal ancestor as recent as four to six generations before it lived (Fu et al., 2015). It has been suggested that that Neandertal alleles may have helped modern humans adapt to non-African environments during their dispersal (Sankararaman et al., 2014). In modern humans there is the 3.3–5.8% of Neanderthals genome. In this scenario, Neanderthals could be seen as a species on the verge of extinction that was genetically assimilated into the AMH population. Traces of Neanderthals extinction can be found still today, in our genome. There are regions of millions of base pairs that are nearly devoid of Neandertal ancestry ("deserts"), implying a negative selection to remove genetic material derived from Neandertals (Kuhlwilm et al., 2016).

AMHs and Neanderthals were not the only *Homo* species in Eurasia during the Late Pleistocene. In 2008, the distal manual phalanx of the fifth digit of a hominin was excavated in Denisova Cave (Altai region, Siberia). The exceptionality of this discoveries wasn't understood until 2010, when Krause and colleagues started to sequence the genome of that phalanx. The mtDNA showed that this specimen was from any other known hominis, but it appeared to belong to an unknown species that shares a common ancestor with AMHs and Neanderthal mtDNAs about 1.0 million years ago. Indirect dates indicate that this individual lived between 30.000 and 50.000 years ago (Reich et al., 2010), overlapping in time and space with both Neanderthals and humans. If traces of Neanderthal admixture with our genome can be found only in non-African individual, the distribution of the Denisovan genome is even more peculiar. A worldwide genome analysis showed that the high percentage of genetic admixture with Denisovans can be found in Southeast Asia and Oceania, with a 4–6% of its genetic material to the genome of present-day Melanesians (Reich et al. 2010; Vernot et al., 2016; Sankararaman et al., 2016). In this scenario, some authors identified a first split between Neanderthals and Denisovans from modern humans (550–765 ka), then a second split of Neanderthals and Denisovans to 445–473 ka (Prüfer et al., 2014). Evidences of an admixture with Neanderthals and Denisovians continues to come to light (Slon et al., 2018)

Virtual Anthropology

Remains which testify our evolutionary history raise enthusiasm and a great interest in the scientific community. However, hominins fossils are rare. They are often damaged or too delicate, inaccessible in most of the cases. The use of 3D models is revolutionizing the study of the human fossil record, giving rise to the burgeoning field of "Virtual Anthropology" (Weber, 2001). By using medical technology as laser scanner, CT-scan and magnetic resonance imaging (MRI), the permanent accessibility of the virtual objects is allowed. This kind of technology gives access to new information and the possibility to study inner structures and cavities which cannot be seen otherwise.

For surface measurements and analysis, a laser scan technology can be useful to record the complete surface and isolating skeletal elements (Aiello et al., 1998). To study and reconstruct inner cavities, the CT-scan technology is largely used today, since the real object has been converted into a virtual specimen throughout the volume (Weber, 2001). The data acquisition is made through a computed tomography scanner (CT-scanner) which produce the complete image volume of the analysed object. The CT-scanner collects numerous cross-sectional images ("slices") from different directions. Dedicated software can reconstruct the three-dimensional image of the analysed object from the large amount of two-dimensional radiographic images. The final data can be viewed as an image in any triplet of orthogonal planes, as well as from any arbitrary view.

The output of a CT scanner is a 3D data matrix, consisting of small information units, called voxels, comparable to pixels in 2D. Each voxel is labelled by three Cartesian coordinates (x, y and z). Eventually, voxels can be converted in triangular mesh by specific algorithm and software. The final 3D object is a surface mesh formed by a net of oriented triangular facets, which are individually defined by the coordinates of their vertices and by their mutual connections. The collection of vertices, coordinates, and connections defines the shape of the virtual surface in the computer language (Weber and Bookstein, 2011).

The CT-scan technology allows the application of such procedures to whichever specimen whose preservation is good enough to present quality details. The use of CT-scan consents to access inner cavity sizes and shapes, such as the ear structure (Gunz and Mitteroecker, 2013), cranial nerve organization (Ibrahim et al., 2014), the trabecular bone geometry (Chirchir et al., 2015; Ryan and Ketcham, 2002), and brain endocasts (Falk et al., 2005; Beaudet and Bruner, 2017; Diniz-Filho and Raia, 2017). CT-scan technology and 3D modelling techniques can be successfully applied for reconstructing missing or damaged part of a fossil specimen (Gunz et al., 2009; Profico et al., 2016a; Di Vincenzo et al., 2017) and restoring the bilateral symmetry of a digital mode (Schlager et al., 2018).

The aim of the research

The present thesis is focussed on fossil Primates, their ecological characterization, morphological evolution and diversification, and the new tool to study their anatomical features. The thesis is divided in three different part.

The first part regards the morphological adaptation and diversification of Primates. The expansion of their relative brain size is one of the most peculiar characteristics of primate evolution, but motivations behind this trend are still vividly debated. The first paper presented here (*"Macroevolutionary trends of brain size in primates"*, Melchionna et al., under review) is about the identification and the analysis of macroevolutionary trends in brain size evolution in Primates. By using new comparative phylogenetic method, Phylogenetic Ridge Regression (RRphylo; Castiglione et al., 2018), we searched for possible shifts in the evolutionary rate in encephalization across the primate tree (from the stem group of Plesiadapiformes to the genus *Homo*). In addition, we computed the rates of taxonomic diversification and regressed them against evolutionary rates in encephalization, to see whether encephalization induced higher diversification. In the last phase of the analysis, we applied Pradel's models (Pradel, 1996; Finarelli et al., 2016) on palaeontological data to investigate trends in speciation and extinction rates with the aim to assess their influence on diversification patterns. We found a significant increase in EQ rates in the hominins group with an overall increase in EQ values. We found a significant correlation between DR and both EQ rates EQ values. There is also a linear relationship between speciation and extinction rates. Eventually, we found an increase in speciation rates and a reduction in extinction rates with an increase in EQ values.

The second paper ("*Unexpectedly rapid evolution of mandibular shape in hominins*"; Raia et al., 2018) is about the evolution of mandibular shape from the ancient primates to the genus *Homo*. It's known that diet and mandibular shape, as well as body size, are some of the main drivers of ecological diversification in fossil, as well as in living primates. Members of the hominin clade have been long noted for their short and deep mandibles, low-cusped molars, and reduced incisors and canines. These traits evolved in early members of the clade in response to changing environmental conditions of the Early

Pleistocene and the consequent increase in consumption of though food items. The evolutionary trend in the change of mandibular shape were thought to be weak in the genus *Homo*, because of the the tool use and the control of fire. To study the mandibular change in primates we used the Geometric Mophometrics (Adam et al., 2004; Klingenberg, 2010) and the Phylogenetic Ridge Regression to compute evolutionary rates in mandibular morphology. The results were unexpected. We found that mandible shape evolution in hominins is exceptionally rapid as compared to any other primate clade. We also performed a multivariate angle computation analysis to verify whether the mandibular shape trajectory in australopiths and *Homo* were parallel, and whether they differed from that of non-hominin apes. We found that both direction and rate of shape change (from the ape ancestor) are no different between the australopiths and *Homo*.

In the second part of the thesis I introduce new advances in the field of the Virtual Anthropology. The first is a new protocol to obtain three-dimensional reconstruction of inner and outer surfaces of fossil specimens *("Reproducing the internal and external anatomy of fossil bones: Two new automatic digital tools"*; Profico et al., 2018). Starting from the CT-scan of a fossil specimen, the traditional protocol for the acquisition of their 3D surfaces is time-consuming and it depends on the manual ability of the operator (Profico et al., 2016b; Huotilainen et al. 2014; Nicolielo et al., 2017). Also, the softwares commonly used to perform the surfaces acquisition can be very expensive and difficult to use. By using the R software, we developed two automatic tools to reproduce the internal and external structures of bony elements. The first method, Computer-Aided Laser Scanner Emulator (CA-LSE), provides the reconstruction of the external portions of a 3D mesh by simulating the action of a laser scanner. The second method, Automatic Segmentation Tool for 3D objects (AST-3D), performs the digital reconstruction of anatomical cavities. Both methods are embedded in the packages "Arothron" (Profico et al., 2018) and "Morpho" (Schlager, 2017).

The second protocol presented in this section is about the reconstruction of the original shape of fossil bones damaged and deformed by taphonomical processes (*"A new tool for digital alignment in Virtual Anthropology"*; Profico et al., 2018). Since fossil remains are often fragmented and/or deformed by taphonomic processes, a preliminary re-alignment of their constituent parts is often necessary to properly interpret their shapes. Three-dimensional imaging techniques allow substituting manual alignment with virtual protocols, which guarantee the physical preservation of the fossil specimen avoiding potential alterations of its original shape, as introduced by the manual operator. In this paper a new semi-automatic alignment R software tools, Digital Tool for Alignment (DTA), is presented. This tool uses the shape information contained in a reference sample to find the best alignment solution for the disarticulated regions.

The third part of the thesis is focussed on genus *Homo*, particularly on *Homo neanerthalesis* and *Homo sapiens*. The first presented paper of this section is about the status of the Neanderthal niche fragmentation toward their demise (*"Fragmentation of Neanderthals' pre-extinction distribution by climate change"*; Melchionna et al., 2018). Neanderthals went extinct around 40 ka (Higham et al., 2014) and the role of both Late Pleistocene climate worsening and human competition were proposed as main causes of extinction. The Neanderthal demise is very complex to interpret. Neanderthals were found to have had small population size and high mortality rates (Sørensen, 2011; Bocquet-Appel and Degioanni, 2013). There are evidences of an early extinction of Northern European populations before 48 ka followed by recolonization from the Middle East, while Southern populations persisted there (Fabre et al., 2009). Furthermore, genetic evidences support this scenario, pointing out a species divided into a number of small and isolated populations (Rogers et al., 2017). By using Species Distribution Models, and a habitat fragmentation analysis, we reconstructed the Neanderthals and human ecological niche. We found *Homo sapiens* had greater ecological plasticity over Neanderthals, which probably allowed this species to better react to climatic worsening at 44 and then at 40 ka. However, Neanderthals potential habitat appear to be very reduced and fragmented during the last phase of their occupation.

The second publication of this section regards the role of *Homo sapiens* in the Late Pleistocene megafauna extinction ("*The well-behaved killer: Late Pleistocene humans in Eurasia were significantly associated with living megafauna only*"; Carotenuto et al., 2018). Human hunting is often depicted as the major driver of megafauna demise ('overkill hypothesis'). However, the magnitude of the human influence is not clear and might have had different patterns in the Old and the New World. Moreover, studies on living population of hunter-gathers revealed that only a small percentage of energetic supply comes from hunt (Hill and Hurtado, 2009; Hill et al., 2013). By using SDMs, we obtained megafauna and humans occurrence probability maps over the last 40 ka in Eurasia. Then, we divided species in ecological groups (i.e., body size and feeding category combined). We evaluated their geographical overlap to human range and the species suitability in the core area of *Homo sapiens*. Intriguingly, results showed that the extinct megafauna was rare within humans' range and Palaeolithic hunters had stronger association to extant rather than extinct herbivorous species.

Macroevolutionary trends of brain size in primates

Abstract

Primates are among the most successful mammalian groups. One of the most peculiar characteristics of primate evolution is the expansion of their relative brain size. The motivation behind this trend is vividly debated. Here, we assembled a phylogeny for 318 primate species, including both extant and extinct taxa, to identify macroevolutionary trends in brain size evolution by applying a new comparative phylogenetic method, Phylogenetic Ridge Regression (RRphylo). We computed the rates of taxonomic diversification and regressed them against the evolutionary rates in encephalization, to see whether encephalization associates to diversification. Our findings show a neat macroevolutionary trend for increased encephalization apply to all Primate, although hominins stand out for distinctively higher rates and phenotypes.

We found a strong association between diversification rates and degree of encephalization. A strong increase in diversification applies since the beginning of the Oligocene and seem to coincide well with the appearance of Anthropoids.

Keywords: Primates, encephalization quotient, diversification rate, macroevolution, RRphylo

Introduction

Primates are among the most successful mammalian orders. Their last common ancestor lived some 71 to 63 million years ago (Springer et al., 2012). Plesiadapiforms are the oldest known stem primates (Bloch et al., 2007). These tiny arboreal species appeared in North America around the Paleocene/Eocene boundary and spread throughout Europe and Asia afterwards. The phylogenetic relationships between the (most probably polyphyletic) Plesiadapiforms and true primates is still discussed. The oldest unquestionable crown primates belong to omomyids (Eocene), and adapiforms (Eocene-Late Miocene). During the Miocene warm climatic optimum, primates peaked in taxonomic diversity and colonized tropical and subtropical biomes in both the New and the Old World (Springer et al., 2012). Living Primates belong to either Strepsirhine or Haplorhine. Malagasy lemurs, galagoes and lorises fall into the strepsirhini clade, whereas haplorhini include tarsiers and anthropoids (monkeys, apes and humans).

The evolution of primates always received great attention because of their peculiar cognitive abilities. Primate brain expansion, both in absolute (endocranial volume, ECV) and relative (encephalization quotient, EQ) terms, is one of the main peculiarities of the group (Montgomery et al., 2016). The outstanding degree of encephalization in primates and its influence on physiological, ecological and social performance has been vividly discussed (Gould, 1975; Deacon, 1990; Dunbar and Shultz, 2017). According to the Expensive Tissue Hypothesis (Aiello and Wheeler, 1995), natural selection favours large brains, but this comes at the cost of forcing high-quality diets, because the brain tissue is one order of magnitude costlier than any other tissue in the mammalian body (Isler and van Schaik, 2009). As such, only calories-rich food can afford maintaining a particularly large brain (Mink et al., 1981; Isler and van Schaik, 2006). Different views relate selection for increased brain size to diet DeCasien et al., 2017), home range size and activity period (Powell et al., 2017), mating system (Schillaci, 2006), and terrestriality and dexterity (Heldstab et al., 2016). There is strong evidence that relative brain size correlates to cognitive performance (Sol et al., 2005; Deaner et al., 2007; MacLean et al., 2012). The cognitive demands imposed by sociality are thus commonly expected to produce selection for brain expansion (the Social Brain Hypothesis, SBH; Kudo and Dunbar, 2001; Dunbar, 2009). Although this link extends to animal clades other than primates (Marino et al., 2004; Montgomery et al., 2013), SBH remains open and strongly discussed (Street et al., 2017; González-Forero and Gardner, 2018).

Since brain size scales allometrically to body size (Isler et al., 2008; Grabowski et al., 2016) most studies addressing encephalization patterns uses EQ as the reference metrics. However, both brain and body sizes influence EQ, that makes it difficult to disentangle their relative selection effect on encephalization, so that ECV is often taken as the best proxy for encephalization (Deaner et al., 2007; Shultz and Dumbar, 2010).

At the macroevolutionary level, increased brain size was found to relate to diversification dynamics. Large brain size (EQ) reduces extinction risk in birds (Sol et al., 2005) and mammals (Isler and Schaik, 2009; Sol et al., 2008). Clade-level ECV patterns are associated to origination and extinction processes in hominids (Du et al., 2018), and a significant increase in EQ corresponds to a shift in diversification rate in carnivores (Finarelli an Flynn, 2009). There is substantial evidence for increases in speciation rates in Primates (Gómez and Verdú, 2012; Arbour and Santana, 2017; Herrera, 2007). Yet, it is still unknown how these relate to encephalization.

Our goal here is to identify and analyze macroevolutionary trends in brain size evolution in Primates. We assembled a large paleontological phylogeny (Raia et al., 2018) inclusive of 318 primate species we had endocranial volume (ECV) and body mass estimates for. We applied Phylogenetic Ridge Regression (RRphylo, Castiglione et al., 2018) to search for possible shifts in the evolutionary rate in encephalization across the primate tree. Then, we present an implementation of RRphylo designed to search for phenotypic evolutionary trends, which we apply to study encephalization patterns. Furthermore, we computed the rates of taxonomic diversification and regressed them against evolutionary rates in encephalization, to see whether encephalization prompted higher diversification, as often posited in the scientific literature. Eventually, we used Pradel's models (Pradel, 1996; Finarelli and liow, 2016) applied on palaeontological data to investigate trends in speciation and extinction rates and assess their influence on diversification patterns.

Material and methods

Data preparation

We collected from literature estimates of primate body mass and endocranial volume (ECV) (see Appendix 1). Our dataset and tree include 318 species, both extant (248) and extinct (70), ranging from Paleogene plesiadapiforms to extinct and living primates. ECV data only include direct estimations of the brain cavity volume. In keeping with Grabowski and colleagues (Grabowski et al., 2016), we computed encephalization quotients (EQ) from ECV and body mass estimates (see Appendix 1) according to the equation:

$$EQ = \frac{ECV}{e^{0.60\ln(BM)-1.402}}$$

where ECV is the endocranial volume, and BM is body size; Grabowski et al., 2016).

RRphylo

We applied a recently-implemented Phylogenetic Comparative Method (PCM) that is specifically thought to work with phylogenies including fossil species. The RRphylo method (Castiglione et al., 2018) performs phylogenetic ridge regression (Kratsch and McHardy, 2014) on tree and data in order to compute phenotypic evolutionary rates for each branch of the phylogeny. Under RRphylo, evolutionary rates are computed as regression coefficients. As such, they can be either positive or negative, indicating the direction of phenotypic change (increase or decrease). The magnitude of the rate is represented by the coefficient absolute value. RRphylo allows removing the effect of a covariate on the evolutionary rates. In the present case, the function computes rates on the residuals of either ECV or EQ regressed against body size (all data were ln-transformed before analyses).

After computing the evolutionary rates, for each variable (i.e. body mass, ECV, and EQ) we searched for rate shifts across the tree by applying the function *search.shift* (Castiglione et al., 2018). The latter uses randomizations to see whether specific clades have higher absolute rate values than the rest of the tree.

To search for temporal trends in phenotypes and rates, we applied a new RRphylo function, named *search.trend*. The function regresses evolutionary rates and phenotypic values (the original tip values plus the ancestral states estimated through RRphylo) against their age, and then compares the regression slopes to slopes generated by simulating data with no trend in either phenotypic mean or variance. The performance of *search.trend* was assessed by means of simulation experiments. It revealed to perform with low Type I and Type II error rates (see Electronic Supplementary Material). All the functions are available as part of the R package RRphylo (Raia et al., 2018b) available at https://github.com/pasraia/RRphylo.

Diversification Rate (DR)

We used the DR statistic (Jetz et al., 2012) as a metric for diversification rate. DR has been shown to work well on both living and fossil phylogenies (Cooney et al., 2017; Cantalapiedra et al., 2017), and proved to be particularly well-suited to investigate the correlation between diversity and disparity dynamics (Harvey and rabosky, 2017), which was our goal here. DR is computed as the inverse of equal splits, which represent the proportion of the total evolutionary time in the phylogenetic tree attributed to each lineage (Redding and Mooers, 2006). This metric has the advantage of giving a distinct rate to each species, thus allowing a lineage-by-lineage investigation of the correlation between taxonomic and phenotypic diversification rates. We also tested the relationship between DR and endocranial volumes (ECV), and encephalization quotient (EQ) separately, looking for possible anatomical drivers of diversification.

Pradel models

Pradel models [38] belong to Jolly-Seber family of capture-mark-recapture (CMR) models. In keeping with Finarelli and Liow (Liow and Finarelli, 2014; Finarelli and Liow, 2016) we used such implementation on paleontological data in order to estimate interval-to-interval extinction, origination, diversification and sampling probabilities.

Survival probability (φ_i) is defined as the probability of a species surviving from the interval *i* to the interval *i*+1. Thus, the complement of this term (1-φ_i) is the probability of extinction from time *i* to time *i*+1. Seniority (γ_i) is the probability that a species extant at interval *i* was already present during the interval *i*-1. Thus, the complement of this term (1-γ_i) is the speciation probability from time *i*-1 to time *i*. This parameter is related to recruitment, f_i, which is the number of new species appearing at interval *i*+1 divided by the number of species present at interval *i*. Recruitment is computed as: $f_i = \varphi_i \left(\frac{1-\gamma_{i+1}}{\gamma_{i+1}}\right)$. Growth rate ($\lambda_i$) is defined as the ratio between the number of species at intervals *i*+1 and *i*. It can be also computed as: $\lambda_i = f_i + \varphi_i$. Therefore, the net per capita diversification rate is: $\frac{N_{i+1}-N_i}{N_i} = \lambda_i - 1$. Eventually, sampling probability (p_i) is the probability for a species actually extant during interval *i* to be sampled in that very interval.

We divided fossil occurrences in consecutive, one million years long time bins. Then, we built two types of Pradel's models, one based on the estimation of 'survival and seniority' (which fits extinction, speciation, and sampling rates) and the other on the estimation of 'survival and population growth' (which fits extinction, diversification, and sampling rates) through time. The application of two different models is necessary because parameters are linear functions of each other (i.e. they are defined by a family of linear equations).

We were interested in the course of diversification metrics (speciation and extinction) over time, and how and whether they were affected by EQ. Therefore, we developed 12 different Pradel models overall, where parameter estimates were function of time, EQ, and their combination. For each model, we implemented one version with constant sampling probability over time, and another version where sampling was allowed to change from one time bin to the next. The motivation was that sampling affects diversification metrics, and it is hard to tell whether sampling follows a random walk path or is highly variable among intervals (see Table 1 for the description of individual models). Model selection was based on AICc values. Parameter estimates were finally derived through maximum likelihood optimization.

This method gives advantages over more traditional approaches. Foote (2000) developed the computation of instantaneous per-capita speciation and extinction rates, but excludes 'singleton taxa' (taxa confined to a specific time bin) to account for over-sampling. Alroy (2008) calculated an interval-specific sampling probability by taking into account the number of species that are present and sampled in three consecutive intervals and those sampled only in the first and last interval (thereby presumably missing because of sampling in the middle interval). With Pradel's absences are interpreted as either real absences or as failed-to recognize presence. Hence, sampling probability is estimated jointly with the other parameters. For these reasons the method is recommended with paleontological data, especially with heterogeneous and incomplete sampling (Liow and Finarelli, 2014). The analyses were run using MARK and RMark version 2.2.4.

	Model	**Survival**	**Sampling**	**Growth**	**Seniority**
1	Phi(~time)p(~time)Gamma(~time)	t	t	-	t
2	Phi(~time)p(~time)Lambda(~time)	t	t	t	-
3	Phi(~1)p(~1)Gamma(~1)	K	K	-	K
4	Phi(~1)p(~1)Lambda(~1)	K	K	K	-
5	Phi(~1)p(~time)Gamma(~1)	K	t	-	K
6	Phi(~1)p(~time)Lambda(~1)	K	t	K	-
7	Phi(~EQ)p(~EQ)Gamma(~EQ)	EQ	EQ	-	EQ
8	Phi(~EQ)p(~EQ)Lambda(~EQ)	EQ	EQ	EQ	-
9	Phi(~time*EQ)p(~time*EQ)Gamma(~time*EQ)	t*EQ	t*EQ	-	t*EQ
10	Phi(~time*EQ)p(~time*EQ)Lambda(~time*EQ)	t*EQ	t*EQ	t*EQ	-
11	Phi(~EQ)p(~time*EQ)Gamma(~EQ)	EQ	t*EQ	-	EQ
12	Phi(~EQ)p(~time*EQ)Lambda(~EQ)	EQ	t*EQ	EQ	-

Table 1. Pradel models implemented in this study. The column names indicate individual models (Model) and how the parameters were fitted. Parameters were Survival (the complement to extinction risk), Sampling (the probability of a species being sampled in a given interval), Growth (the complement of diversification rate) and Seniority (the complement of speciation rate); t = time variable parameter, K = time-constant parameter, EQ = encephalization quotient.

Results

Endocranial volume (ECV)

We found two positive significant shifts in ECV evolutionary rates, corresponding to hominins, and to cheirogaleids and sportive lemurs. Conversely, tamarins (genus *Saguinus*) and Lorisiformes show a significant decrease in the evolutionary rates. ECV means in these groups are significantly different (ANOVA p value < 0.001, Table S1A) with hominins have significantly greater mean value than the other groups and compared to primates as a whole. Pairwise comparison method showed that Lorisiformes are not different from both *Saguinus* and Cheirogaleidae and *Lepilemur* (Table S1A).

There is a positive temporal trend for ECV in the whole primate tree and in the hominins clade, with positive and significant evolutionary rates (both absolute and relative rates). Contrariwise, other clades do not show trends in this phenotypic trait during their evolutionary history. Lorisiformes decrease significantly in absolute rate and increase in relative rate through time. *Saguinus* plus Cheirogaleidae and *Lepilemur* show an opposed pattern as loris (Table 1).

Standard Major Axes (SMA) regression revealed that phenotypic, absolute and relative rate regressions through descendant's hominins node are different from regressions through other tested nodes (see Table S2 for details).

A

Clade	Average rate difference from the rest of the tree	*p*	Increase or decrease
Hominins	0.495	**0.001**	+
Saguinus	-0.533	**0.014**	-
Lorisiformes	-0.333	**0.981**	-
Cheirogaleidae & *Lepilemur*	0.591	**0.993**	+

B

	Phenotype		Absolute rate		Relative rate	
	slope	*p* value	slope	*p* value	slope	*p* value
Total	0.035	**< 0.001**	0.004	**0.001**	0.008	**0.020**
Hominins	0.193	**0**	0.366	**0**	0.363	**0**
Saguinus	-0.008	0.160	0.024	**0**	-0.024	**0.010**
Lorisiformes	-0.003	0.280	-0.001	**0.070**	0.036	0.130

Cheirogaleidae & *Lepilemur*	-0.008	0.170	0.023	**0**	-0.090	**0.010**

Table 2. Results for ECV. A) search.shift results; B) search.trend results.

Phenotype and evolutionary rates are significantly correlated with DR ($slope_{phenotype}$ = 0.923, $p_{phenotype}$ < 0.001; $slope_{rates}$ = 0.343, p_{rates} = 0.001; table S3) by using linear regression model. On the contrary, Phylogenetic Generalized Least Squares (PGLS) regression between DR and phenotype is not significant (p = 0.994; Table S3).

Encephalization quotient (EQ)

There is a single significant increase in evolutionary rates for EQ corresponding to hominins (Table 3). We found that EQ increases positively during Primate evolutionary history, although absolute and relative rates trends are not significant. Conversely, hominins show a significant and positive trend in both relative brain size and evolutionary rates over time (Table 3; Fig. 1). SMA analysis returned significant different regression slopes between hominins and rest of tree (Table S4).

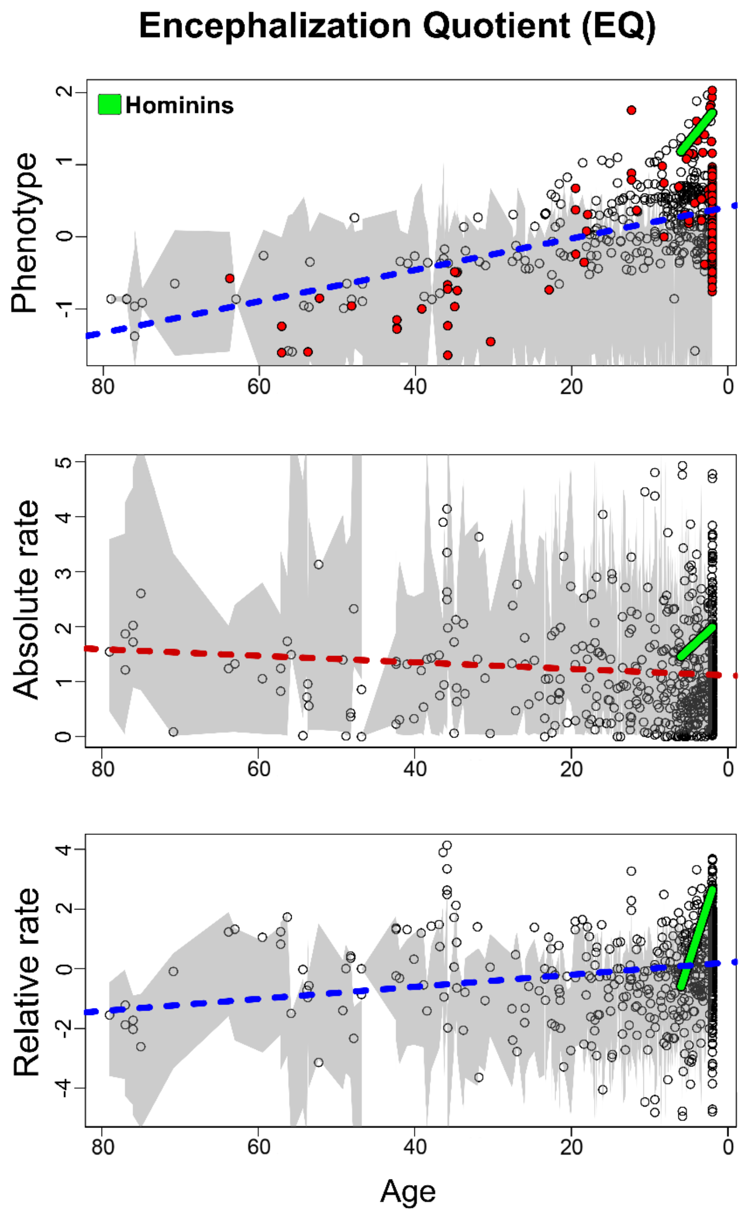

Figure 1. RRphylo results for encephalization quotient (EQ). Phenotype estimation (top), absolute rates (middle) and relative rate (bottom) over time. Red circles represent actual phenotypes, open circles represent ancestral state estimates as produced by RRphylo.

A

Clade	Average rate difference from the rest of the tree	*p*	Increase or decrease
Hominins	0.605	**0.987**	+

B

	Phenotype		Absolute rate		Relative rate	
	slope	*p* value	slope	*p* value	slope	*p* value

Total	0.022	**0**	-0.006	0.330	0.020	0.310
Hominins	0.134	**0**	0.132	**0**	0.808	**0**

Table 3. Results for EQ. A) *search.shift* results; B) *search.trend* results.

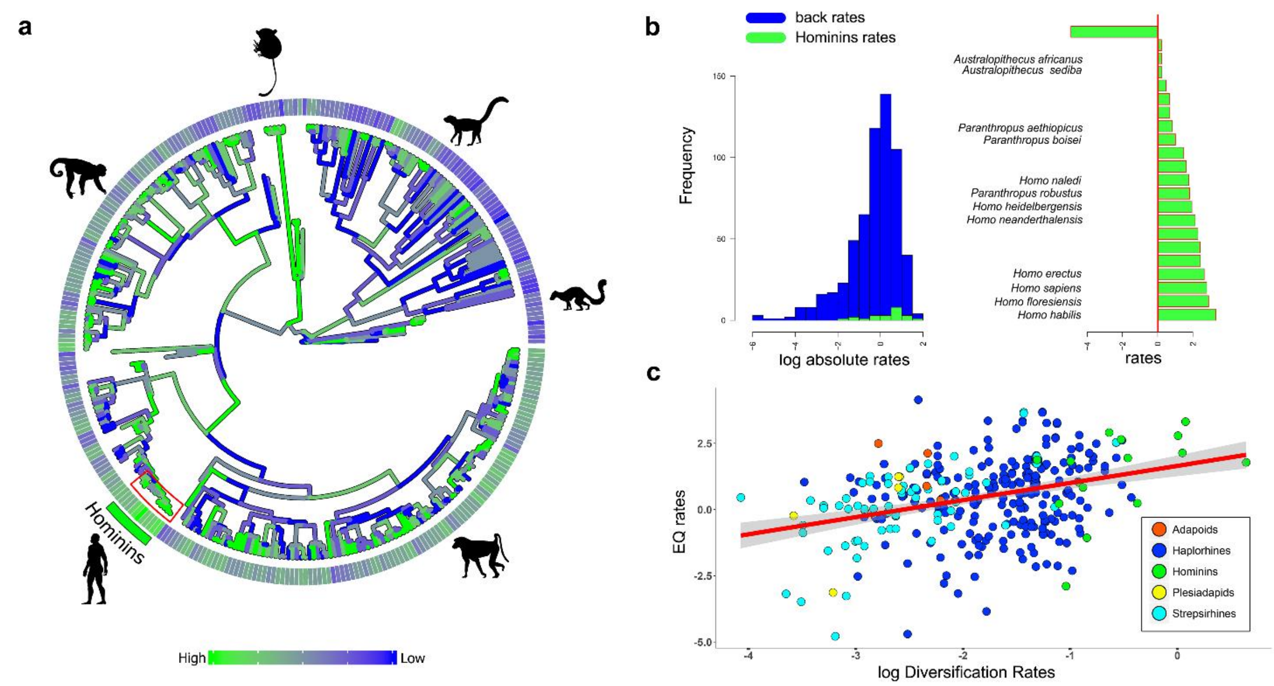

Figure 2. (a) Primate phylogeny. Colour gradient associated to the branches represent estimated rates of EQ evolution. The bars around the tree represent estimated diversification rates (DR). (b) Absolute rates of individual branches of the Hominins clade are collated in increasing rate value (green bars) and contrasted to the average rate computed over the rest of the tree branches (the vertical red line). Bars without names correspond to internal nodes. (c) Regression between encephalization quotient rates and diversification rates.

The image was generated by using the R package ggplot (http://ggplot2.org/) and our own R codes. Animal silhouettes were available under Public Domain license at phylopic (http://phylopic.org/), unless otherwise indicated. Specifically, *Homo sapiens* (http://phylopic.org/image/c089caae-43ef-4e4ebf26-973dd4cb65c5/), *Cebus* (http://phylopic.org/image/156b515d-f25c-4497-b15b-5afb832cc70c/) available for reuse under the Creative Commons Attribution 3.0 Unported (https://creativecommons.org/licenses/by/3.0/) image by Sarah Werning; *Tarsius* (http://phylopic.org/image/f598fb39-facf-43ea-a576-1861304b2fe4/); lemuriformes (http://phylopic.org/image/eefe8b60-9a26-46ed-a144-67f4ac885267/), available for reuse under Attribution-ShareAlike 3.0 Unported (https://creativecommons.org/licenses/by-sa/3.0/) image by Smokeybjb; *Plesiadapis* (http://phylopic.org/image/b6ff5568-0712-4b15-a1fd-22b289af904d/), available for reuse under Attribution-ShareAlike 3.0 Unported (https://creativecommons.org/licenses/by-sa/3.0/) image by Nobu Tamura (modified by Michael Keesey).

EQ values and rates are positively correlated with DR ($\text{slope}_{\text{phenotype}} = 0.434$, $p_{\text{phenotype}} < 0.001$; $\text{slope}_{\text{rate}} = 0.646$, $p_{\text{rate}} < 0.001$; Fig. 2; Table S5). Furthermore, DR and EQ values are significantly correlated ($p = 0.027$; Table S5) when the effect of phylogeny is added as covariate in the regression model (PGLS).

Body mass

Results for body mass shows an increase in average rates in Colobine monkeys, whereas Pitheciids and Indriidae shows an opposite pattern. Furthermore, there is a general positive trend for body mass along Primate history (Table 4). For more details on trends in Colobinae, Pitheciids and Indriidae, and on SMA results see table S6 and S7. Eventually, we performed the same analysis focussing on hominins node (Table S8, S9).

A

Clade	**Average rate difference from the rest of the tree**	***p***	**Increase or decrease**
Colobinae	0.411	**< 0.001**	+
Pitheciidae	-0.495	**0.022**	-
Indriidae	-0.292	**0.977**	-

B

	Phenotype		**Absolute rate**		**Relative rate**	
	slope	*p* value	slope	*p* value	slope	*p* value
Total	0.022	0	-0.004	0.140	0.017	0.120

Table 4. Results for body mass. A) *search.shift* results; B) *search.trend* results for all Primates.

Pradel's models

For both types ('survival and seniority' and 'survival and growth rate'), the best model is the one where parameter estimates are function of EQ and sampling is allowed to change from one time bin to the next (Table 5). As models for seniority and growth rate are equivalent (DeltaAICc = 0.710), we retrieved estimates for speciation (1 - seniority), and extinction (1 - survival) rates from the former.

model	npar	AICc	DeltaAICc	weight	Deviance
Phi(~EQ)p(~time*EQ)Lambda(~EQ)	130	1363.347	0.000	0.588	992.040
Phi(~EQ)p(~time*EQ)Gamma(~EQ)	130	1364.057	0.710	0.412	992.750
Phi(~time)p(~time)Lambda(~time)	187	1467.487	104.140	0.000	4.067
Phi(~1)p(~time)Lambda(~1)	65	1485.348	122.001	0.000	525.179
Phi(~1)p(~time)Gamma(~1)	65	1485.854	122.507	0.000	525.685
Phi(~EQ)p(~EQ)Lambda(~EQ)	6	1525.967	162.620	0.000	1513.772
Phi(~EQ)p(~EQ)Gamma(~EQ)	6	1533.310	169.963	0.000	1521.115
Phi(~time)p(~time)Gamma(~time)	187	1608.559	245.212	0.000	145.138
Phi(~1)p(~1)Gamma(~1)	3	1938.160	574.813	0.000	1125.062
Phi(~1)p(~1)Lambda(~1)	3	1938.160	574.813	0.000	1125.062

Table 5. Results for comparison of Pradel's models applied on one million year time intervals. npar = number of parameters; AICc = corrected Akaike Information Criterion; DeltaAICc = the difference in the AIC value between each model and the model with the lowest AIC; weight = normalized Akaike weights; Deviance = models deviance.

In accordance with the best model, there is a linear relationship between extinction and speciation rate and EQ. We extracted regression coefficients from model results and computed extinction and speciation rates for each EQ values, hence for each species (Fig. 3 left). We therefore found a trend for increase in speciation rate and decrease in extinction rate with EQ. The intersection of the regression lines corresponds to EQ values in the range of early Primates species (Plesiadapids and Adapoids).

Eventually, we calculated the average rates value for each time interval (Fig. 3 right). We found an increase in speciation rate and a corresponding decrease in extinction rate starting from Early Oligocene. The distance between the curves accentuates at the beginning of Miocene.

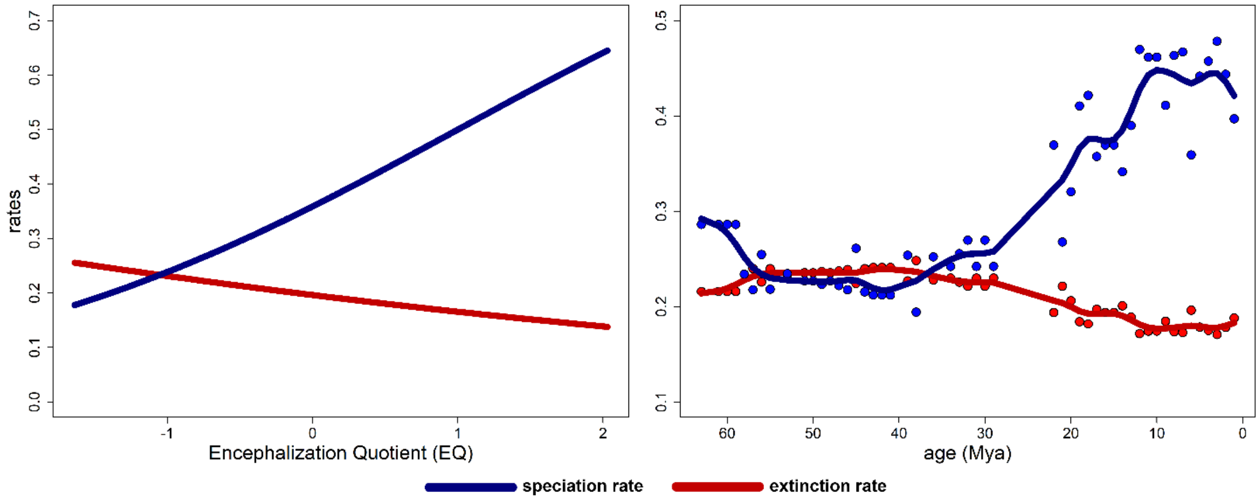

Figure 3. On the left side, the statistical relationship between speciation and extinction rates and the encephalization quotient. To the right, patterns of speciation and extinction rates plotted against time.

Discussion

In this study, we investigated macroevolutionary patterns in Primate encephalization. We found that hominins have unambiguously larger EQ and show stronger tendency for increased encephalization over time than any other primate clade. Primate as a whole, though, do show a neat macroevolutionary trend for increased EQ. Intriguingly, we further found EQ is strongly associated to diversification rates, even after controlling for phylogenetic effects. Through time, primates developed both larger EQs, lower extinction rate, higher speciation rate, and larger body mass. The positive effect of EQ on diversification has been repeatedly proposed to apply in birds (Sol et al., 2005), mammals (Sol et al., 2008) and hominins (González-Forero and Gardner, 2018; Du et al., 2018). Larger relative brain size is said to favour behavioural plasticity, hence adaptation to variable environmental conditions, and ecological reliance (Sol et al., 2015). Intriguingly, our results show that such positive effect of EQ becomes evident since the early Oligocene, when Anthropoids appeared. The Oligocene was a moment of intense climatic change and major reorganization in the history of mammals in general, and primates in particular (Prothero, 2012). The global climatic cooling near the Eocene-Oligocene boundary (Zachos et al., 2001) was the major driver of such intense species turnover, and of a major peak in extinction ("Grande

Coupure''). After that, there was an increase in diversification rates (Arbour and Santana, 2017; Herrera, 2017). This is consistent with our conclusions, which point to a peak in speciation rate during the Miocene, and with genetic evidence linking the intense Miocene Primate diversification to elevated global mean temperatures (Springer et al., 2012). Such process culminated in the appearance of hominins. Although the finding that hominins have exceedingly large brains is not novel, it is intriguing that australopiths and *Homo* do share this trait (i.e. the rapid evolution of high EQ) and remain significantly different from any other primate clade on several additional aspects, including tool use (Skinner et al., 2015), bipedalism (Dowdeswell et al., 2017), and mandible evolutionary rate (Raia et al., 2018). Beyond these strong macroevolutionary trends, we found little evidence for a possible role of feeding ecology. DeCasien and colleagues (2017) showed that frugivorous primates exhibit larger brains than folivore species, in association with a high foraging efficiency. Our findings on ECV do not lend support to this pattern. Instances of increased rates include both strictly arboreal (lemurs) and terrestrial (hominins) species, as well as folivore (sportive lemurs), gumnivore (Masoala fork-marked lemur), frugivore (dwarf lemurs) and omnivore (hominins) primates. This inconsistency may be due to the unquestionable difficulty in categorize primate diets, since dietary habits can vary seasonally and geographically, even within the same species. About the influence of sociality and mating system on evolution of ECV, scientific literature is full of conflicting results. While some authors linked bigger brains with polygamous systems (Shultz and Dunbar, 2007), other frameworks support quite the opposite (Schillaci, 2006). Even if we did not directly investigate relationship between brain size evolution and social system, we found no clear pattern in species with increased rates, as groups with higher values for ECV evolution are both monogamous and polygamous and live in group of varying size.

This study demonstrates that increased encephalization is a macroevolutionary pattern pertaining to primate as a group, and to hominins in particular. The most important finding here is perhaps that such pattern associates significantly, regardless of phylogenetic effects, to increased diversification rate, and especially to increased speciation rate. The rise in EQ and diversification coincide with the appearance of Anthropoids. The reason and drivers of such association remain to be elucidated.

Unexpectedly rapid evolution of mandibular shape in hominins

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Abstract

Members of the hominins – namely the so-called 'australopiths' and the species of the genus *Homo* – are known to possess short and deep mandibles and relatively small incisors and canines. It is commonly assumed that this suite of traits evolved in early members of the clade in response to changing environmental conditions and increased consumption of though food items. With the emergence of *Homo*, the functional meaning of mandible shape variation is thought to have been weakened by technological advancements and (later) by the control over fire. In contrast to this expectation, we found that mandible shape evolution in hominins is exceptionally rapid as compared to any other primate clade, and that the direction and rate of shape change (from the ape ancestor) are no different between

the australopiths and *Homo*. We deem several factors including the loss of honing complex, canine reduction, and the acquisition of different diets may have concurred in producing such surprisingly high evolutionary rates. This study reveals the evolution of mandibular shape in hominins has strong morpho-functional and ecological significance attached.

Main Text

Primates are a large group of mainly arboreal, mostly tropical mammals, ranging in body size from 30g in Berthe's mouse lemur (*Microcebus berthae*) to 200kg in male gorilla. In terms of diet, primates are nearly equally variable, being adapted to feed on insects, honey, fruits, leaves, seeds, nuts, and even vertebrate meat. Such wide dietary ambit reflects in the primate mandible and teeth variation. The extent to which diet actually influences the masticatory apparatus in Primates is the subject of intense investigation. It is now well recognised that variation in both mandibular shape and body size were the primary pathways for ecological diversification in fossil, as well as in living primates (Marroig and Cheverud, 2005), with diet acting primarily at high taxonomic level, while size has stronger effects between closely related species (Meloro et al., 2015). Hominins (which include the species belonging to either *Homo* or to the so-called 'australopiths') make no exception to this pattern. Members of the hominin clade have been long noted for their peculiar mandible shape, with short and deep corpus (the horizontal part that bears the tooth-row), low-cusped molars, and reduced incisors and canines. This suite of features is said to allow for a diet including tough food items such as roots and seeds (Corruccini and Beecher, 1982; Sponheimer et al., 2013), and is linked to the reduced importance of food processing by the anterior dentition, as compared to fellow apes. This habitus is common to many, but by no means to all of the australopiths (White et al., 2009; Sponheimer et al., 2013), and reached its extreme in the Early Pleistocene hominin *Paranthropus boisei* (Wood and Costantino, 2007), consistently with the lifestyle in the grasslands the late australopiths adapted to (Cerling et al., 2011). While living in open-habitats was common to *Homo* as well (McHenry and Coffing, 2000), species in our own genus have smaller, thinner-enamel cheek teeth, less robust mandible and zygomatic arches (Chamberlain and

Wood, 1985), reduced masticatory muscles and bite force (Stedman et al., 2004), and decreased protrusion of the dental arcade (i.e. prognathism). Most of the differences between *Homo* and the australopiths are believed to relate to the evolution of an extremely large brain in *Homo*, which is responsible for ever increasing technological abilities and, later, for the control over fire. This would have eventually released adaptive pressures on the mandible and teeth, by endowing efficient mechanical food processing before chewing (Wrangham and Carmody, 2010; Zink et al., 2014; Attwell et al., 2015; Zink et al., 2016). As such, while the evolution of a mandible shape responsive to a new lifestyle and diet in australopiths should make them no different from the other primates, the robust relationship between mandible shape and diet presumably faded out in *Homo*, with the expected consequence of low evolutionary rate of change in *Homo* mandibles.

To verify this hypothesis, we analysed mandibular shape variation in a large sample of primates, ranging from Paleogene 'plesiadapids' to living species, by applying geometric morphometrics (GMM) to the primate mandible under a new phylogenetic comparative method (PCM) approach (Castiglione et al., 2018). We assembled a dataset of 731 primate mandible images belonging to 211 different species and built a phylogenetic tree for those. We implemented and applied the RRphylo PCM (Castiglione et al., 2015), to the shape data ordinated via GMM (Fig. 1). Such method allows retrieving the rate of shape evolution for all the branches in the tree and verifies the existence of shifts in the rate of evolutionary change among clades.

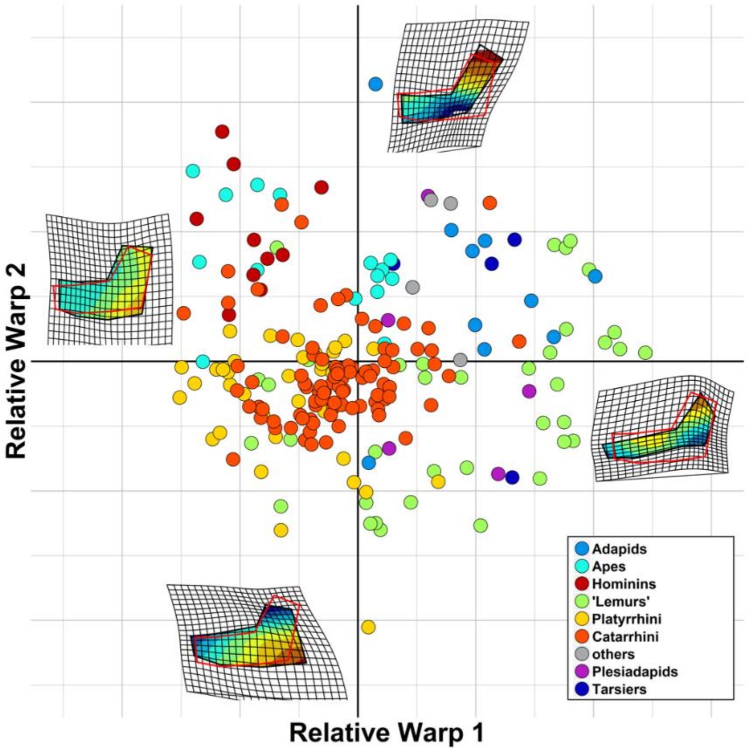

Figure 1. The major axes of mandibular shape variation in primates, retrieved from GMM. *Homo* and the australopiths almost exclusively occupy the upper left quadrant of the plot (purple circle). At the two extremes of both axes we reported the shape deformation associated to these axes, overimposed on the primate consensus shape (in red) and a continuous colour scale representing the mandibular areas or more intense deformation, from areas where the mandible widens compared to the consensus (in red) to areas where it compresses (in blue). The image was generated by using the R package ggplot (http://ggplot2.org/) and our own R codes.

Results

We found the entire hominin clade to stand out among primates, accounting for a disproportionately large share of the clade mandibular shape variation (Fig. 2).

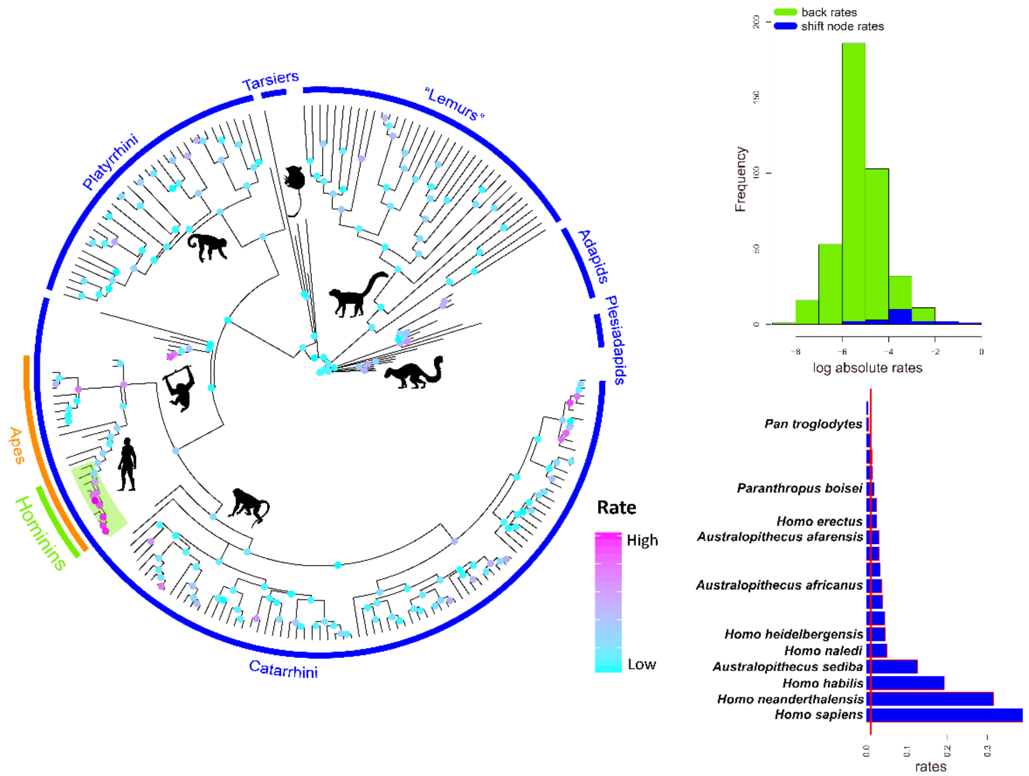

Figure 2. The evolutionary rates of mandible shape on the primate tree. The tree on the left reports rates computed according to phylogenetic Ridge Regression (coloured dots, scaled according to the rate value, from low = cyan, to high rates = magenta). The human clade, highlighted with a green semitransparent box, represents the only rate shift as indicated by the variable Brownian rate approach. On top right, the phylogenetic Ridge Regression rates (in absolute values) computed for the branches of the tree not belonging to the human clade (green) are contrasted to rates for the human clade (blue). On bottom right, phylogenetic Ridge Regression rates of individual branches of the human clade (in absolute value) plus the human clade sister species, the common chimpanzee, are collated in increasing rate value (blue bars) and contrasted to the average rate computed over the entire tree (the vertical red line). Bars without names correspond to internal nodes of the human clade. The image was generated by using the R package ggplot (http://ggplot2.org/) and our own R codes.

More importantly, hominins represent the only instance of (multivariate) rate shift in mandibular shape evolution in primates, either according to RRphylo, or by using the more traditional, multivariate Brownian rate variation approach (Fig. 2). This result does not depend on the tree topology and branch lengths we adopted. We produced 100 random trees where half of the node ages were allowed to vary in between the ages of their parent and descending nodes. Contemporarily, in each random tree 50% of the tips were allowed to swap position, up to three nodes from their actual position (e.g., a *Homo erectus - Homo sapiens* sister species relationship, albeit *Homo neanderthalensis* and *Homo heidelbergensis* are present in the tree, is theoretically permitted in the random trees). Despite such strong rearrangement of the topology and branch lengths, the average rate of evolution calculated for the branches of the hominin clade remains statistically higher than for the remaining part of the tree (see figure S3). Since body size variation accounts for a large share of ecological diversification within primates (Marroig and Cheverud, 2005), and is significantly related to shape variation (see supplementary material, and figures S6 and S7) we also repeated the analyses after factoring out the effect of size on shape, by using the centroid size of the landmark configuration as a proxy for size. Again, only hominins stand out for having exceptionally large rates (figure S6).

The direction of shape change, Homo and the australopiths evolved along parallel trajectories of shape change

The evolutionary rate represents the magnitude of shape change to the unit time. However, it is silent as per the direction of change. RRphylo produces vectors of regression coefficients (associated to the RW scores) describing the mandible shape change from one node in the tree to the next. Such vectors, besides their size (magnitude) have specific directions, that can be expressed in terms of the angle they form to each other, or to a specific reference. Given the indication of a rate shift in mandible shape evolution accruing to all hominins, we took the most recent common ancestor to the great apes in the tree as the reference and computed the angles between each ape species and such ancestor. Then, we partitioned the great apes in non-hominin apes (here to fore just 'ape' for simplicity), *Homo* species, and australopiths.

We found the mean angle of apes to the most recent common ancestor of all great apes was 26.5 degrees. For australopiths, the angle was 68.2 degrees, some 42 degrees more. For *Homo* species, the mean angle was 73.5 degrees, 47 degrees wider than apes, but only 5.3 degrees wider than the mean angle for the australopiths (Fig. 3). According to a randomization test, the difference in angles between apes and australopiths, and apes and *Homo* are both significant ($p = 0.032$ and $p = 0.01$, respectively). In contrast, the angle between australopiths and *Homo* is not significant ($p = 0.43$). This implies the trajectories of *Homo* and the australopiths are parallel, whereas both diverge significantly from the other greater apes' trajectory (Table 1). The same procedure repeated with the inclusion into the analysis of the Hylobatidae (lesser apes) shows similar results, but also indicates there is no significant difference in angles between the trajectories of lesser apes and the hominins (Fig. 3 b, d).

comparisons	Difference in angle	p.value		
APE_AUS	-41.74	0.06		
APE_HOM	-47.025	0.047		
AUS_HOM	-5.285	0.603		
		APE	AUS	HOM
angle from the origin		26.5	68.24	73.53

Table 1. Multivariate angle of evolutionary rates. The row names correspond to individual comparisons of one group to another. APE = great apes exclusive of hominins, AUS = australopiths, HOM = *Homo* species.

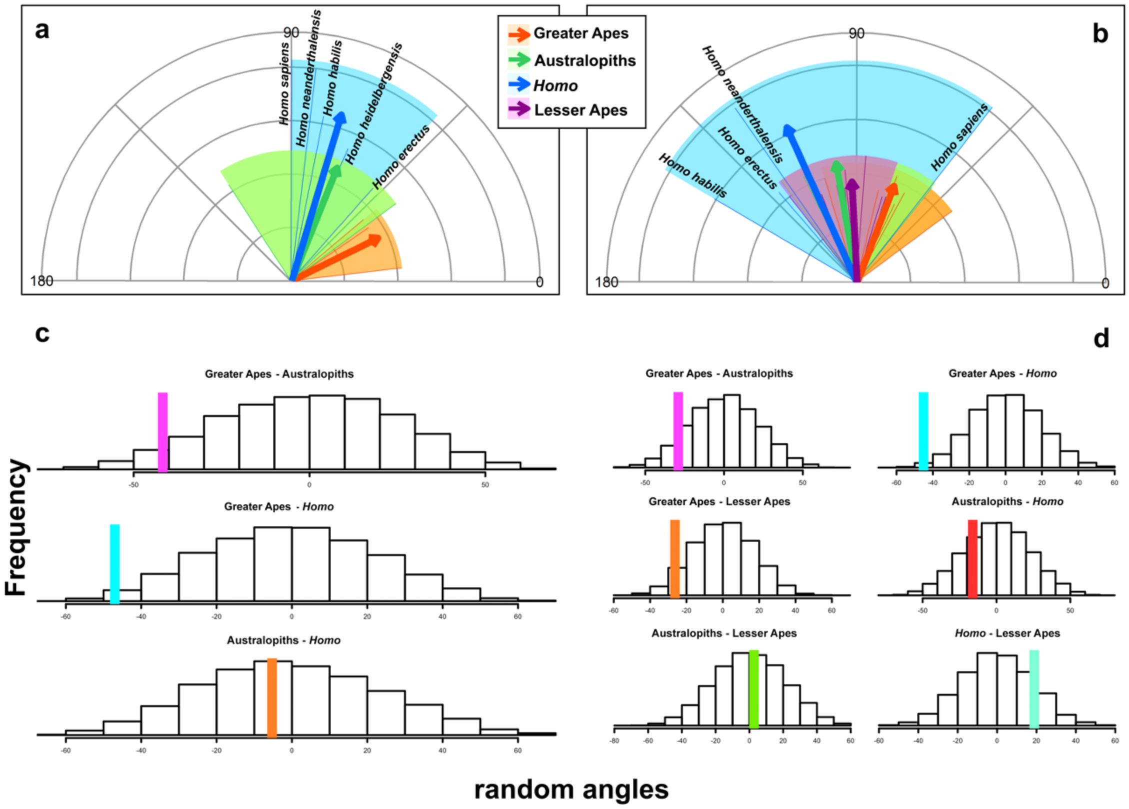

Figure 3. Multivariate angle comparisons among non-hominin apes, *Homo* species and the australopiths, assessed through multivariate angles between rate vectors. In (**a**) angles of *Homo*, australopiths, and non-hominin greater apes (Great Apes) are depicted starting from the common origin (the ancestor of all these species). The range of angles for each group is highlighted: *Homo*, transparent blue; Australopiths,

transparent green; Great Apes, transparent orange. Vector length is proportional to actual vector size (i.e. the evolutionary rate). In (**b**) the same as with (**a**) but including lesser apes (Hylobatidae) highlighted in transparent purple. In (**c**) the angles in (**a**) are tested for significance by shuffling the rates among groups 10,000 times, real differences are indicated by the color bars. In (**d**) the angles in (**b**) are tested for significance by shuffling the rates among groups 10,000 times, real differences are indicated by color bars.

Mandibular shape evolution, dental occlusion, and canine size

Our results show that mandibular shape in hominins evolved faster than in any other primate clade. Contrary to our expectations, the rate of evolution in *Homo* is not smaller than in the australopiths, and the direction of the shape change velocity is one and the same for the two hominin clades. This means that the reason for the unexpected pattern of rapid mandible shape evolution observed across hominins has to be found among the characteristics shared by the australopiths and *Homo*. According to a large corpus of available data, the australopiths and *Homo* differ from each other in terms of habitat preferences, body size, patterns of sexual dimorphism, diet and food processing behaviour (Reed et al., 2013; Foley et al., 2016). However, tool use has been hypothesized to occur in all early hominids, including australopiths (Susman, 1994; McPherron et al., 2010; Skinner et al., 2015). Such emphasis on mechanical food processing might have caused parallel evolutionary changes in the mandible of hominins. Relevant dental features shared by all hominins are the reduction of maxillary canines crown height, reduced sexual dimorphism (Hylander, 2017), and loss of the honing capacity of the C/P_3 complex (Haile-Selassie et al., 2004), which by contrast represents a nearly ubiquitous and stable adaptation in nonhuman anthropoids. As compared to the greater apes, all hominins evolved after *A. anamensis* also share a derived temporomandibular joint (Lockwood et al., 2002), that allows for a peculiar forward translation and rotation of the mandible during mouth opening in increase gape (Ulhaas et al., 2007; Rak and Hylander, 2008), and show strongly reduced anterior dentition (incisors and canines), shorter mandibular corpus with more divergent rami and an increase in the absolute and relative size and complexity of the post-canine dentition. The evolutionary emergence of these features has been related to dietary shifts, sexual selection, or a combination of both (Greenfield, 1992; Guatelli-

Steinberg, 2016). Stelzer et al. (2017) suggest that the reduction in incisors size, and the assumption of the parabolic dental arcade in *Homo* was due to canine and diastema reduction, rather than being selected per se. In turn, whereas usually interpreted as evolving under sexual selection, canine size in male hominins is functionally linked to an increase in mechanical efficiency of the jaws, in order to preserve gape and bite force (Hylander, 2013; Delezene, 2015; Hylander, 2017; Glowacka et al., 2017). Hylander (2013; 2017) argued that in hominins feeding on tough foods items bite force is increased by a forward shift in the position of the jaw muscles. Yet, this comes at the cost of decreasing gape. The reduced gape thus becomes incompatible with vertically elongated canines, hence with a working C/P_3 honing complex (Hylander, 2013; 2017), because the P_3 has to slide forward towards the canine tip, rather than producing sliding friction against the upper canine rear margin. However, there is no evidence that the earliest hominins such as *Sahelanthropus*, *Ardipithecus* and *A. anamensis*, which all show a non-honing C/ P_3 complex, were tough food consumers (Suwa et al., 2009; Strait et al., 2013; Sponheimer et al., 2013; Guatelli-Steinberg, 2016). Hylander (2013) found that among the living catarrhines intersexual differences in the degree of canine overlap and gape are not significant only in *Homo sapiens* and the hylobatids. Inspired by these reports, we repeated the multivariate angle calculation taking lesser apes in consideration. Intriguingly, whereas the trajectories of the two hominin groups remain parallel, and both are significantly or marginally different from the trajectory of the other great apes, hylobatids are not smaller (in multivariate angle) than either hominins or great apes (table 2, table S3). Delezene (2015) showed that since the inception of our own clade (i.e. with the appearance of *Sahelanthropus, Orrorin,* and *Ardipithecus*) there was no longer any integration or covariation either between the canines and third lower premolars, which is necessary for efficient honing. While this might have served to increase bite force in early hominins (Hylander and Vinyars, 2006; Lieberman, 2011), its most important evolutionary consequence could have been the increased evolvability of premolars and increased pattern of reduction of the anterior dentition, including incisors. Such rapid evolution in the dentition (hence in mandible shape) has profound adaptive significance (Pampush, 2015). It might have permitted the acquisition, in the later species, of deep mandibular corpus and strong ramus (Rak et al., 2007; Rak and Hylander, 2008) in relationship to though food consumption (Lee-Thorp et al., 2010;

Cerling et al., 2011). Differences in absolute size and relative position of the cheek teeth link to major changes in the trophic niches of our ancestors during the Plio-Pleistocene (Chamberlain and Wood, 1985; Sponheimer et al., 2013), and to the ever more extensive use of stone tools.

comparisons	**Difference in angle**	**p.value**
APE_AUS	-29.057	0.073
APE_HOM	-45.174	0.006
APE_HYLO	-26.33	0.057
AUS_HOM	-16.116	0.242
AUS_HYLO	2.727	0.544
HOM_HYLO	18.844	0.85

	APE	**AUS**	**HOM**	**HYLO**
angle from the origin	69.26	98.31	114.43	95.59

Table 2. Multivariate angle of evolutionary rates. The row names correspond to individual comparisons of one group to another. APE = great apes exclusive of hominins, AUS = australopiths, HOM = *Homo* species, HYLO = lesser apes.

Even if many aspects of mandibular and dental morphology, as for example the high rami in the mandible of the lineage *A. afarensis* – *P. boisei* and the development of megadontia in the *Paranthropus* are functionally related with some major shift in diet, it is unlikely that food adaptations per se may account for the high rates of mandible shape evolution along the entire hominin lineage. Taking in consideration the differences in both dietary and food processing habits between the australopiths and *Homo*, the vectors of the rates should be divergent, which we found was not the case. Intriguingly, sexual selection cannot explain the very high rates we observed in *Homo sapiens* and *Homo neanderthalensis* that are the species showing the lowest level of sexual dimorphism among primates, and the ostensibly divergent shape in *Homo sapiens* mandible is not shared by the Neanderthals (Pampush, 2015; Pampush and Daegling, 2016).

We propose the reshaping of the mandible, shared by the australopiths and *Homo*, was startled by both biomechanical and "structural" events such as the loss of a functioning of the C/P_3 honing complex (Haile-Selassie et al., 2004). This exaptive condition occurred early in hominin evolution and generated "cascading effects" that were recruited for a number of different adaptations along and across the history of the human clade, in response to the rapid environmental changes recorded in Africa from the Upper Miocene through the Plio-Pleistocene.

Methods

Geometric Morphometrics of Primate mandibles

We used Geometric Mophometrics (Gmm, Adams et al., 2004; Klingenberg, 2010) to extract morphological data. This method permits to retrieve shape information of anatomical objects after removing non-shape variation (i.e. as related to size, position and orientation of the objects) by applying Generalized Procrustes Superimposition (GPA, Rohlf and Slice, 1990). By using the TpsRelw software ver. 1.53 we performed Relative Warps Analysis on aligned coordinates (RWA, Zelditch et al., 2012) to decompose shape variation into orthogonal axes of maximum variance.

For this study we collected (either by taking pictures directly, from digital sources, or from published pictures) 731 digital images of primate hemimandibles, belonging to 211 species (148 extant, 63 extinct). The number of mandibles per species ranges from 1 to 13 (median = 3, mean = 3.48). The requirements for picture inclusion in the dataset were the presence of anatomical regions where landmarks had to be placed, absence of distortions and breakages on the bone, and orientation perpendicular to the picture plane. Fortunately, being the hemimandible a flat bone, these features were easily recognizable, even on samples taken from published resources. The pictures we took directly derive from Meloro et al. (2009). We used tpsDig2 software to digitize 9 landmarks as to adequately describe the lower jaw profile (Fig. S4). Gmm also returns the Centroid Size (the square root of the sum of squared distances between each landmark and the centroid of each configuration), a metric that permits to get back the information related to size that are removed by GPA. We regressed the natural logarithm of centroid size (lncs) and ln body mass estimates taken from the literature, to assess whether lncs works good as a proxy for body size. The regression is highly significant and positive (slope = 0.300, R^2= 0.844, $p < 0.001$, Fig. S5). Shape variance was decomposed into 14 axes (Relative Warps). We performed the Gmm analyses twice: on the full dataset, and on a dataset deprived from pictures we obtained from literature. The former dataset (FULL) consists of 211 species, the reduced dataset

(SMALL) includes pictures for 158 species (145 extant, 13 extinct). For both datasets, we used for the rate analyses only the four first largest RW axes, as they capture some 90% of the shape variance.

RRphylo

The Phylogenetic Ridge Race Regression version we present here ('RRphylo') develops on phylogenetic ridge regression as described in Castiglione et al. (2018). It applies penalized ridge regression to the tree and species data. The difference between the phenotype at each tip and the phenotype at the tree root is the sum of a vector of phenotypic transformations along the root to tip path, given by equation (1)

$$\Delta P = \beta_1 l_1 + \beta_2 l_2 + \cdots + \beta_n l_n \qquad (1)$$

where the β_{ith} and l_{ith} elements represent the regression coefficient and branch length, respectively, for each i_{th} branch along the path. As regression slopes, the β coefficients represent the actual rate of phenotypic transformation along each branch. The matrix solution to find the vector of β coefficients for all the branches is given by equation (2) (James et al., 2013);

$$\hat{\beta} = (L^T L + \lambda I)^{-1} L^T L \qquad (2)$$

where **L** is the matrix of tip to root distances of the tree (the branch lengths), having tips as rows. For each row of **L**, entries are zeroes for branches outside the tip to root path, and actual branch lengths for those branches along the path. The vector $\hat{y}$ is the vector of phenotypes (tip values), $\widehat{\beta}$ is the vector of regression coefficients, and λ is a penalization factor that avoids perfect predictions of $\hat{y}$, therefore allowing for the estimation of the vector of ancestral states, computed as in equation (3):

$$\hat{a} = L'\hat{\beta} \qquad (3)$$

where $\mathbf{L}'$ is the node to root path matrix, calculated in analogy to **L**, but with nodes as rows.

After computing the rates for the tree branches, we searched for shifts in the rates across the tree. This rate by clade (RBC) analysis within RRphylo scans the tree to find shifts in the rate of phenotypic evolution. There are a number of methods available in literature to apply model-free computations of the evolutionary rates, yet some of them do not work with fossil phylogenies (e.g. Morlon et al., 2016) or are computationally very intensive. With RRphylo, the Brownian rate (σ^2) is calculated for all clades as large as the user specifies (in terms of number of tips). Individual nodes (i.e. the clade they subtend to) are arranged according to their rates (i.e. in descending σ^2 value). Then, the user is left with two different options to locate a number of potential shifts. First, it is possible to specify the number *n* of shifts to be searched for all combinations of the *n* clades with the *n* largest σ^2 value, with size 1 to *n*. For instance, with *n* = 3 RRphylo will search through all the eight possible combinations of the 3 nodes with the largest σ^2 values (three combinations with one shift only, one for each node; three combinations of two shifts at two different nodes; and a single combination including all the three shifts for all *n*=3 nodes, plus Brownian motion, which means no shift applied). Alternatively, all selected nodes are partitioned in groups according to their patristic distance, and the number of distinct groups with potential shifts is established via bootstrapped cluster analysis of the internodes distances. This way the number of potential shifts is located in topologically distinct parts of the tree. The resulting number of groups *k* is thus taken to be equivalent to the number of shifts to be searched, by examining all possible combinations of the *k* nodes with the largest σ^2 values. Of course, it is still possible (and in fact tested) that more than one shift falls in the same region of the tree.

Once potential shifts are located, their combinations represent different rate variation models, which are compared to each other (and to a single rate, pure Brownian motion model) by means of restricted maximum likelihood fitted with the function brownieREML in phytools (Revell, 2012), in the case of a single variable, or mvBM in mvMORPH (Clavel et al., 2015) in the multivariate case. The likelihoods of individual models are contrasted to each other to find the best model by means of likelihood ratio test. It is important to note that whereas RRphylo assigns each branch its own rate of evolution, shifts are located by assessing the likelihood of multi-rate Brownian motion models.

Accounting for phylogenetic uncertainty in node age and topology

The distribution of evolutionary rates depends on the distribution of branch lengths and on the tree topology (Bapst, 2013). Every phylogenetic tree represents at best a phylogenetic hypothesis, which should be evaluated against alternative topologies, and branch lengths. To account for phylogenetic uncertainty, we wrote a Rcode that changes the tree topology and branch lengths. For every given species, the function swaps the phylogenetic position up to two nodes distance. For instance, the topology ((A,(B,C)),D) could be swapped to the forms ((C,D),(A,B)); (((B,D),A),C) and so on. In addition, each node age is randomly set at any age between the age of its parental node, and the age of its oldest daughter node. We applied the tree swapping function 100 times, computed RRphylo rates at each time, and draw the difference in mean absolute rates between the human clade and the rest of the tree each time.

Multivariate angle computation of evolutionary rates

Our goal was to verify whether the shape trajectory in *Homo* and australopiths were parallel, and whether they differed from that of non-hominin apes. One limitation with traditional trajectory analysis (e.g. Adams and Collyer, 2009) is that it ignores phylogenetic relationships. To overcome this problem, we analysed shape trajectories by using phylogenetic ridge regression results.

In the context of RRphylo, each branch of the tree has its own rate vector computed. With our data, such rate is composed by the ⍰ coefficients of individual RW scores. The magnitude of the rate vector (i.e. the evolutionary rate) is equivalent to the square root of the sum of squared ⍰ coefficients. Direction is defined in reference to another vector, computing the angle between the two. Assuming **A** and **B** are two rate vectors the angle between them θ is defined by equation (4):

$$\theta = arccos \frac{A \cdot B}{|A||B|} \qquad (4)$$

Thus, the path between any node in the tree and a given tip is given by the trigonometric addition of successive vectors, aligned along the node to tip path, which could be summarized as a resultant vector having its own magnitude and angle to the node. For instance, given a species and two successive parental nodes above it, so that the node-to-species path sequence is Node1/Node2/species, the resultant vector $\vec{R}$ is given by equation (5):

$$\vec{R} = \vec{A}_{Node1} + \vec{B}_{Node1} + \vec{C}_{Node1} \qquad (5)$$

$\vec{R}$ is centered on Node1, so that $\vec{R}$ will be at a certain angle to it. Here, we computed the angle between each ape species and the most recent common ancestor common to all of them (the species to apes most recent common ancestor angles) and contrasted the angles between species partitioned into non-hominin great apes (just 'apes' for simplicity), species belonging to *Homo*, and the australopiths. We measured the difference in mean angles between groups and generated a family of 10,000 random differences by shuffling angles between individual species. If the actual mean angle difference between two groups is larger than expected by chance, it means that the between groups trajectories are divergent, otherwise they are parallel.

Acknowledgements

We are especially in debt with Paolo Piras for the kind and profound assistance with the R scripts for the geometric morphometrics analyses.

Reproducing the internal and external anatomy of fossil bones: Two new automatic digital tools

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Abstract

Objectives

We present two new automatic tools, developed under the R environment, to reproduce the internal and external structures of bony elements. The first method, Computer-Aided Laser Scanner Emulator (CA-LSE), provides the reconstruction of the external portions of a 3D mesh by simulating the action of a laser scanner. The second method, Automatic Segmentation Tool for 3D objects (AST-3D), performs the digital reconstruction of anatomical cavities.

Materials and methods

We present the application of CA-LSE and AST-3D methods to different anatomical remains, highly variable in terms of shape, size and structure: a modern human skull, a *malleus* bone, and a Neanderthal deciduous tooth. Both methods are developed in the R environment and embedded in the packages "Arothron" and "Morpho," where both the codes and the data are fully available.

Results

The application of CA-LSE and AST-3D allows the isolation and manipulation of the internal and external components of the 3D virtual representation of complex bony elements. In particular, we present the output of the four case studies: a complete modern human endocast and the right maxillary sinus, the dental pulp of the Neanderthal tooth and the inner network of blood vessels of the malleus.

Discussion

Both methods demonstrated to be much faster, cheaper, and more accurate than other conventional approaches. The tools we presented are available as add-ons in existing software within the R platform. Because of ease of application, and unrestrained availability of the methods proposed, these tools can be widely used by paleoanthropologists, paleontologists and anatomists.

1. Introduction

The use of 3D models is revolutionizing the study of the human fossil record, giving rise to the burgeoning field of "Virtual Anthropology" (Weber, 2001). In virtual anthropology applications, a fossil specimen is represented by a 3D object, commonly a surface mesh formed by a net of oriented triangular facets, which are individually defined by the coordinates of their vertices and by their mutual connections. The collection of vertices, coordinates, and connections defines the shape of the virtual surface in the computer language (Weber and Bookstein, 2011). Besides reduced handling of the fossil items, the advantages of using virtual objects over the original fossil specimens are the unrestrained availability, ease of magnification, and unlimited access to inner details. There arises the possibility of digitally "dissecting" the specimen in order to observe its internal structures, which often have significant diagnostic value and are hard to access, measure, and study otherwise.

The attention of paleoanthropologists to the inner cavities of the human skull is longstanding, tracing back at least to Taung child's natural endocast discovered in South Africa, and described by Raymond Dart (1925). In palaeoanthropology, the use of CT-scans is now becoming very common, also given the ever-increasing availability of web-based repositories (e.g., Nespos, Digital Morphology

Museum, KUPRI, MorphoSource). By using digital specimens, it is possible to reconstruct both inner cavities and outer surfaces, such as cranial endocasts and partially missing, broken or deformed vaults. The CT-scan allows the application of such procedures to almost every specimen whose preservation is good enough to present quality details. Thanks to this technology, the number of studies dedicated to inner cavity sizes and shapes has increased in the last few years. Such studies include investigations on inner ear structure (Gunz and Mitteroecker, 2013), cranial nerve organization (Ibrahim et al., 2014), trabecular bone geometry (Chirchir et al., 2015; Ryan and Ketcham, 2002), and, of course, the volume and shape of brain endocasts (Beaudet and Bruner, 2017; Diniz-Filho and Raia, 2017; Falk et al., 2005; Iurino et al., 2015).

Similarly, biological symmetry and reference shapes (i.e., integral or better-preserved specimens available for comparison) are becoming the focus of growing interest, for they can be used as a guide to reconstruct missing, deformed or broken portions, allowing the study of the original external anatomy of incomplete fossil material (Daura et al., 2017; Di Vincenzo et al., 2017; Gunz, Mitteroecker, Neubauer, Weber, & Bookstein, 2009; Gunz et al., 2012; Hublin et al., 2017; Profico, Di Vincenzo, Tafuri, & Manzi, 2016b; Spoor et al., 2015; Zollikofer et al., 2005).

The protocol usually applied to render three-dimensional fossil remains using computer graphics demands manual segmentation of the CT-scan data (Weber and Bookstein, 2011). Proceeding through sequential CT slices, the operator defines a mask of the inner cavities in each region of interest. Eventually, the operator performs a triangulation of the segmented slices, thus obtaining a 3D mesh. This procedure is time-consuming and prone to generating topological artefacts (Profico et al., 2016c; Veneziano et al., 2018), due to the almost unavoidable inaccuracies in the manual processing (closure) of holes and gaps, such as foramina or missing portions (Huotilainen et al., 2014; Nicolielo et al., 2017). On the other hand, the isolation of the external surface could be useful to virtually restore incomplete/damaged specimens. In virtual reconstructions, reference models (e.g., well-preserved specimens) are used to fill the gaps in a deficient specimen. These portions can be warped by Thin-Plate-Spline (TPS) interpolation (Gunz et al., 2005) or aligned and merged via digital alignment (Profico et al., 2016a).

Commercial software commonly used for segmentation and mesh editing are often expensive. In this article, we describe and apply two new methods (developed in R and hence available for free), both aimed at automatically reproducing virtual images of both inner and outer surfaces of fossil remains. The first method, Computer-Aided Laser Scanner Emulator (CA-LSE), provides the reconstruction of the external portions of a 3D mesh, being a replacement for laser scanners, and it further allows the reconstruction of internal surfaces by subtraction. The second method, Automatic Segmentation Tool for 3D objects (AST-3D), performs the digital reconstruction of anatomical cavities, and further allows the reconstruction of the outer surface by subtraction.

We provide a detailed description of the protocols used to apply both CA-LSE and AST-3D, and present the direct application of both methods to different kinds of anatomical remains, greatly variable in terms of shape, size, structure, and quality of preservation: a modern human skull, a *malleus* bone from a Middle Ages human skeleton, and a Neanderthal deciduous tooth. Both methods are developed in R (Team, 2015) and embedded in the packages "Arothron" (Profico et al., 2018) and "Morpho" (Schlager, 2017) where the code and the 3D models used in this work are made freely available.

2. Matherials and method

We tested CA-LSE and AST-3D on human skeletal remains differing in complexity, size, and quality of preservation. We chose a modern human skull, a deciduous tooth from a Neanderthal individual, and a subrecent human *malleus* bone.

The skull FU-3115 belongs to an adult male *Homo sapiens* individual stored within the Natural History Museum collections (section Anthropology), at the University of Florence, Italy. The specimen was available as a CT-scan (voxel size: $0.57 \times 0.57 \times 0.9$ mm^3) and a 3D mesh with 886080 facets and 1199016 vertices. The Neanderthal tooth comes from Hušnjak hill in Krapina (Croatia). Discovered in 1899, Hušnjak hill yielded a huge number of skeletal remains of *Homo neanderthalensis*, representing at least 80 different individuals. We chose the specimen Kr-d1, a complete and well-preserved second right lower molar belonging to a juvenile individual; we used a micro CT-scan (voxel size: $0.025 \times 0.025 \times$

0.025 mm³), accessible on the Nespos database (www.nespos.org). The mesh is made of 3167736 facets, and 1583854 vertices. The *Homo sapiens* right *malleus* comes from the area of Portico D'Ottavia, Rome (PO 2010 US 23), and belonged to a subadult individual lived during the Middle Ages (XI century A.D.). The specimen, presently stored in the Anthropology lab at the Department of Biology (University of Florence, Italy), was digitally acquired with a Skyscan 1172 microCT scanner. The data type is micro CT-scan (voxel size: 0.01 × 0.01 × 0.03 mm³). The mesh is formed by 4577072 facets, and 228278 vertices.

2.1 CA-LSE and AST-3D application in Arothron

In Arothron (Table 1), a set of points of view (POVs) is defined in order to delineate the outer surface of the digital object of interest, thus producing a mesh of the visible (from the POVs perspective) surface. This operation is an implementation of the "Hidden Point Removal" (HPR) operator method developed by Katz, Tal and Basri (2007).

ext.int.mesh	
mesh	triangular mesh of class 'mesh3d'
views	vector or k x 3 matrix containing a set of viewpoints
param1	value to generate an offset at the meshes surface (see text)
default	if TRUE the points of view are defined automatically, if FALSE the user needs to define matrix_pov
import_pov	if TRUE the user needs to specify matrix_pov. If NULL the points of view are automatically specified
matrix_pov	matrix of set of points of view
method	set "ast3d" or "calse" for the method to be used in the selection of the points of view
start.points	number of points of view to be plot when "ast3d" or "calse" method is used
num.cores	integer: number of cores to use, set NULL to suppress this option
out.inn.mesh	
scans	an object obtained using the ext.int.mesh function
mesh	triangular mesh of class 'mesh3d'
plot	logical: if TRUE, the wireframes of the visible and the not visible component of the mesh are plotted

Table 1. Main arguments and correspondent definitions, of the functions *ext.int.mesh()* and *out.inn.mesh()* stored in the Arothron R package

There is no restriction upon the definition of POVs under CA-LSE, which are automatically placed on a sphere containing and not intersecting the 3D mesh. Conversely, under AST-3D the POVs set has to be manually defined within the cavity of interest (Figure 1). In both cases, the number of POVs will be instrumental in defining the final quality of the mesh pruning process. The more POVs, the better the final result.

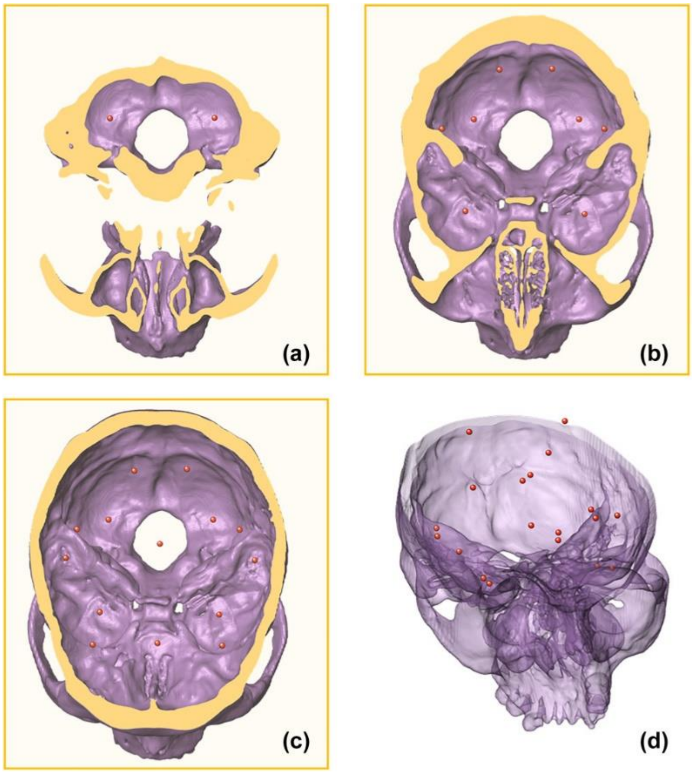

Figure 1. Graphical representation of the definition of the POVs (red spheres) to virtually reproduce the endocast, via 3D imaging software. POVs are sampled (a, b, c) cutting progressively the skull using a cutting plane (yellow square), until a complete set of POVs is defined (d)

It is possible to "scan" or "prune" a 3D mesh placing the POVs respectively outside or inside the mesh (i.e. the digital representation of a fossil specimen). As a result, two meshes are obtained, formed respectively by visible and not visible (from the POVs' perspectives) surfaces. The detection of the visible surface is directly obtained by applying the HPR process (Katz et al., 2007). The "not visible" surface is obtained via subtraction of the visible triangles from the original 3D mesh.

HPR is a two-step process: spherical flipping, and convex hull construction. The spherical flipping reflects each vertex of the mesh onto a sphere centred on a POV (Supporting Information Figure S2). The convex hull is built taking into account the POV (i), the vertices of the mesh (ii) and the reflected vertices of the mesh obtained from the spherical flipping (iii). A vertex of the mesh is marked as visible from the POV perspective if its reflected point lies on the convex hull (Supporting Information Figure

S2). Arothron is designed to perform CA-LSE both using automatic definition of the POVs or user selected POVs (Figures 1, 2 and Supporting Information Figure S1). For the former, the argument *default* in the function *ext.int.mesh()* has to be set to TRUE. Under the latter, the arguments *default* and *method* have to be set respectively to FALSE and "*calse*." To perform the AST-3D method the user has to set the arguments *default* and *method* respectively to FALSE and *ast3d*. It is possible also to import the coordinates of the POVs from external software (e.g., Slicer3d, ImageJ, Amira) setting the arguments *default* and *import.pov* on FALSE and TRUE, respectively. The matrix of POVs must be defined as the value of the argument *matrix_pov* (Table 1). To speed up the process the methods can run in parallel.

To install the Arothron R package:

install.packages("Arothron")

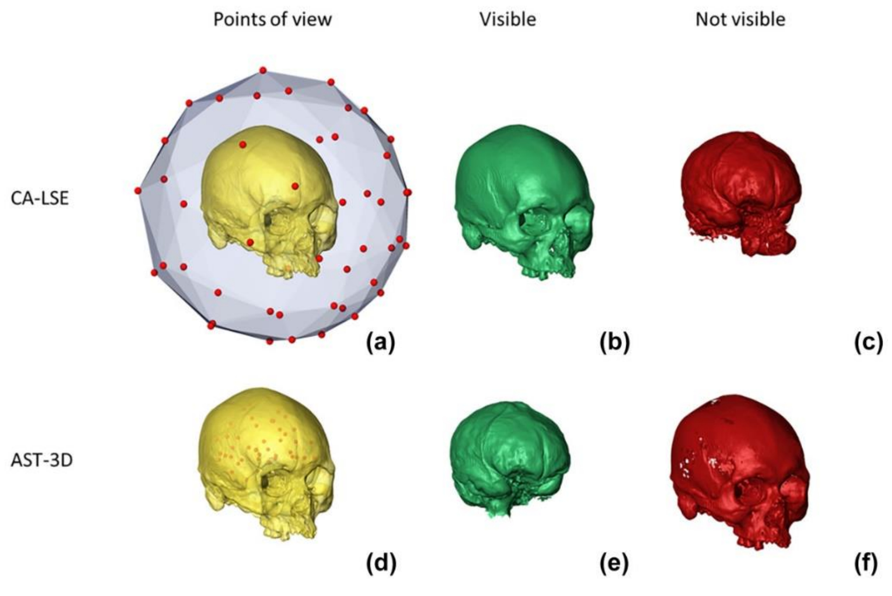

Figure 2. Functioning of CA-LSE and AST-3D methods. CA-LSE uses an external set of POVs (a) tagging the external surface as visible (b). AST-3D uses a set of POVs placed inside the cavity to be built (endocast, d) tagged as visible (e). In both cases nonvisible structures are acquired by subtraction (c and f). POVs are represented by the red spheres in (a) and (b)

2.2 CA-LSE and AST-3D application in morpho

A development version of the Morpho R package (Table 2) contains the function *virtualMeshScan()*, that allows the selection of all the vertices of the mesh that are visible from at least one of the defined POVs.

Argument	Definition
virtualMeshScan	
x	triangular mesh of class "mesh3d"
viewpoints	vector or k × 3 matrix containing a set of viewpoints
offset	value to generate an offset at the meshes surface (see text)
cores	integer: number of cores to use
getOuterViewpoints	
x	triangular mesh of class "mesh3d"
n	number of viewpoint to generate
inflate	factor for the size of the sphere: inflate = 1, for example means that the sphere around the object just touches the point farthest away from the mesh's centroid.
radius	defines a fix radius for the sphere (overrides argument inflate).
subdivision	parameter passed to vcgSphere, defining the triangle density on the surrounding sphere
PCA	logical: if TRUE, the sphere will be deformed to match the ordination defined by the principle axes of the mesh. NOTE: this may result in the sphere not necessarily completely enclosing the mesh.

Table 2. Main arguments and correspondent definitions, of the functions *virtualMeshScan()* and *getOuterViewpoints()* stored in the Morpho R package

Visibility is determined by evaluating whether a straight line running between the 3D-mesh vertices and the POVs intersects the mesh. As the vertex itself is on the surface of the mesh, technically all lines intersect the mesh at least once. To avoid this, a slight offset (by default this is 0.001 mm) is applied in the direction of the POV (Figure S2). The whole process mimics the behavior of a camera rotating around each POV. The visible portion of the mesh (from the perspective of POVs), is then obtained by removing all the 3D mesh facets tagged as "not visible" (Figure S2). To increase speed of computation, the function may run using parallel computing. There are no constraints as to where the POVs are placed. To facilitate the simple separation of the outer layer (for CA-LSE method), the helper function *getOuterViewpoints()* allows sampling of a predefined number of equidistantly spaced coordinates on a sphere surrounding the mesh and centered at the barycentre of the mesh. To perform AST-3D a set of specified points has to be defined by the user.

To install the developmental version of the Morpho R package:

require(devtools)

install_github("zarquon42b/Morpho", local = FALSE)

3. Results and discussion

The application of CA-LSE and AST-3D (see Supporting Information 1–2) allows isolation and manipulation of the internal and external components of the 3D virtual representations of complex bony elements. We provide a video tutorial as Supporting Information (Supporting Information 3) for the application of both methods in R environment. The common element to both methods is the definition of a set of points of view (POVs). A POV is a dimensionless point simulating a camera recording the portion of a 3D model which is visible from its Cartesian coordinates.

The two methods work by identifying the visible vertices of the original 3D mesh from the perspective of each POV. If the POVs are located around the 3D model (CA-LSE), the outer surface will be tagged as "visible," whereas the internal structures will be tagged as "not visible" and built secondarily by subtraction (of the outer surface from the original 3D mesh). In contrast, if the POVs are placed inside a cavity of the 3D model (AST-3D), the vertices forming the surface of the cavity itself will be recorded as visible and the remaining vertices will be tagged as not visible and built by subtraction. CA-LSE works by defining a set of evenly spaced POVs sampled on a sphere surrounding the virtual specimen. AST-3D isolates visible portions by locating the POVs inside the cavity to be built, via 3D imaging software packages, such as Amira® (version 5.4.5, Visualization Sciences Group, ©2013; https://www.fei.com/software/amira-for-life-sciences/), the open-source software 3DSlicer® (version 4.6, 3D Slicer project, ©2005; https://www.slicer.org/) (Figure 1), or within the R environment by using the package Arothron (Profico et al., 2018) (S1). AST-3D requires internal elements be recorded via CT-scan. The virtual reconstruction of the body cavity is thus analogous to the conventional segmentation process, but completely automated. While either outer (under AST-3D) or inner (via CA-LSE) surfaces can be retrieved by subtraction, the level of detail and precision is method-specific. We therefore recommend using AST-3D for inner structures and CA-LSE for outer structures. It is nonetheless useful in many instances (e.g., while studying the influence of internal organs, such as the brain, on the shape of outer structures, such as the neurocranium) to have at least a plain representation of the countersurface. Hence, regardless of the methods and the R packages used, the output of the procedures will always be represented by two surfaces formed respectively by the facets of the 3D mesh either visible, or invisible from the specified set of POVs. In this article, AST-3D was applied to a modern human skull, to build the endocast and the right maxillary sinus. CA-LSE was applied to a deciduous tooth (Kr-d1) from a Neanderthal individual of the Krapina sample and to the *malleus* bone (PO 2010 US 23) from Portico D'Ottavia (Roma).

By default, the implementations in both R packages perform CA-LSE because the POVs are automatically set around the object to be "scanned." AST-3D is run under user specification by placing the POVs inside the region to be "pruned." The R package Arothron allows the selection of both internal and external POVs by means of an interactive 3D plot (Figure S1).

3.1 AST-3D application

The human endocast (Figure 2) and the right maxillary sinus (Figure 3) were built by defining a set of POVs inside the endocranial cavity (Figures 1 and 2) and the maxillary sinus, respectively. In the first case, the output is a complete endocast (visible facets) where the lobes as well as the branches of the middle meningeal artery are well-defined (Figure 2). In the case of maxillary sinus, the 3D model shows the connections of this air-filled cavity (visible facets) with the nasolacrimal foramen and the nasal aperture (Figure 3).

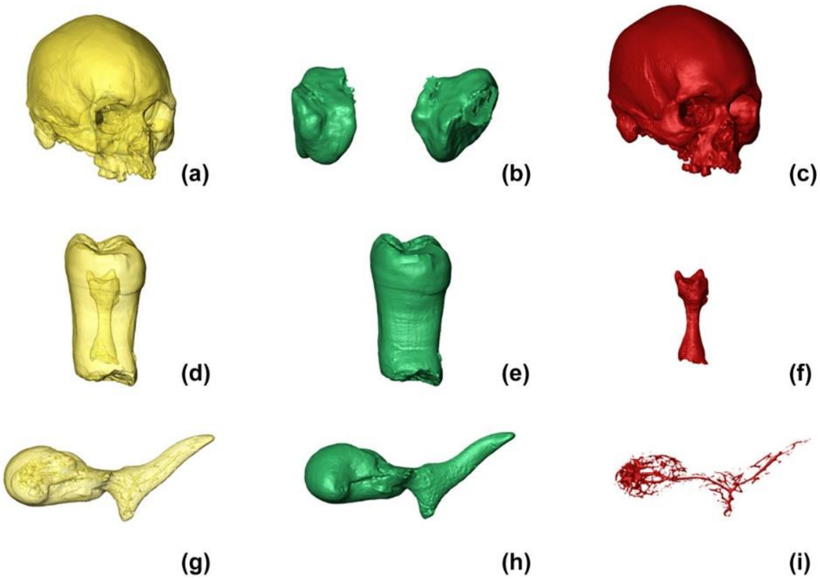

Figure 3. Graphical illustration of the three case studies: the right maxillary sinus (not in scale, and under two different views, b) obtained by AST-3D from the human skull (a) and the CA-LSE method applied to the Neanderthal deciduous tooth (d) and the human malleus bone (g). In green (b, e, h) is reported the surface visible from the POVs. In red (c, f, i) the nonvisible components of the mesh are reported. To reproduce these case studies see the R code reported as Supporting Information (Supporting Information 1,2)

3.2 CA-LSE application

We present the output of CA-LSE as applied to a Neanderthal tooth and to a human malleus bone. In the first case, the output consists of two separate objects, the first being the external surface of the tooth (crown and root included), and the latter is a detailed mesh of the dental pulp (not visible facets, Figure 3). The application to CA-LSE to a human malleus bone returned two separate meshes of both the bone external morphology (visible facets) and the inner micro-structure (not visible facets). The latter actually is a complex network of anastomosing blood vessels connected to the superior branch of the anterior tympanic artery through the nutrient foramen (Hamberger et al., 1963). In the case of the malleus, the versatility of CA-LSE method appears clear: the internal structure of the bone is not organized as a clearly delimited cavity. Therefore, this specific case-study demonstrates how the application of CA-LSE could be at least as effective in producing the internal structures as the external view in some specific instances.

The procedures described here were applied to three bony elements differing in size and complexity, highlighting the efficiency and versatility of the methods (Figures 2 and 3). Moreover, the creation of a mesh starting from the vertices and triangulations of a given surface prevent any risk of generating topological artefacts as it often happens when performing a manual segmentation of the regions of interest. This is particularly welcome when dealing with structures that are difficult to render, such as: (i) the complex network of blood vessels in the malleus bone, (ii) the connections of the maxillary sinus with other cranial cavities, and (iii) the middle meningeal artery visible on the surface of the cranial endocast. A further, major advantage of the semiautomatic tool is the speeding up of reconstruction of inner and outer 3D models, which in the cases presented were carried out in a dozen of seconds up to few minutes (see Supporting Information Table 1 for details).

CA-LSE and AST-3D address the increasing need for automation in virtual anthropology. In addition, the two methods have several advantages compared to conventional methods, in terms of time-effectiveness, accuracy and are implemented in a free open source software environment. As compared to manual protocols (i.e., visible surface cutting-out and segmentation) (Ogihara et al., 2018), CA-LSE and AST-3D are faster and more accurate, avoiding biases due to the subjectivity of an operator performing a manual segmentation. With respect to other semi-automatic tools (e.g., see Michikawa et al., 2017) which use segmentation of CT-scan instead of mesh editing, the entire procedure is easier, more versatile, and allows to build, at once, the meshes of both the external topology and internal structures.

Acknowledgments

The authors thank the NESPOS society (www.nespos.org) and Dr. D. Radovčić for kindly providing the virtual osteological material. They thank Dr. M. Zavattaro, curator of the Natural History Museum (Anthropology and Ethnology section) of the University of Florence, for providing access to the CT scan of the modern human skull. They also thank two anonymous reviewers for their useful suggestions and comments.

A new tool for digital alignment in Virtual Anthropology

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Abstract:

The study of the fossil record is fundamental to understand the evolution of traits. Since fossil remains are often fragmented and/or deformed by taphonomic processes, a preliminary re-alignment of their constituent parts is often necessary to properly interpret their shapes. In the field of virtual anthropology these procedures are carried out using digital models of the remains. We present a new semi-automatic alignment R software (Digital Tool for Alignment, DTA). DTA uses the shape information contained in a reference sample to find the best alignment solution for the disarticulated regions. We tested DTA on three different case-studies: i) a sample of 14 different primate species including both male and female individuals, ii) a simulated, disarticulated skull of *Homo sapiens*, and iii) a real disarticulated human fossil specimen, Amud 1 (*Homo neanderthalensis*). In the first case we simulated disarticulation directly on the Primate skulls digital models and tested alignment quality as a function of phylogenetic proximity, gender, and body size. In the second one, we compared DTA to manual alignments conducted over the same item. In the latter, we performed DTA on a real-world case study. We found out that phylogenetic proximity is the most important factor affecting alignment quality. However, gender and allometric effects might also be important and should carefully taken into account.

DTA consistently outperforms manual alignments. We provide the source code for DTA as an add-on to the R package Arothron.

Keywords:

geometric morphometrics; fossil; primates; R; Virtual restoration; *Homo neanderthalensis*.

Introduction

Fossil remains often appear badly deformed by biostratinomic and taphonomic processes (Hughes and Jell, 1992; Arbour and Currie, 2012; Schlager et al., 2018) which usually result in major cracks, missing portions, or the alteration of biological symmetry (Ogihara et al., 2006; Arbour and Brown, 2013; Di Vincenzo et al., 2017). This lack of information can now be recovered by applying virtual reconstruction procedures, which take advantage of software implementations to perform the restoration of a digital version of the fossil remain under study. Three-dimensional imaging techniques further allow substituting the manual intervention with virtual protocols (Shipman, 1981; Lyman, 1994), which guarantee the physical preservation of the fossil item and avoids potential alterations of its original shape as introduced by the manual operator. Missing morphological information can be digitally recovered by either using the preserved data on the deficient specimen (e.g. exploiting biological symmetry), or through the use of a 3D comparative sample of phylogenetically close species, conspecifics, or even individuals of the same sex (Gunz et al., 2009). Several case-studies are reported in the literature, and the use of virtual reconstructions is now becoming commonplace. Unfortunately, only very rarely (e.g., Ogihara et al., 2006; Tallman et al., 2014; Schlager et al., 2018) the issue of quantifying the efficiency of the applied virtual reconstruction method is addressed.

Herein, we present the Digital Tool for Alignment (DTA), a new landmark-based procedure to align portions of the same (broken) skull. The procedure simulates the manual and/or landmark-based alignment commonly used in virtual anthropology studies and provides the digital restoration of remains broken into two anatomical regions, even not in continuity, in which anatomical/geometrical points are recognizable.

This work is articulated in three parts. First, we assessed the influence of (i) phylogenetic distance, (ii) sex, and (iii) body size on DTA performance. To this aim, we analyzed a large sample of 14 different primate species, of both sexes, for a total of 131 individuals.

Secondly, we compared digital to manual alignments by using a digital model of a single *Homo sapiens* skull as a target, taking advantage from the help of expert operators in the field.

Lastly, we performed DTA on the Amud 1 cranial material, a Neanderthal specimen composed by two anatomical regions not in continuity: the maxillary region and the neurocranium with some elements of the facial complex.

Both the R code and a selected material are fully available in the Arothron R-package (Profico et al., 2018).

Materials and methods

The Digital Alignment tool (DTA)

The Digital Tool for Alignment (DTA) is a landmark-based methodology, written in R, which allows aligning two portions of a 3D mesh (here to fore the disarticulated model, DM) by using a reference sample or model (RM) for comparison (Fig. 1.a). To run DTA, a set of anatomical landmarks is defined on two separated portions of the DM (Fig. 1.b). Each point of the landmark sets is moved to the nearest vertex of the triangles (Fig. 1.c). This way, each landmark is identified by a number corresponding to a row of the vertex matrix of the mesh and its position is tracked on the 3D models moved in the Cartesian coordinate system. The second step is the alignment via Generalized Procrustes Analysis (GPA) of each part of the DM (Fig. 1.d) on each RM of the comparative sample, where the same landmark configuration as with the DM has been previously defined. Steps c and d make it possible the definition of the landmark set on both the DM and the aligned model (AM) (Fig. 1e).

The items of the reference sample are previously scaled to the mean of the single scale factors calculated for each half of the DM, separately, and symmetrized via reflection and relabeling, thereby producing a perfectly symmetrical, bilateral, and scaled landmark configuration (to avoid alignment error introduced by asymmetry).

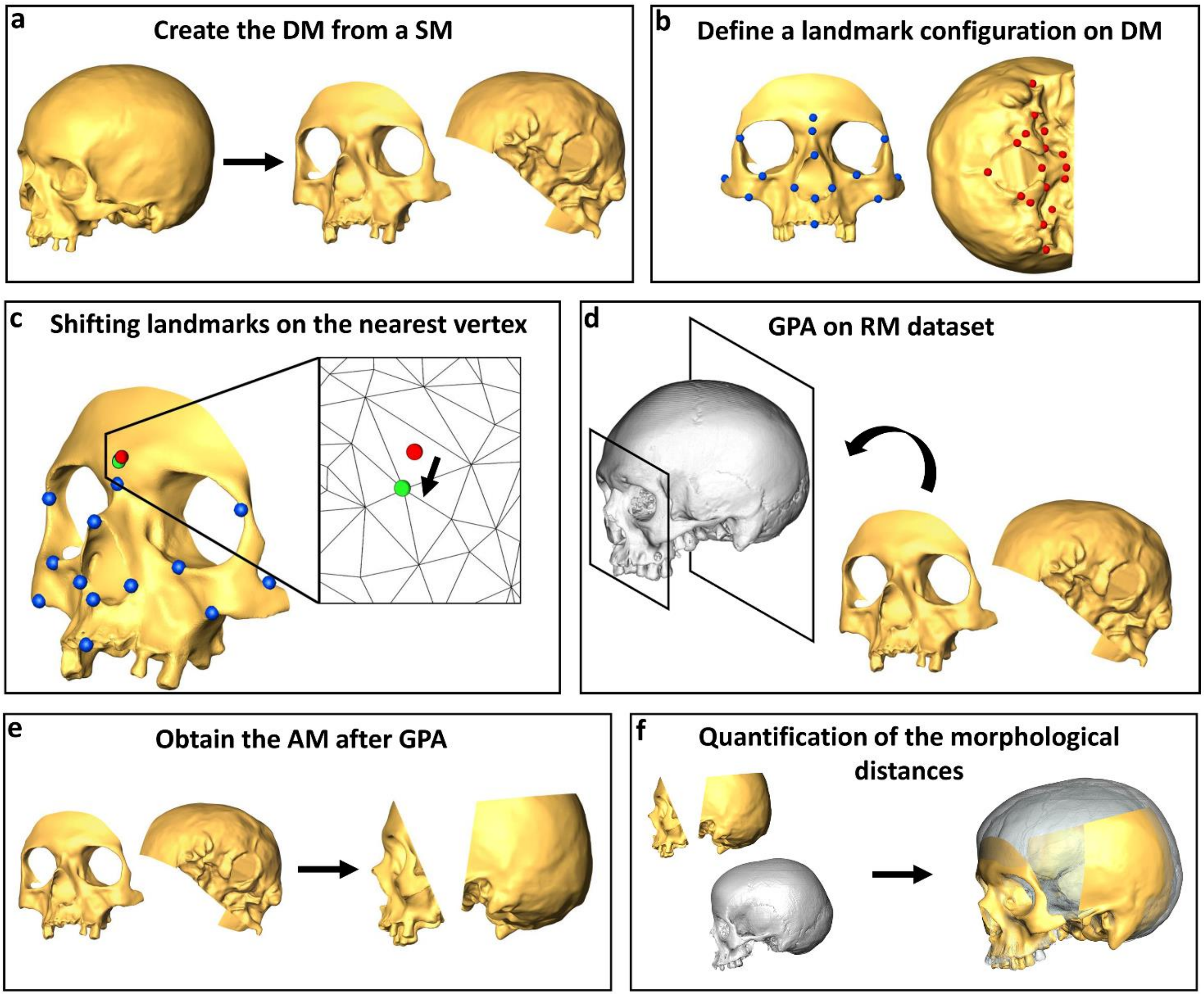

Figure 1. DTA methodology explained step by step. (a) Definition of the Disarticulated Model (DM) from a starting model (SM). (b) Definition of a landmark configuration on both face complex and cranial base of DM. (c) Shifting landmarks of DM model (in red) on the nearest vertex of the mesh (in green). (d) Compute a General Procrustes Analysis (GPA) of the facial complex and the cranial base on each reference model (RM). (e) Alignment of the two halves of the DM after the GPA. (f) Quantification of the morphological distance between the aligned configuration and the reference model dataset.

Abbreviations: DTA = Digital Alignment Tool; DM = Disarticulated Model; L set = Landmark Set; RM = Reference Model; GPA = Generalized Procrustes Analysis.

The third step consists of the quantification of the morphological distances between each part of the DM and the corresponding landmark configurations on each item in the RMs sample (Fig. 1.f).

DTA allows to calculate the morphological distance using either one of two different metrics: the total displacement (Euclidean distance) and the Procrustes distance.

Then, the single specimen in the reference set with the lowest morphological distance to DM is selected as the best RM for the digital alignment to reconstruct the integral shape of the target (Fig. 1.f). A complete list of abbreviation used here is reported in Table 1.

Label model	Abbreviation	Definition
Starting Model	SM	The SM is the mesh of the specimen used as case study.
Disarticulate Model	DM	The SM cut in two different parts. Each part is translated in the Cartesian coordinate system losing the starting spatial orientation.
Reference Model	RM	The RM is the model used as reference to align the two portions of the DM through two different Procrustes Fittings: each one performed on one of the two halves of the DM.
Aligned Model	AM	Merge of the two halves of the DM after the aligning via Procrustes Fitting on the selected RM.

Table 1. Models nomenclature. Labels of the models with abbreviation and definition used in the text.

Datasets

Case Study 1. Primate sample

We collected a sample of 131 sexed, adult skulls of 14 different Primate species. The specimens belong to the virtual collections of the Smithsonian Institution (www.vertebrates.si.edu, Washington), the Kyoto University Primate Museum (www.dmm.pri.kyoto-u.ac.jo, KUPRI, Kyoto, Japan), the anthropological museum, "G. Sergi"of the Sapienza University of Rome (Italy) and Morphosource (www.morphosource.org) (Supp. Table 1). On each specimen, we recorded 61 three-dimensional landmarks (Fig. 2, Supp. Table 2). The 3D coordinates were acquired using the software Amira® (version 5.4.5, Visualization Sciences Group, ©2013; https://www.fei.com/software/amira-for-life-sciences/).

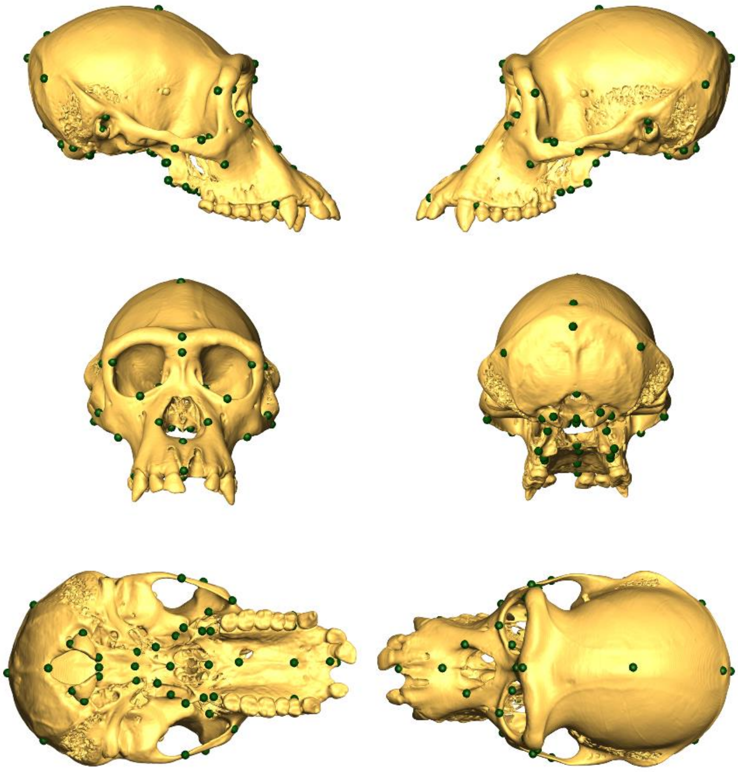

Figure 2. Landmark configuration used in the primate case-study.

For each of the 14 species in the sample, we built two separate DMs, one per sex. The process starts by dividing the 3D model in two inequal halves, along a plane passing through three points, chosen as to simulate a fracture separating the face from the neurocranium: the middle point, along the midsagittal plane, between the spheno-occipital suture and the two sphenoidal spines lines (i); the middle point along the right (ii) and left (iii) frontozygomatic suture. The two halves were randomly translated in the *xyz* Cartesian system to change their original spatial position.

We applied DTA to each of the 28 DMs (one per each sex per species) using the remaining 130 specimens as the reference sample. This leads to a total amount of 3640 alignments (28 disarticulated individuals times 130 individuals in each reference sample set).

Case Study 2. Homo sapiens skull

The specimen used as a target for all the alignments is a disarticulated, female modern human skull (BOL_2548) belonging to the "Bolognesi" collection preserved at the "G. Sergi" Anthropology Museum Rome (Italy) (Supp. Fig. 1). BOL_2548 was restored taking for comparison a sample of *Homo sapiens* skulls including 32 three-dimensional landmarks acquired on 50 different modern human specimens (Fig. 3, Supp. Table 3), belonging to the "G. Sergi" Anthropology Museum Rome (Italy), Oloriz collections and NESPOS database (Supp. Table 4).

The 3D coordinates were acquired using the software Amira® (version 5.4.5, Visualization Sciences Group, ©2013; https://www.fei.com/software/amira-for-life-sciences/).

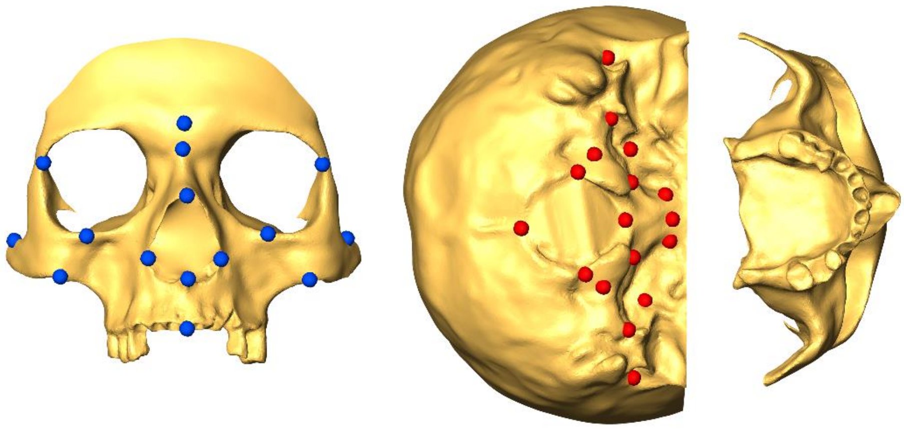

Figure 3. The two landmark configurations shown on the "cranial base" (in red) and "face complex" (in blue) 3D models (*Homo sapiens* case-study).

The DM consists of two portions belonging to the specimen BOL_2548, not in topological continuity. These are parts of the neurocranium and the facial complex, respectively (Supp. Fig. 2). We defined a landmark configuration on each of the two halves (afterward "cranial base" and "face complex") and applied DTA using a modern human sample of 50 specimens as the reference set. We calculated the Procrustes distance between the landmark sets from the reference sample and the landmark sets of the two halves of the disarticulated model. Eventually, the specimen of the reference sample which best fits the aligned model was selected.

Case Study 3. Real-world fossil items: Amud 1 (Homo neanderthalensis)

Amud 1 is a Neanderthal skull excavated at Amud cave in 1961 (Suzuki and Takai, 1970). This specimen has undergone different virtual reconstructions (Suzuki and Takai, 1970; Amano et al., 2015). Although severely damaged, two non-contiguous macro anatomical regions are still preserved as: i) the neurocranium with partial cranial base and facial complex (hereafter Amud 1a) and ii) the maxillary region (hereafter Amud 1b). We isolated the two regions of the DM (Amud 1a + Amud 1b) using the software Geomagic Studio 2014, and acquired two landmark sets of 16 (Amud 1a) and 17 (Amud 1b) landmarks, respectively (Fig. 4). In addition, we defined two semi-landmark sets of 104 and 42 points on Amud 1a and Amud 1b (Fig. 4). DTA allows to perform the alignment by using a comparative sample as well as by using a single specimen chosen as reference. In the present case, we opted for the latter by using the Shanidar 1 and La Ferrassie 1 Neanderthal skulls as reference models, and the restoration of Amud 1 by as the standard model to derive the DM.

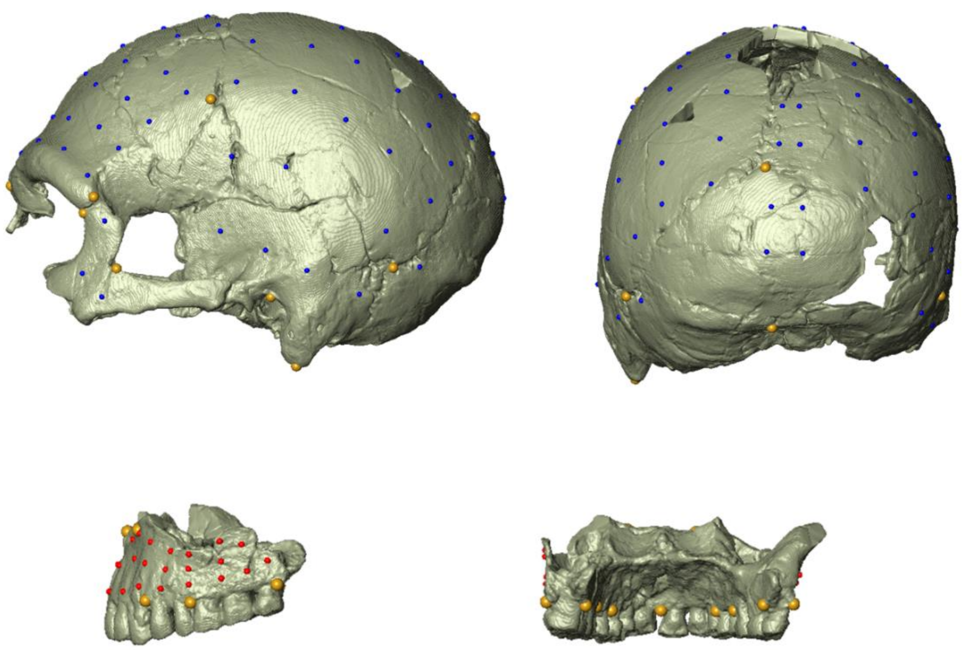

Figure 4. Landmark (in yellow) and semi-landmark (in blue) configurations shown on the DM of Amud 1 (*Homo neanderthalensis*). Abbreviations: DM = Disarticulated Model.

Evaluation of DTA performance

To evaluate DTA performance, we applied ANOVA on the 3640 alignments performed on the Primate sample, to compare differences in Procrustes distance among groups pooled by taxonomic status and sex. Additionally, we calculated the correlation between the Procrustes distance and two vectors representing, respectively, the phylogenetic and the centroid size distances pooled per species, using the Spearman coefficient. The phylogenetic distance was calculated as the number of nodes between the starting and the reference species. The phylogenetic tree was obtained from molecular data (available on the 10KTrees website, Arnold et al., 2010) and pruned down to the 14 OTUs analysed here. The centroid size distance was calculated by transforming the differences in size between the starting and the reference species.

The *Homo sapiens* case study includes 51 DTAs (the DM and 50 RMs) and 11 manual alignments performed by anonymous operators who are experts in the field. We compared the results, in terms of Procrustes distance, coming from the two alignment batches.

In the case of Amud 1, four DTAs were performed, using either landmark or landmark + semi-landmark configurations selecting either Shanidar 1 or La Ferrassie 1 as the reference model. We reported the result of the alignments (AMs) and we compared them with the SM (original reconstruction of Amud 1) by calculating the average distance between DM and AMs, in terms of the mean Euclidean distance between the vertices belonging to the DM and AM.

We supply as supplementary information the R code (Supp. R code) to compare the performance of DTA and manual alignment: in this way, anyone who wants it can manually align the disarticulated model presented here as Homo sapiens case study.

Results

Primate sample

After the application of the digital alignment tool (DTA), we obtained 130 surfaces and landmark configurations for each of the 28 case-studies for a total of 3640 alignments (Supp. Table 5). The

Procrustes distances were calculated after GPA for each aligned models pair, and then again after pooling models by either species or sex (taking averages per each factor). In 15 of the 28 cases, the lowest Procrustes distance is observed between the DM and a RM belonging to the same species of the DM. Among these 15, the sex of the selected RM is the same with the DM 11 times (Supp. Table 5)
The lowest species-pooled Procrustes distance coincides with the species with the closest centroid size value 13 times. This is not influenced by the absolute CS value, as indicated by Wilcoxon test (W=94; p-value = 0.89) (Supp. Table 6). A summary of the ANOVA output is reported in Table 2.

Using the primate sample, the results always returned statistically significant p-values associated to the same-species group. The p-values for the sex variable is statistically significant in 21 out of 28 cases (Table 2).

Species	SEX	OTU	SEX
Alouatta caraya	F	0.00	0.00
Alouatta caraya	M	0.00	0.00
Alouatta palliata	F	0.00	0.00
Alouatta palliata	M	0.00	0.00
Ateles geoffroyi	F	0.00	0.00
Ateles geoffroyi	M	0.00	0.00
Cebus albifrons	F	0.00	0.00
Cebus albifrons	M	0.00	0.00
Gorilla gorilla	F	0.00	0.00
Gorilla gorilla	M	0.00	0.00
Homo sapiens	F	0.00	**0.40**
Homo sapiens	M	0.00	**0.44**
Hylobates lar	F	0.00	0.00
Hylobates lar	M	0.00	0.00
Macaca cyclopis	F	0.00	0.00
Macaca cyclopis	M	0.00	0.00
Pan troglodytes	F	0.00	**0.19**
Pan troglodytes	M	0.00	**0.16**

Papio hamadryas	F	0.00	0.00
Papio hamadryas	M	0.00	**0.28**
Pongo abelii	F	0.00	**0.89**
Pongo abelii	M	0.00	0.00
Pongo pygmaeus	F	0.00	0.02
Pongo pygmaeus	M	0.00	0.00
Symphalangus syndactylus	F	0.00	0.00
Symphalangus syndactylus	M	0.00	0.00
Therapithecus gelada	F	0.00	0.00
Therapithecus gelada	M	0.00	**0.39**

Table 2. ANOVA performed on the Primate case study. ANOVA summary (p-values) performed between the Procrustes distances (Supp. Table 1) and the categorical variables OTU (species) and SEX. Abbreviations: OTU = Operational Taxonomic Unit.

Homo sapiens

DTA applied to the female modern human disarticulated skull "BOL_2548" identifies the reference specimen "BOL_2546" (another female individual) as morphologically the closest (Supp. Table 7). The morphological distances (between DM and RM) expressed as Procrustes distance between them is equal to 0.0074 (Supp. Tab. 7). The distance to the other specimens of the reference sample ranges from 0.0080 to 0.0816.

The Procrustes distance between the AM (built on "BOL_2546") and the SM (unbroken "2548") is equal to 0.0046. The average Procrustes distance of the manual alignments group from the starting model is twice that much, reaching 0.0103 on average (95% CI = 0.0079 - 0.0142). Nevertheless, in 2 of out 11 manual alignments the distance from SM are lower than the distance from the best fit found by DTA. The distances of the manual alignments range from 0.0032 to 0.0175 (Fig. 5-6). The mean Procrustes distances between the SM and the AMs are 0.0110 for the manual alignments, 0.006 for the AMs using a comparative sample as reference and 0.0046 for the digital alignments performed on all the specimen of the reference sample.

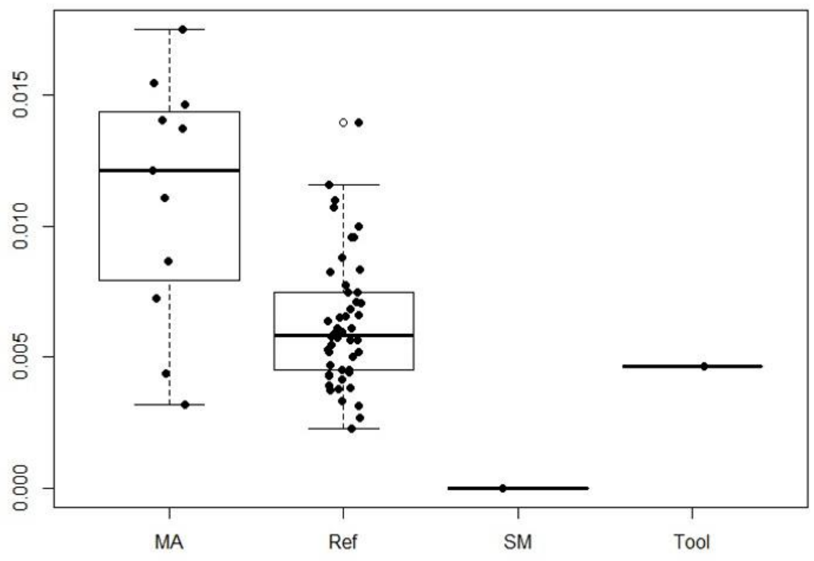

Figure 5. Boxplot of the Procrustes distance calculated between the landmark configuration sampled on the original 3D model used as case study (SM), the manual alignments (MAs), the landmark configurations obtained aligning the two halves on a comparison sample (AMs), the digital alignment performed by the tool (DTA) and the alignments performed via DTA on each specimen of the reference sample (Ref). The differences between the means of the groups MAs and Ref are statistically different (p-value < 0.001).
Abbreviations: DTA = Digital Alignment Tool; SM = Starting Model; MA = manual alignments; AM = Aligned Model.

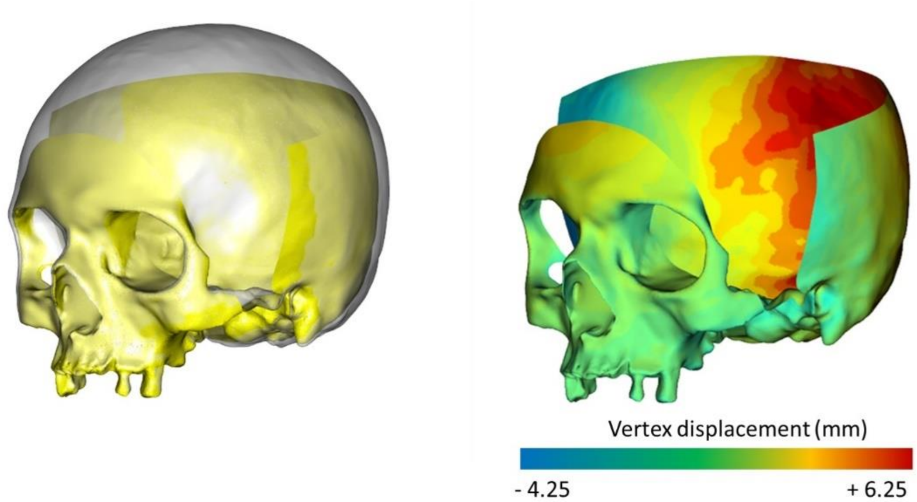

Figure 6. DTA applied on *Homo sapiens* case study. On the left, the AM after DTA (yellow) and the starting model (white). On the right the vertex displacement showed on the AM. Abbreviations: DTA = Digital Alignment Tool; AM = Aligned Model.

Amud 1

We applied DTA on the DM of Amud 1 using the Neanderthal specimen Shanidar 1 and La Ferrassie 1 as references. For each RM we performed two DTAs: the first using a landmark configuration, the latter using landmarks and semi-landmarks (Figure 5).

The average distances between the surfaces of the DM of Amud 1 and the DM Shanidar 1 amounts to 3.44 or 5.20 mm using landmark or landmark + semi-landmarks, either. Using La Ferrassie 1 as the reference average distances equal to 5.87 (landmarks) and 7.06 (landmark + semi-landmarks), respectively (Figure 7).

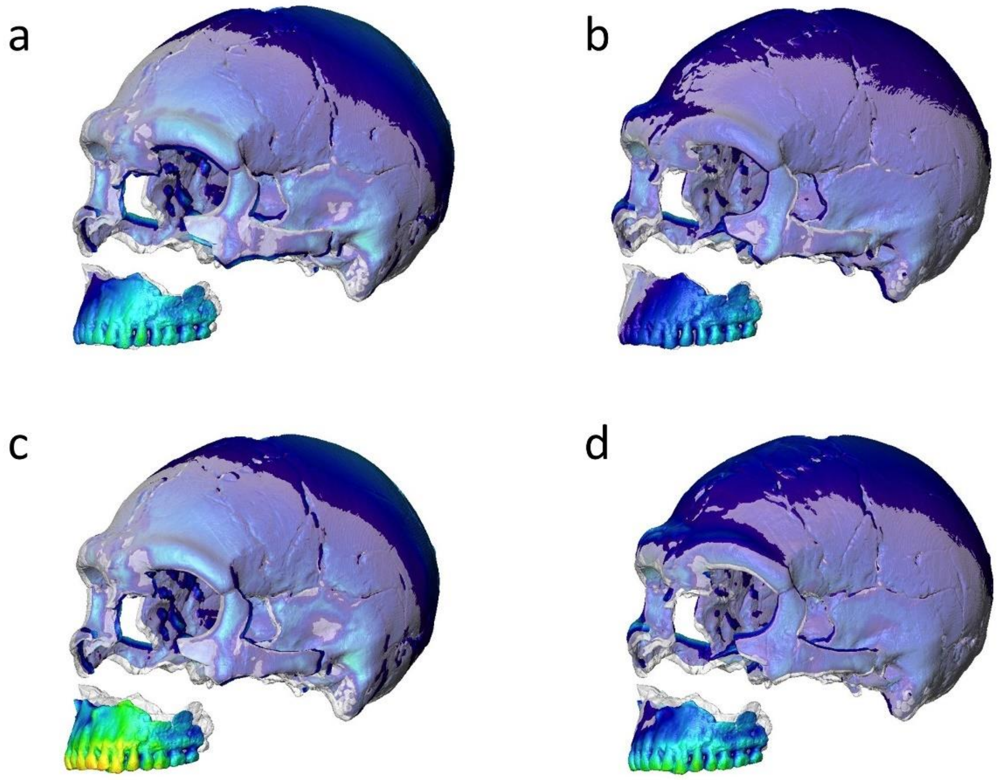

Figure 7. DTA applied on Amud 1 using respectively La Ferrassie 1 (a, c) and Shanidar 1 (b, d) as reference. DTA was applied using landmark (a, b) and landmark + semi-landmarks (c, d).
Abbreviations: DTA = Digital Alignment Tool

Discussion

Museum collections include a wealth of fossil material belonging to living and fossil primate species. This material is a goldmine to understand the evolution of this group. Unfortunately, most of it comes with the burdens (in terms of preservation quality) of time, fossilization and handling accidents. This is especially true of cranial remains, that are at the same time more informative and often deformed. Most cranial remains are in fact broken, partially incomplete, or badly deformed. This means plenty of crucial information is lost, and the general anatomy of such skulls stands in the minds of observers, rather than before their eyes. Manual reconstruction has always provided invaluable assistance in the case of deformed and broken specimens. Yet, it rests on the ability and subjective judgement of a few highly-trained operators, which is time consuming, prone to errors (MacLeod et al., 2010; Boyer et al., 2015) or in limited availability. Fortunately, a growing number of virtual procedures, based on digital reconstructions of the remains, are becoming ever more frequently applied to restore primate fossil specimens.

Here, we propose a new landmark-based method (DTA) to align disarticulated parts belonging to the same specimen and applied on three different case studies. The first, 'Primate' case, provides an exhaustive application with more than 3600 DTAs being carried out. This made it possible to quantify DTA performance, and assess the importance of sex, size and taxonomic identity in providing the best reference model to guide the alignments. We directly compared DTA to manual alignments in our second case study, a *Homo sapiens* skull broken in two halves. DTA performs better than manual alignments on average. However, there are a minority of manual alignments that work better. These results suggest that DTA works almost as well as expert-based reconstruction, which is fundamental in situations where the handling of fossil items is difficult, dangerous (because the specimen is not robust in all details), or simply unavailable. This is especially true of rare, exceptionally important fossils such as BOU-VP-12/130 (*Australopithecus garhi*) (Asfaw et al., 1999), AL-442 (*Australopithecus afarensis*) (Kimbel et al., 2004), OH5 (*Paranthropus boisei*) (Leakey, 1959; Benazzi et al., 2011), ATD6-15 and ATD6-69 (*Homo antecessor*) (De Castro et al., 1997), Amud 1 (*Homo neanderthalensis*) (Suzuki and Takai, 1970; Amano et al., 2015), Le Moustier 1 (*Homo neanderthalensis*) (Klaatsch and Hauser, 1909; Thompson and

Illerhaus, 1998; Ponce De León and Zollikofer, 1999; Ponce De León, 2002) and the Neanderthal infant from Mezmaiskaya (Gunz et al., 2012). Restoration, in the case of Amud 1, is complicated by the fact that the two cranial portions recovered are not contiguous, leaving a large gap of missing bone below the orbits and around the nasal cavity to be imagined someway. The expert-based restoration we used is just a few millimetres different from the DTA product. This testifies DTA is genuine and opens up the possibility to align and then access the three-dimensional investigation of otherwise troublesome, hard to access material, even into fine details which digital models make available. Nevertheless, many applications of virtual restoration have been applied, in literature any tool has been proposed except for specific applications (Vidal-Garcia et al., 2017). DTA is a flexible tool and it can be applied to align two disarticulated models or to find the best reference specimen within the available sample. DTA has been designed in R environment and future implementations can be done depending on request of users and researchers.

In virtual anthropology applications, most reconstructions use a skull collection of living primates as reference. This is an obliged choice when conspecifics of the same age and sex are not available or otherwise easily identifiable. For example, in 2009 Gunz and colleagues reconstructed by TPS warping the Taung child (*Australopithecus africanus*) skull, using a juvenile chimpanzee cranium as a reference model. Although conceivable, this is necessarily arbitrary. DTA allows to select the closest specimen to the target to minimize bias in the virtual restoration procedure, thus bypassing the need for subjective choices which could be severely misleading (Gunz et al., 2009). The results of the primate case study highlight how critical, and tricky, the choice of the reference model could be. Contrary to common sense expectation, specimens of close phylogenetic affinity are not always the best choice. Allometric factors or convergence (such as in the case of the highly-specialized vocal tracts in *Pongo* and *Alouatta*, see Profico et al., 2017 and Fiorenza and Bruner, 2018) may in fact influence cranial morphology, and show how uncertain the choice of the appropriate RM could be.

Even when a large comparative sample of the same species as the DM is available (the *Homo sapiens* case study) the performance of the DTA varies greatly across RMs, suggesting that allometric and gender effects could be highly influential in this case too.

A few generalizations emerge from this study, which introduce a new and powerful tool for the alignment of disarticulated cranial material. First, when available it is appropriate to use as RM a specimen belonging to the same species and gender of the disarticulated model. Although DTA could be used to select the RM, this must be taken in consideration when confronting a limited number of reference items. Secondly, although manual procedures served with distinction the goal of restoring the original shapes of fossil species skulls, this study demonstrates that DTA is at least as precise and accurate as manual alignments, but give the advantages of being cheaper, faster, and provide unrestrained access to the aligned digital model. than the application of.

Acknowledgments

We thank the Smithsonian Institution (www.vertebrates.si.edu), the Kyoto University Primate Museum (www.dmm.pri.kyoto-u.ac.jp), the anthropological Museum "G. Sergi" (Rome, Italy), the Museo Nacional de Ciencias Naturales, Universidad Complutense de Madrid (Oloriz collection) and the online databases of NESPOS (www.nespos.org) and Morphosource (www.morphosource.org) for kindly providing their osteological database. We thank Emiliano Bruner for his kind comments and suggestions. We also thank 11 anonymous operators for the manual alignments performing.

Melchionna et al. 2018. *Palaeogeography, Palaeoclimatology, Palaeoecology*, *496*, 146-154.

Fragmentation of Neanderthals' pre-extinction distribution by climate change

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Abstract

Neanderthal lived in Eurasia alongside anatomically modern humans (AMHs) until some 40,000 years ago. The extinction of Neanderthals is attributed to either climatic change, or to the effect of competition with AMHs. We used fossil occurrence records and paleoclimatic data to model the potential distributions of *H. sapiens* and *H. neanderthalensis* using Species Distribution Models and calculated the degree of habitat quality and connectivity at successive time steps. We found that both species potential geographic ranges progressively retreated from their northeastern borders beginning with 44 ka. Although the degree of habitat loss is similar for the two species, the potential range for *H. sapiens* was constantly some 50% larger on average. The degree of habitat fragmentation, and the size, number, and average distance between optimal habitat patches was initially very similar for the two species.

However, all these landscape metrics showed a progressive deterioration for *H. neanderthalensis* only over time. At the end of their existence, the most suitable habitat patches for Neanderthals were small and isolated, and their inferred climatic niche width was statistically narrower than in *H. sapiens*. This does not mean that climate worsening drove Neanderthals extinct, yet it suggests extinction risk for the latter markedly increased over time, towards its actual extinction date.

Keywords: *Homo neanderthalensis*, *Homo sapiens*, species distribution modeling, patch fragmentation, climatic niche width

1. Introduction

It is often thought that Neanderthals were the hominin species best adapted to live under the cold conditions of the Pleistocene. Many features in their bodies are recognized as adaptations to such harsh climates (Steegmann et al., 2002). The large nasal cavity was useful in humidifying and warming cold and dry air during inhalation (Churchill, 1998). As compared to Anatomically Modern Humans (AMHs), Neanderthals were shorter and stouter, had wider chest, and shorter limbs, all of which helps heat preservation (Helmuth, 1998; Holliday, 1997). Despite this apparent propensity to live under rigid climates, Neanderthals did not survive into the coldest phase of the last glacial period. Their extinction is statistically placed around 40 ka (Higham et al., 2014), during marine isotopic stage 3 (MIS 3), and almost in coincidence with Heinrich Event 4, which is a sudden, global shift towards colder temperatures (HE4, Van Meerbeeck et al., 2009). Bradtmöller et al. (2012) proposed the Repeated Replacement Model (RRM) to explain population and cultural breakdown among Neanderthals during Heinrich Events 5 and 4 (at ca. 45 and 40 ka, respectively, López-García et al., 2013; Müller et al., 2011). Under RRM, climatic deterioration is the main driver of *H. neanderthalensis* extinction. In fact, many authors agree that colder climates drove Neanderthals extinct (Finlayson and Giles-Pacheco, 2000; Sepulchre et al., 2007; Stewart, 2004, Stewart, 2007). However, the last Neanderthals also had to compete with AMH populations. Negative interactions between the two species are often viewed as the potential driver of *H. neanderthalensis* extinction, in alternative to climate change. Hortolà and Martínez-Navarro (2013) even took the extreme view of considering the extermination of Neanderthals as a non-special branch of megafauna extinction, propelled by habitual killing of Neanderthal individuals by AMHs. However, the intensity of competition between Neanderthals and AMHs might have been low. Stable isotope analysis on the enamel of AMHs contemporary to the last Neanderthals revealed a wider niche breadth for the former. AMHs diet included vertebrate meat, fish and/or shellfish and a sizeable amount of plant food (Ben-Dor et al., 2016; Hockett and Haws, 2005). In contrast, some authors argued Neanderthals had a less diverse diet centered on large and medium-sized terrestrial herbivore meat (Salazar-García et al., 2013). However, the difference in nutritional ecology between the two species is not entirely clear, and it is in fact possible that Neanderthals exploited a resource spectrum nearly as wide as AMHs (Bocherens et al., 2014; Fiorenza et al., 2015; Henry et al., 2014; Smith, 2015). Gilpin et al. (2016) investigated the interactions between AMHs and Neanderthals taking into account cultural development. According to their results, the faster learning skills of AMHs may have promoted competitive exclusion of a larger population, the Neanderthals, by an initially rare competitor. This model has the merit to show that competition alone could have, in principle, driven Neanderthals extinct.

At some point, Neanderthals and ancient *H. sapiens* populations even interbred. Green et al. (2010) found that between 1 and 4% of the genome in Eurasians is inherited from Neanderthals, despite purifying selection in *H. sapiens* might have removed a number of alleles from the introgression between the two species (Castellano et al., 2014; Sánchez-Quinto and Lalueza-Fox, 2015). The strong evidence for interbreeding between Neanderthals and AMHs poses a question about the real nature of the interaction between the two species, and further complicates our understanding of the role of AMHs in *H. neanderthalensis* extinction. As such, several studies now support the view that *H. neanderthalensis* extinction was likely due to a combination of factors, rather than the product of a single, dominant cause (Rey-Rodríguez et al., 2016).

Competition and climatic tolerance together define a good portion of a species ecological niche (Dormann et al., 2010). To understand whether climate change had any effect on Neanderthals extinction it is fundamental to define the climatic niche first. Furthermore, evidence for competition with AMHs rests on a basic yet untested hypothesis, which is if the niches of the two species were overlapping. Besides trying to decipher the amount of niche overlap between AMHs and Neanderthals, and individual niches characteristics from controversial data (such as palaeodietary reconstructions, aging and positioning of fossil sites and their cultural content) we propose the two climatic niches should be statistically defined, and compared, first. This is further welcome because the cultural identification of Middle Palaeolithic toolmakers can be troublesome (Bar-Yosef and Bordes, 2010; Benazzi et al., 2011, but see Zilhão et al., 2015) dating of such layers can be uncertain (Higham et al., 2014), and climatic (Benito et al., 2017) and dietary preferences of Neanderthals are not entirely clear (Ben-Dor et al., 2016; Bocherens et al., 2014; Fiorenza et al., 2015; Hardy and Moncel, 2011; Henry et al., 2014).

In this paper, we use Species Distribution Modelling (SDM) to quantify and compare statistically the inferred climatic niches of *H. sapiens* and *H. neanderthalensis* in Western Eurasia during the last 8 ka of Neanderthals existence. Eurasian Neanderthals during the 48 to 40 ka interval formed a genetically uniform and distinctive population, which invaded Western Europe from the East after a local extinction (Dalen et al., 2012; Fabre et al., 2009). We studied climatic niche evolution and overlap in the two *Homo* species, identified their optimal habitat patches and to which degree these patches connected to each other.

2. Materials and methods

2.1. Occurrence records

We collected *H. neanderthalensis* occurrence data from three datasets, the Radiocarbon Palaeolithic Europe Database (Vermeersch, 2015), the Stage Three Project archaeological database (van Andel, 2002), and the Canadian Archaeological Radiocarbon Database (CARD, Gajewski et al., 2011). *Homo sapiens* occurrence data were collected mainly from CARD. We decided to keep as valid only occurrences that can be confidently linked to either *H. neanderthalensis* or *H. sapiens*, discarding sites/layers with uncertain taxonomic attribution, or dating. We decided to consider radiocarbon records computed by using Accelerator Mass Spectrometry (AMS) only. Dates were calibrated under the 'intcal13' curve, by using the R package 'Bchron' (Parnell, 2016). The full dataset with details about the dating is accessible as supplementary information (Data Set S1, Fig. S1). For the two species, we extracted occurrence records covering the 60–36 ka period (uncalibrated radiocarbon ages) in order to capture the highest amount of information on the climatic niches of the two *Homo* species during this time interval, while maintaining a sizeable number of occurrence records. The choice of these temporal limits is not casual, since it has been demonstrated that European Neanderthals after 48 ka did form a homogeneous population with little mitochondrial genetic variation (Dalen et al., 2012) and HE5 climatic turmoil paved the way for AMHs invasion of Europe (Müller et al., 2011). Indeed, AMHs were extremely rare in Western Eurasia prior to 40 ka (Benazzi et al., 2011). Yet, it is important to notice that the palaeoecological techniques we applied here (see below for the full explanation) are suited to project species niches in space and time, which makes it feasible comparing species potential niches even outside their temporal occurrence limits.

Once the species records were extracted, we removed duplicated records falling in the same cell of the climatic grid used for the model calibration (see below). After this procedure, we obtained the following numbers of species occurrences: 135 records for *H. neanderthalensis* and 104 records for *H. sapiens* (Fig. S1).

2.2. Climatic predictors

Simulations of past climates for the considered time frames were derived from the global ocean–atmosphere climate model of Singarayer and Valdes (2010). The model is provided with a temporal resolution of 4 kyr and a spatial resolution of 3.75° × 2.5° based on the Hadley Centre climate model (HadCM3). Downscaled climate simulations from this ocean–atmosphere climate model were taken from Maiorano et al. (2013) at 0.5° of spatial resolution. Specifically, the following four climatic predictors were derived: i) mean temperature during summer, ii) mean temperature during winter, iii) mean precipitation during summer and iv) mean precipitation during winter. Winter and summer temperatures and precipitations define most of the climatic variability relevant to *Homo* (Davies and

Gollop, 2003). We preferred using intra-annual ranges rather than annual means to maintain a fair representation of yearly climatic variation. Predictors were re-projected adopting a Mollweide equal area coordinate reference system at a final spatial resolution of ca. 50 km. Absence of multicollinearity among the four predictors was checked, reporting a variance inflation factor < 5 (Zuur et al., 2010).

2.3. Species distribution models

To model species distributions we pooled occurrence and climatic data together across all the time intervals where the two species occur (see Maiorano et al., 2013; Nogués-Bravo, 2009). This approach reduces the effect of environmental truncation (Guisan et al., 2014) on niche estimation by including the highest possible amount of information on niche characteristics. It also smoothens the problem of dating uncertainty of individual fossil sites. However, to tackle more effectively the problem of dating accuracy, we produced around each calibrated AMS date estimate a uniform distribution of dates ranging over the 95% confidence interval around the date. Then, we randomly sampled a single date within this range, and performed SDM evaluation. This procedure was repeated 100 times, and SDMs results of the 100 replicated were eventually averaged. For each species and SDM replicate, we randomly generated a set of 10,000 background points over Eurasia, which were used as pseudo-absences together with observed presences to calibrate the SDMs. The 10,000 pseudo-absences were subdivided across the time periods where each species occurred, proportionally to the size of the occurrence records falling into each interval. SDMs were calibrated using an ensemble forecasting approach, as implemented in the biomod2 package (Thuiller et al., 2009) within the R environment. We considered the following four modelling algorithms: Generalized Linear Models (GLMs); Generalized Additive Models (GAMs), Generalized Boosted Regression Models (GBMs) and Maximum Entropy (MAXENT). Each species occurrence dataset was randomly split into a 70% sample, used for the calibration of the model, and the remaining 30%, used to evaluate the model performance. Models' predictive performance was assessed measuring the area under the receiver operating characteristic curve (AUC), and Boyce index (Hirzel et al., 2006). The splitting procedure for model evaluation was repeated 10 times and evaluation scores and projections were averaged. To avoid using poorly calibrated models, only the projections from the models with AUC > 0.7 were considered in the subsequent analyses. Models were averaged calculating a weighted mean by model's AUC (Marmion et al., 2009). SDMs were projected over Eurasia on three specific moments, i.e. at 48 ka, at 44 ka, and at 40 ka, in keeping with the temporal resolution of the climatic data. The three models projections were transformed into binary maps of species presence and absence, using the threshold that maximizes the sum of sensitivity and specificity (Di Febbraro et al., 2015; Maiorano et al., 2013). To assess the effect of model extrapolation on values of predictor variables lying outside the training range, i.e. projecting models on non-analogous climates (Nogués-Bravo, 2009), we conducted a MESS analysis (see Fig. S2), following Elith et al. (2011).

2.4. Evaluation of structural connectivity

To evaluate the degree of structural connectivity between optimal habitat patches as predicted by SDMs for the two species separately and at each time projection, we calculated the following landscape metrics, as implemented in the Fragstats software (McGarigal et al., 2012): Number of Patches (NP), Area_weighted mean patch area (AREA_AM), Area_weighted mean patch Euclidean distance (ENN_AM), Clumpiness Index (CLUMPY); Proportion of Like Adjacencies (PLADJ); Patch Cohesion Index (COHESION); Effective Mesh Size (MESH); Splitting Index (SPLIT) and Aggregation Index (AI). Optimal habitat patches for each species at 48, 44, and 40 ka time points were identified by progressively binarizing continuous SDMs predictions (i.e. averaged from the 100 replicates) according to a threshold ranging from the 50th to the 95th percentile of the suitability values predicted by the ensemble forecasting, with a step of 1. The landscape metrics were then calculated for each of the 46 (50th to 95th percentile) resulting binary maps. Such metrics are highly dependent on the amount of suitable habitat for a species in a landscape and tend to be strongly correlated to each other (Wang et al., 2014). Therefore, it is often difficult to disentangle the distinct components of landscape structure (e.g., the amount and configuration of habitat) when analyzing landscape patterns (Wang et al., 2014). As we were mainly interested in testing differences in spatial configuration between optimal habitat patches of the two *Homo* species, we sub-selected those landscape metrics exhibiting a low mutual correlation, i.e. Pearson |r| < 0.7, with the area of the predicted distribution for each species and time interval. Subsequently, we excluded highly correlated landscape metrics by considering the same correlation threshold. The remaining metrics, that is NP, ENN_AM and COHESION, along with their interaction terms with time intervals, were included into a GLM with a binomial response (*H. neanderthalensis* ["0"] vs *H. sapiens* ["1"]), in order to test for statistically significant differences in these metrics among the optimal habitat patches of the two species. A stepwise model selection based on the Akaike Information Criterion (AIC) was implemented. To assess GLM goodness-of-fit we computed Nagelkerke's adjusted R2.

2.5. Ecological Niche Factor Analysis (ENFA) and niche overlap

To better evaluate niche characteristics of the two *Homo* species and their evolution through the time steps, we used Ecological Niche Factor Analysis (ENFA, Hirzel et al., 2002). ENFA is a well-established approach to derive species climatic preferences from point data (Hirzel et al., 2002), and can be used to rank species according to their different susceptibility to climate change. ENFA analyzes the position of the niche in the ecological space by comparing the distribution of ecological predictors values between species occurrences and the global area. Such niche position is evaluated in terms of marginality i.e. the squared distance of the niche barycenter from the mean available habitat, specialization i.e. the ratio of the ecological variance in mean habitat to that observed for the target species and tolerance i.e. the reciprocal of specialization (Hirzel et al., 2002). A high marginality indicates that a species occurs in very particular environments as compared to the background environmental variation. High specialization corresponds to a narrow niche relative to the habitat conditions available to the species (Hirzel et al., 2002). High tolerance indicates that a species tolerates large variations from its optimum conditions (Simard et al., 2009) and therefore shows broad niche (Braunisch et al., 2008). We focused on marginality and tolerance, calculating these metrics for the two *Homo* species at each time point and for each of the 100 dating replicated datasets (see above). For each species, time point and replicated dataset, statistical significance of marginality and tolerance was evaluated by means of Monte-Carlo randomization (for details see Calenge, 2006). All the procedure was performed using the R package adehabitatHS (Calenge, 2006). Statistical differences in niche marginality and specialization through time points between *H. neanderthalensis* and *H. sapiens* were evaluated using ANOVA and post hoc Tukey Honest Significant Differences test (Tukey HSD).

After ENFA, we compared the degree of overlap between the two species. To this aim, we calculated the niches in a gridded and smoothed Principal Component Analysis (PCA) environmental space, taking into account climatic variables over the study area for each time frame, as in Broennimann et al. (2012). We represented the available climatic space of the two species (i.e. all the climatic conditions occurring in Eurasia during the selected time period) by pooling climatic data together for the 60–36 ka time intervals (climatic data occur in 4 ka long frames) and by using these to calibrate a PCA. Subsequently, we projected the values of climate variables corresponding to species locations in the 48 ka, 44 ka and 40 ka time steps into the PCA space to delineate the partial niches of the two *Homo* species in these three different moments. The degree of niche overlap was eventually estimated by means of Schoener's D (Schoener, 1970; Di Febbraro et al., 2017) ranging from 0 (no overlap) to 1 (complete overlap).

3. Results

3.1. SDMs predictions of Homo habitat preferences

SDMs reached excellent predictive performances (Table S1). We found both *Homo* species distributions as primarily driven by temperature during the coldest and the warmest seasons (Fig. 1). Response curves of both species are highly overlapping, suggesting close similarity between Neanderthals' and AMH's potential climatic preferences. However, *H. sapiens* curves tails partly exceeded those of *H. neanderthalensis* for three of four predictors, namely temperature during summer and both precipitation variables, suggesting a wider tolerance to these predictors by *H. sapiens* (Fig. 1).

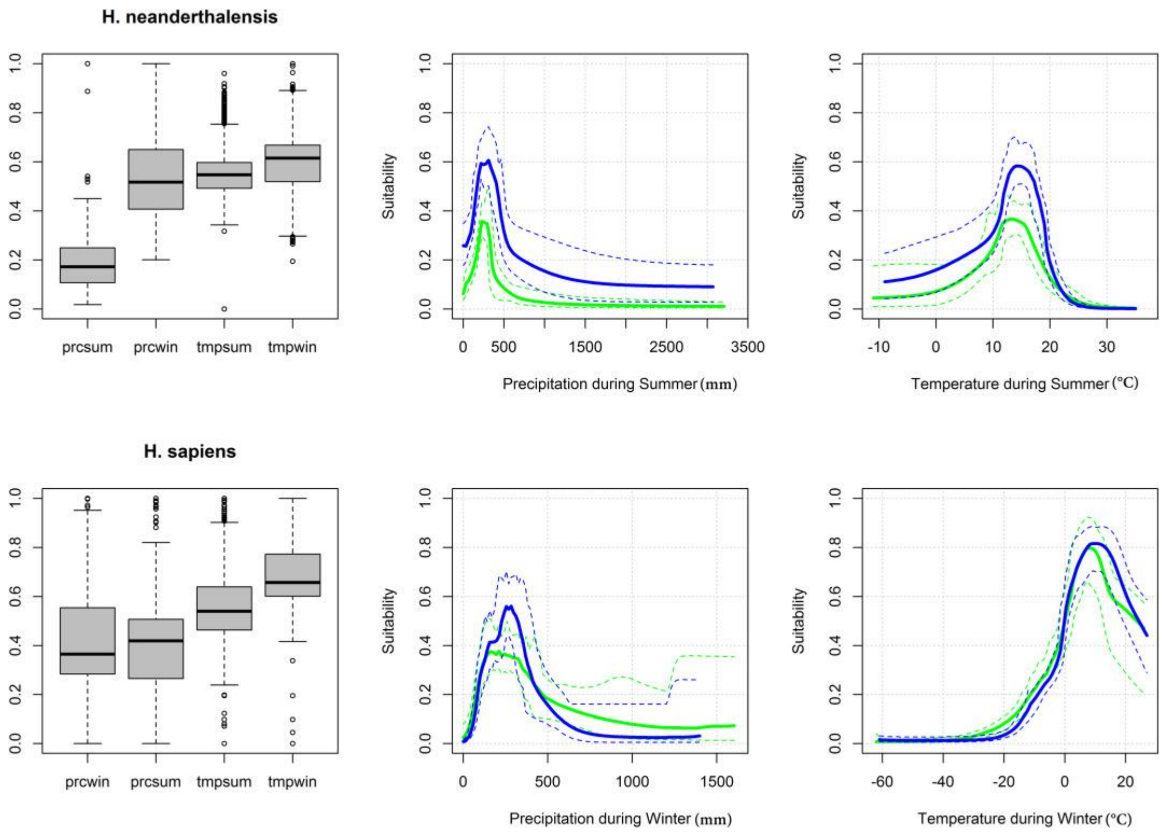

Figure 1. Relative contribution to the models and related response curves of each climate predictor. Variables in the box plots are listed in order of importance from left (low importance) to right (high importance). Response curves depict the variation of the probability of presence versus each variable, with blue (green) curves referring to *H. neanderthalensis* (*H. sapiens*). Dotted lines represent the range interval over the 100 SDMs run per species in order to account for dating uncertainty. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

3.2. Range size and structural connectivity

Predicted distributions of both *H. neanderthalensis* and *H. sapiens* showed a slight though constant reduction over time, especially along their northern-eastern boundaries of their geographic ranges (Fig. S3). *H. neanderthalensis* reduced its predicted distributions of 6.5% from 48 ka to 44 ka, and a further 9.4% from 44 ka to 40 ka. Overall, the territory loss is of some 16% over 8 kyr, equivalent to ca. 600,000 km2. The corresponding figures for *H. sapiens* are 4.8% reduction from 48 ka to 44 ka, and a further 13.0% from 44 ka to 40 ka, which amounts to nearly 1.2 million km^2 (Figs. 2, S2).

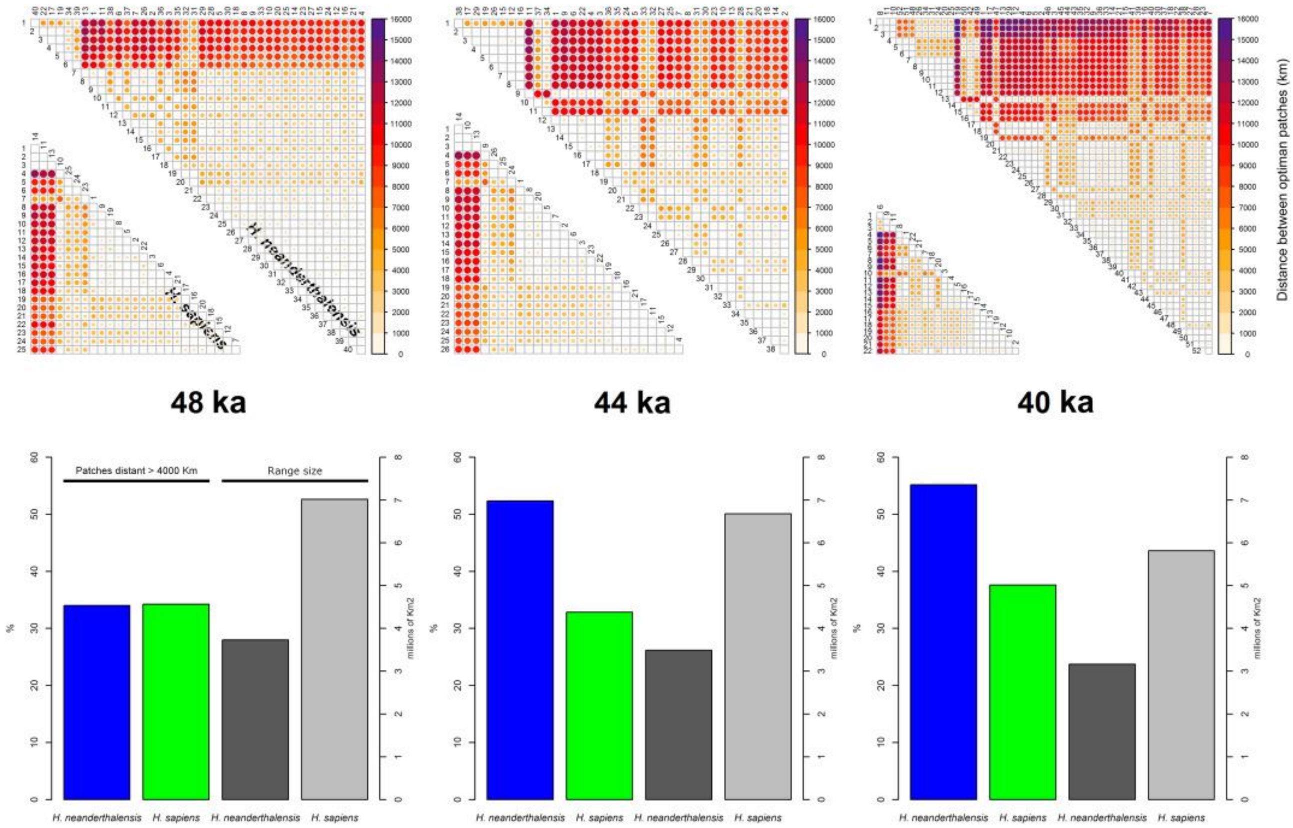

Figure 2. Evolution of optimal habitats in Neanderthals and AMHs. Dots depict the linear distance in kilometers between optimal patches pairs (i.e. above the 95th percentile of the suitability values predicted by the ensemble forecasting). Distance increases from white to purple and is proportional to dots size. Row and column numbers refer to the individual patch ID. Blue (green) columns in bar plots summarize the percentage of optimal patches pairs >4000 km apart for *H. neanderthalensis* (*H. sapiens*) in the three time points. Dark grey (light grey) bars indicate range size of *H. neanderthalensis* (*H. sapiens*) in millions square kilometers. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Although the absolute range size reduction is greater in *H. sapiens*, its potential geographic range was constantly 1.8–1.9 times larger than the Neanderthal's range.

As for structural connectivity analysis, stepwise AIC model selection drops only the interaction term between NP and time intervals, while retaining all of the remaining terms in the final model. The resulting GLM outcomes indicate statistically significant differences in the spatial configuration of the two *Homo* species predicted distributions, reporting a Nagelkerke R2 = 0.59. A statistically significant association emerged between the distributions of *H. neanderthalensis* and lower COHESION values (Table 1; Fig. 2).

Coefficients	Estimate	St. error	p value
Intercept	0.04631	0.16708	>0.05
NP	−1.45212	0.25415	<0.001
ENN_AM	0.18538	0.33813	>0.05
COHESION	1.45023	0.30625	<0.001
ENN_AM:44 ka	1.17464	0.65828	>0.05
ENN_AM:48 ka	0.97142	0.60475	>0.05
COHESION:44 ka	1.50920	0.64470	<0.05
COHESION:48 ka	1.34968	0.61127	<0.05

Table 1. Landscape metrics. Selected landscape metrics slope (Estimate) and standard error (St. error) estimates and the p value for the test for differences between the two species (p). The acronym referring to individual metrics is explained in the tex

In addition, we found a significantly higher number of patches in *H. neanderthalensis* predicted distributions compared to *H. sapiens*, irrespectively of the time steps (Table 1; Fig. 2). Finally, there was no significant difference in mean patch distance between the two *Homo* species distributions (Table 1; Fig. 2). Despite its smaller absolute range, the number of isolated patches within the Neanderthal range is statistically higher than with *H. sapiens*, and these patches are less connected to each other. Importantly, focusing on optimal patches (i.e. above 95th percentile of the suitability values) a clear temporal trend in the data emerges. Optimal patches predicted at 48 ka show negligible differences in their spatial configuration between the two species, but as time progressed structural connectivity within *H. sapiens* range remained almost constant, whereas that of Neanderthals steadily deteriorated. The number of optimal patches >4000 km apart in Neanderthals rose from 34% for the SDM projection at 48 ka, to >55% at 40 ka. The corresponding figure for *H. sapiens* changed from a mere 34.2% to 37% (Fig. 2).

3.3. Evolution of niche characteristics

Monte-Carlo randomization tests reported significant marginality and tolerance values for each species, time point and replicated dataset. More importantly, ANOVA indicated significant differences in both niche marginality ($F = 5$, $df = 151.3$, $p < 0.001$) and tolerance ($F = 5$, $df = 579.9$, $p < 0.001$) between the two *Homo* species and the three time moments. Specifically, the related post hoc Tukey HSD reported significantly higher niche marginality by *H. neanderthalensis* irrespectively of the time point (values are reported as standardized difference in means between *H. sapiens* and *H. neanderthalensis*; 48 ka: difference = −1.32, $p < 0.001$; 44 ka: difference = −1.80, $p < 0.001$; 40 ka: difference = −1.14, $p < 0.001$; Figs. 3, S4, S5). On the other hand, *H. sapiens* significantly increased its niche tolerance through time (48 ka: difference = −1.92, $p < 0.001$; 44 ka: difference = −0.14, $p < 0.001$; 40 ka: difference = 2.46, $p < 0.001$), exhibiting the highest increase from the 48 ka time point to the 44 ka time point (difference = −1.69, $p < 0.001$; Figs. 3, S4, S5).

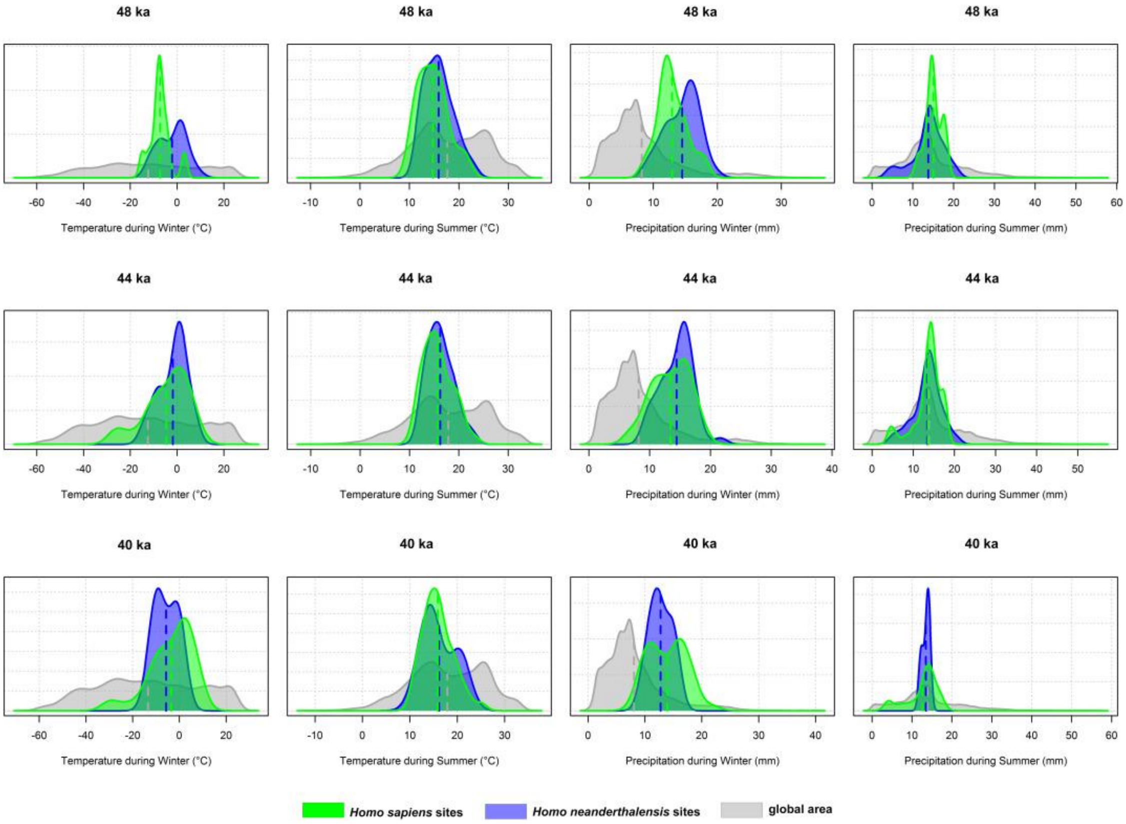

Figure 3. Kernel densities of climatic predictors values at *H. neanderthalensis* (blue) and *H. sapiens* (green) occurrence sites and in the global area (grey). Dashed lines indicate the mean of each distribution. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

As for niche overlap tests, the first two PCA axes account for >75% of the total variance in the data (~52% for PC1 and ~24% for PC2). The niches of the two species showed Schoener's D values >0.6 and reported statistically significant niche similarities ($p < 0.05$) in all the three time frames, with the highest overlap (i.e. Schoener's D = 0.75) at 44 ka.

4. Discussion

Neanderthals were perfectly fit to live in Western Eurasia. They were present there since 150 ka at the very least, and well before the Northern Hemisphere begun experiencing the cold conditions of the last Ice Age. Evidence from mtDNA suggests late Neanderthals were divided into three different populations, occurring in the Middle East, Southern Europe, and Western Europe, respectively (Fabre et al., 2009). Further mtDNA data pointed out to a large genetic diversity in Middle East and Southern European Neanderthals older than 48 ka, while more recent populations inhabiting Western Europe had low mitochondrial genetic variation (Dalen et al., 2012). This is consistent with a scenario of extinction of Northern European populations before 48 ka followed by recolonization from the Middle East, while Southern populations persisted there (Fabre et al., 2009). Therefore, the available evidence seems to confirm the hypothesis of a regional extinction model for North-Western Neanderthal populations in the coldest (Northern) stretches of its habitat (Hublin and Roebroeks, 2009), before the arrival of AMHs. Benito et al. (2017) recently demonstrated *H. neanderthalensis* most suitable environment during the Eemian was the Mediterranean area, while mountain ranges and continental plains showed low habitat suitability. Our data strongly concur on these findings. At 44 and then at 40 ka, (which is in between Heinrich cold events 4 and 5) *H. neanderthalensis* potential range crumbled into a number of little-connected optimal patches, which means its population was steeply reducing in numbers and growing in isolation.

Genetic and demographic data are consistent with these notions. Neanderthals were found to have had small population size and high mortality rates (Bocquet-Appel and Degioanni, 2013; Sørensen, 2011; Trinkaus, 1995). Genetic diversity in late Neanderthals was much lower than in contemporary *H. sapiens* (Krause et al., 2007) and show very low level of heterozygosity (Castellano et al., 2014; Prüfer et al., 2014), and indicate a species split into a number of small and isolated populations (Rogers et al., 2017), which made them prone to inbreeding and outbreeding depression. As a result, Neanderthals might have had at least 40% less fitness than humans on average (Harris and Nielsen, 2016). This is not the same as to say that climatic worsening was the sole factor driving Neanderthals extinct. The close similarity between Neanderthals and (presumed) AMHs climatic preferences makes room for a large effect of competition, in whatever forms it came about. Whether this was competition on the same game species or direct (interference) competition, involving direct killing of Neanderthals by *H. sapiens* individuals (as expected by intraguild competition between carnivore species, Palomares and Caro, 1999), it remains to be elucidated. Hortolà and Martínez-Navarro (2013) propended for this latter, perhaps extreme view. Banks et al. (2008) found that the retraction of Neanderthals to the South during Greenland Inderstadial 8 (almost in coincidence to the moment of extinction) was not due to climatic effect, but to a form of active displacement by modern humans (Banks et al., 2008). References to such displacement are very common in the scientific literature. Villa and Roebroeks (2014) recently referred to this view as a "superiority complex" with little archaeological evidence. In addition, in *H. sapiens* fossil sites, arctic, furred animals are disproportionately represented, while, in comparison to modern humans, remains of *H. neanderthalensis* seem to be associated to warm adapted species (Stewart, 2004) indicating the scope for direct competition over common resources may have been probably narrow (Banks et al., 2008).

According to the model of Gilpin et al. (2016) either cultural differences or rapid population growth in AMHs (both of them being true) may have given the scant and isolated populations of *H. neanderthalensis* a final blow. The molar microwear texture analysis of Neanderthals and modern humans during the last stages of the former existence indicates that Neanderthals had to change their dietary habits in the face of climate change (El Zaatari et al., 2016), and went through hard times when climate turned extremely cold (Hodgkins et al., 2016). In contrast, *H. sapiens* reacted by expanding its ecological niche (Banks et al., 2013). Together with lower fertility and higher mortality in Neanderthals, and in keeping with our results, this indicate that *H. sapiens* fared better than *H. neanderthalensis* when global climates swung towards the very cold conditions of the latest Pleistocene.

Despite the consistent evidence we found, we urge the reader to consider our results with caution. The presence of AMHs in Europe could have been limited to the very latest Neanderthals (Benazzi et al., 2011), reducing the scope for direct competition. A number of sites/fossil layers may have uncertain attribution (e.g. Geissenklosterle, El Castillo, Grotta del Cavallo), and dated material and specific cultural layers are not always unambiguously associated. We preferred not to modify the original records as they are reported in the databases we refer to, in order to avoid influencing the dataset composition with our own opinions and projected the potential niche of *H. sapiens* beyond (i.e. before) its actual presence in Europe. Thus, our insights on niche comparisons between the two species are only valid if SDM correctly projects the AMHs niche back in time, and if erroneous attribution to either species are minor in the original data. We are positive about the first point, while it is hard to judge the second, because this means assuming that the niche of AMHs remained stable. However, it is worth noticing here we approximated the fundamental niche of AMHs by pooling all point occurrences together for SDM calibration, that would reduce the impact of possible niche change anyway. Still, we argue it is unsafe interpreting the results at various time steps as they are. Rather than trusting them at face value, we argue what our study really suggests is that Neanderthals niche deteriorated through time. This is almost independent of data quality and the reliability of AMHs climatic niche projection back in time. Beyond dating uncertainty, niche characteristics for *H. sapiens* did not change significantly over time, perhaps suggesting they were better equipped to face with climatic cooling (Banks et al., 2013). We deem a formal analysis of population viability in Neanderthals is required to ascertain whether competition effects are required to explain the disappearance of *H. neanderthalensis* at 40 ka.

5. Conclusions

In this study we modeled potential niche structure and evolution for *Homo neanderthalensis* and *Homo sapiens*, while accounting for fossil layers dating uncertainty. We found that the potential niche of Neanderthals reduced significantly both in size and spatial continuity since 48 ka. While the size of the potential geographic range for *H. sapiens* reduced significantly as well, optimal habitat patches remained much more well connected than in Neanderthals. While the modelling approach we followed and the scarce presence of *H. sapiens* in Europe before 40 ka do not allow to address the issue of the role modern humans played in Neanderthals extinction, our data suggest the changing climatic conditions jeopardized their survival, in keeping with paleogenetic data suggesting *H. neanderthalensis* population was split in little-connected, small demes just prior to extinction.

Acknowledgments

We are grateful to Andrew Martindale for sharing with us the CARD data. Anna Loy provided important insights about the idea at the base of this study.

Author contributions

M.M. and P.R. conceived the starting idea. M.M, A.M., S.C., C.S, G.T., M.P., and V.V. collected the data. M.D.F. and F.C. performed the analyses. All the authors contributed equally to develop the ideas, analyses and writing of the manuscript.

Carotenuto et al. 2018. *Palaeogeography, Palaeoclimatology, Palaeoecology*, *500*, 24-32.

The well-behaved killer. Eurasian late Pleistocene Humans were significantly associated with living megafauna only

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Abstract

The end of the Pleistocene was characterized by an intense, highly-selective extinction event, affecting large-bodied terrestrial mammals worldwide. This period coincides with two major events, the last glacial period, and the dispersal of technologically advanced *Homo sapiens* outside the Old World. Upper Paleolithic hunters were armed with advanced, projectile weapons, and were able to dispatch prey as large as mammoths. Human population size was also rapidly expanding, which means our meat consumption rate was growing fast. Consequently, Paleolithic hunters are often held responsible for the extinction of the mammalian megafauna. Yet, whether they really focused on megafauna as prey, and drove them extinct, remains unclear. Here we modeled spatial and temporal patterns in habitat suitability for 24 megafauna species and *Homo sapiens* in Eurasia. We found that within humans most suitable patches, the identity of the most abundant herbivorous mammals switched from warm adapted species (such as the wild boar) to cold adapted species (reindeer) as climate swapped from mild to cold conditions. Importantly, the extinct herbivorous megafauna species were consistently rare within the human ideal habitat patches. This suggests that humans may have settled under relatively constant climatic conditions, and possibly behaved as efficient predators, exploiting their prey in a cost-effective manner.

Keywords:

Megafauna Extinction, Switch Selection, Late Pleistocene hunter-gatherers, Climate change

1. Introduction

The increased technological competence and abundance of late Paleolithic and Neolithic hunters was contemporary to the massive wave of extinction that affected the megafauna (i.e., large mammals) at the end of the Pleistocene. As many as 177 mammal species above 10 kg in body size disappeared from all continents between the last interglacial (120 ka) and the Holocene (Sandom et al., 2014). Human hunting is often portrayed as the main driver of megafauna decline, an idea dubbed the 'overkill hypothesis' (Martin, 1966; Mosimann and Martin 1975; Alroy, 2001). However, it is unknown whether human hunting could have been intense enough to force megafauna species to extinction (Grayson and Meltzer, 2003; Lima-Ribeiro and Diniz-Filho, 2013), especially in the Old World, where the intensity of species loss was comparatively lower than elsewhere (Faith, 2014; Sandom et al., 2014). Overkill models usually do not take into consideration that in modern hunter-gatherers big-game hunting could be disconnected from calorie procurement per se, and linked to prosocial functions, such as gaining better mating opportunities (Hill and Hurtado, 2009; Hill et al., 2013). Field surveys indicate food gathering and fishing may provide as many calories and proteins as big-game hunting in such societies (Ember, 1978), and that hunter-gatherers make extensive use of food resources other than vertebrate meat (Stiner, 2013; Morgan, 2015; Zaatari et al., 2016; Sullivan et al., 2017). To understand whether humans may have driven the megafauna extinct, it is necessary to consider simultaneously the climatic preferences of both potential prey species and humans. This is because species with similar climatic requirements tend to coexist, and a correct evaluation of the potential impact of hunting on prey populations depends on prey availability to the hunters (Lorenzen et al., 2011). Modern methodologies and data now allow profiling climatic preferences in fossil species. Past climates, modeled by extending simulations of atmospheric and oceanic circulation models (AOGCM) back in time at fossil occurrences, are useful to 'learn' the climatic preferences of fossil species (Svenning et al., 2011). Such techniques, known as species distribution models (SDMs), thereby provide detailed maps of species occurrence probability in the past (e.g. Di Febbraro et al., 2017). Recent studies demonstrate a positive and significant relationship between such occurrence probability maps and real local abundance, in both vertebrates (VanDerWal et al., 2009; Weber et al., 2016) and plants (e.g. Fois et al., 2018). Thus, SDMs have the potential to tell where and when a given species might be expected to have been abundant.

We collected occurrences data for Late Pleistocene Eurasian large mammal species and *Homo sapiens* and intersected occurrences with paleoclimatic data. Then, we built SDMs for these species to derive their habitat suitability maps. This allows to ascertain which potential prey species were abundant where humans occurred the most. Under the overkill scenario, the distribution of optimal (i.e., most suitable) habitat patches for humans must overlap with that of the extinct megafauna. In contrast, humans might have been alternatively associated with different prey species in keeping with changing climatic regimes, which would suggest they had the potential to exploit different game species at different times.

We drew megafauna and *H. sapiens* occurrence probability maps over the last 40 ka in Eurasia by using SDMs. After partitioning species into groups according to their body size, feeding category, and status (i.e., whether they were large or medium-sized, carnivorous or herbivorous, and extinct or extant), we compared ecological groups for their degree of geographical overlap to the range of *H.*

sapiens. Then, we contrasted species habitat suitability values within the core of *H. sapiens* presumed distribution, where human occurrence was probably the highest.

2. Material and methods

2.1 Climatic predictors

Paleoclimatic variables were derived from AOGCM simulations of past climates (Singarayer and Valdes, 2010), provided from 72 to 8 ka with a temporal resolution of 4 kyr, and downscaled at 0.5° of spatial resolution (Maiorano et al., 2013). Specifically, the data include four climatic predictors: i) mean temperature during summer, ii) mean temperature during winter, iii) mean precipitation during summer and iv) mean precipitation during winter. We re-projected them into a Mollweide equal area coordinate reference system at a final spatial resolution of ~50 km. We tested for the absence of multicollinearity among the four predictors, reporting a variance inflation factor < 5 (Zuur et al., 2010).

2.2 Homo sapiens record

We removed from the Canadian Archaeological Radiocarbon Database (CARD; Gajewski et al., 2011) occurrences with uncertain archaeological attribution, or where the identity of the *Homo* species (either *neanderthalensis* or *sapiens*) was uncertain. Then, we pruned the data from radiocarbon dates not obtained by using Accelerator Mass Spectrometry (AMS), and limited the age range in between 40 to 10 ka. Although climatic data extend before 40 ka, *H. sapiens* presence in Eurasia before this age is limited geographically to the middle East. Still, radiocarbon dates before 40 ka are very unstable, and the extinction wave of large mammals in the Old World started some 40 ka (Sandom et al., 2014). AMS dates were calibrated with the *IntCal13* curve, by using the R package Bchron (Parnell, 2016). Ages are presented as calibrated dates (calBP). Eventually, the database includes 2429 *H. sapiens* fossil occurrences. To compute SDMs, we removed duplicated records occurring in the same cell of the climatic grid used for model calibration (see below). The database of *H. sapiens* record used in this study is provided in Table S1.

2.3 Mammal fauna record

We started from the late Pleistocene fossil large mammal database published in Carotenuto et al. (2016). For humans, we considered a temporal interval between 40 and 10 ka. Yet, for the fauna, we preferred to extend the data back to 72 ka, that is the limit of the palaeoclimatic data. Faunal remains are less intensely studied, and archaeological sites can be readily identified by stone implements, that have much better preservation potential than bone. Therefore, the mammal record is less dense than the archaeological record. By extending the faunal database back in time, we could have comparable number of occurrences for both humans and the other large mammal species, which is a necessary prerequisite for proper SDM calibration (see below). Eventually, the faunal record includes 4965 Eutherian mammal occurrences distributed over 749 fossil localities for 24 either extinct or extant species belonging to the orders of Artiodactyla, Carnivora, Perissodactyla and Proboscidea. The extinct species group includes ten species: *Coelodonta antiquitatis, Crocuta crocuta, Bison priscus, Bos primigenius, Elephas antiquus, Mammuthus primigenius, Megaloceros giganteus, Stephanithinus hemitoechus, Equus hydruntinus, Ursus spelaeus.* Fourteen species analyzed are still living today: *Alces alces, Canis lupus, Capra ibex, Capreolus capreolus, Cervus elaphus, E. ferus, Lynx lynx, Panthera leo, Rangifer tarandus, Rupicapra rupicapra, Saiga tatarica, Sus scrofa, U. arctos, Vulpes vulpes*. The record was prepared by collating information of georeferenced fossil localities, including estimated ages and faunal lists, coming from the following databases: the Fossilworks database (http://fossilworks.org/?a=home), the NOW database (http://www.helsinki.fi/science/now/) and data provided in Raia et al. (2009) and Carotenuto et al. (2010; 2015). We fully revised synonyms and assigned the species names to the most recent accepted scientific name and excluded remains with uncertain identification at the species level. We reported biochronological or radiometric estimates for ages of individual fossil localities. For localities with non-radiometric dating, we assigned a numerical age estimate by using spectral ordering. This method works by ordering fossil localities according to their taxonomic similarity. The matrix of locality similarity is decomposed and the Fiedler eigenvector (the second smallest eigenvalue of the Laplacian matrix) extracted. Such vector provides the ordination of localities according to their temporal sequence (Fortelius et al., 2009). The decomposition further assigns a Fiedler score to each locality. The scores are regressed against known radiometric age estimates, and the regression coefficients used to infer ages for all of the locality with no available age estimate (see Raia et al., 2009 and Carotenuto et al., 2010 for full details).

For SDM calibration, after the numerical dating procedure, we applied to the mammal species record the same set of filtering criteria as with the *H. sapiens* record (i.e., removing duplicate records per cell), to end up with an average sample size of 150 occurrences (min = 21, max = 325) per species.

The faunal record was finally supplemented with species body size data as published in Raia et al. (2011, 2013) and Carotenuto et al. (2010). The faunal database is provided in Table S1.

2.4 Species distribution models

To produce SDMs, we first divided the fossil record of both humans and large mammals into successive four ka long time bins. Subsequently, we randomly generated 10,000 background points over Eurasia, which were used for SDMs calibration. The 10,000 background points were partitioned across time bins, in proportion to the number of fossil localities falling into a particular bin. For each bin, we extracted climate data at each occurrence and background point. As the ensemble of climatic data over species existence (i.e., across temporal bins) provides the closest approximation of the species fundamental niche (Nogués-Bravo, 2009; Maiorano et al., 2013), we calibrated a single SDM for each species by pooling occurrence data across temporal bins. We trained SDMs by using an ensemble forecasting approach, as implemented in the *biomod2* package (Thuiller et al., 2009) within the R environment (R Core Team, 2016). To produce SDMs we applied four different algorithms: Generalized Linear Models (GLMs); Generalized Additive Models (GAMs), Generalized Boosted Regression Models (GBMs) and Maximum Entropy (MAXENT). We randomly split each species occurrence dataset into a 70% sample, used for the calibration of the model, and the remaining 30%, used to evaluate models predictive performance. The latter was assessed by two different metrics, the area under the receiver operating characteristic curve (AUC; Swets, 1988) and the Boyce index (Hirzel et al., 2006). We repeated such splitting procedure 10 times, and then averaged evaluation scores and model projections. To avoid using poorly calibrated models, only the projections from the models with AUC > 0.75 were considered in the subsequent analyses. Models were averaged calculating a weighted mean by model's AUC (Marmion et al., 2009). In details, for Eurasian large mammals SDMs were trained in the time frame from 72 to 8 ka, whereas for *H. sapiens* models were trained from 40 to 8 ka. For all the species models were projected over Eurasia on each time interval spanning from 40 to 10 ka (that is within the human record range). Continuous models projections were transformed into binary, presence/absence maps, using the threshold that maximizes the sum of sensitivity and specificity (Maiorano et al., 2013; Di Febbraro et al., 2015; Liu et al., 2016, 2017). To assess the effect of model extrapolation on the values of predictor variables lying outside the training range, i.e., projecting models on non-analogous climates (Nogués-Bravo, 2009), we calculated the Multivariate Environmental Similarity Surface (MESS) index (see Table S2), following Elith et al. (2006).

2.5 Spatial association between mammal fauna and Homo sapiens

To assess how *H. sapiens* spatially associated to other predators and potential prey (i.e., large herbivores), we divided the large mammal species according to their status (extant or extinct), their body mass (large or medium-sized) and their presumed diet (herbivores or carnivores). As regards body mass, we split primary consumers into a large- and a medium-sized category, depending on whether their estimated body size was either more or less than 1000 kg (megaherbivores and mesoherbivores in the classical sense, Owen-Smith, 1988; Mondanaro et al., 2017). Among carnivores, we considered to be 'large' those species with estimated body size > 45 kg, and 'medium-sized' species < 45 kg in body size (Bekoff et al.; 1984). These criteria originate eight ecological categories: 'Extinct Large Herbivores', 'Extinct Medium Herbivores', 'Extinct Large Carnivores', 'Extinct Medium Carnivores', 'Extant Large Herbivores', 'Extant Medium Herbivores', 'Extant Large carnivores' and 'Extant Medium Carnivores'. We used the group affiliation as the response variable in a multinomial logistic regression model. As explanatory variables, we produced the following five covariates derived from the SDMs output:

1) Predictor 1 (CLIMATIC PLASTICITY) represents the degree of climatic conservatism, which is the tendency to seek after constant environmental conditions under climatic change. Predictor 1 is based on MESS values derived by SDMs (Fig. 1B). MESS is calculated as the environmental similarity between a given site (e.g. predictors raster cells) with a reference list of points (usually species occurrences), according to a given set of environmental variables. A Ratio MESS between successive time intervals is computed as:

$$\text{Ratio MESS} = \text{MESS species}/\text{MESS total}$$

where MESS species refers to MESS values obtained comparing each cell of predicted presence in time interval j with cells of predicted presence in time interval j + 1. MESS total indicates MESS values calculated over all the cells, irrespective of where the species is predicted to occur (with this being a metric for the intensity of climatic change between successive intervals). High values of Ratio MESS indicate that a species occupied similar climates under constant climatic conditions or, alternatively, that the species sought after constant environmental conditions under dramatic climatic change (i.e. high climatic plasticity in our sense). Whatever the case, the higher Ratio MESS, the more constant climatic preferences for the species were.

2) Total area of the species most suitable territories ("PIXEL95", Fig. 1C, the total geographic area where the habitat was highly-suitable to the focal species). PIXEL95 counts the number of pixels above the 95th percentile of the suitability distribution for the focal species. Therefore, it represents the total area where the species is presumed to be abundant.

3) This predictor ("PIXEL95H") is the mean suitability value of the focal species within *H. sapiens* PIXEL95 (Fig. 1D).

4) Degree of overlap (OVERLAP, Fig. 1E) between the focal species and *H. sapiens* in terms of area of predicted geographical ranges. This was calculated as the ratio between the count of pixels shared by both the focal species and *H. sapiens*, and the total count of pixels obtained by combining the maps of the two.

5) Range shift over time (DISTANCE, Fig. 1F) is the extent of range shift over successive time intervals. DISTANCE is calculated as the Euclidean distance between the centroids of species predicted ranges over consecutive time bins. Centroids were located by weighing the suitability values predicted within the species range per bin. In theory, high values of both predictors 1 and 5 indicate habitat tracking.

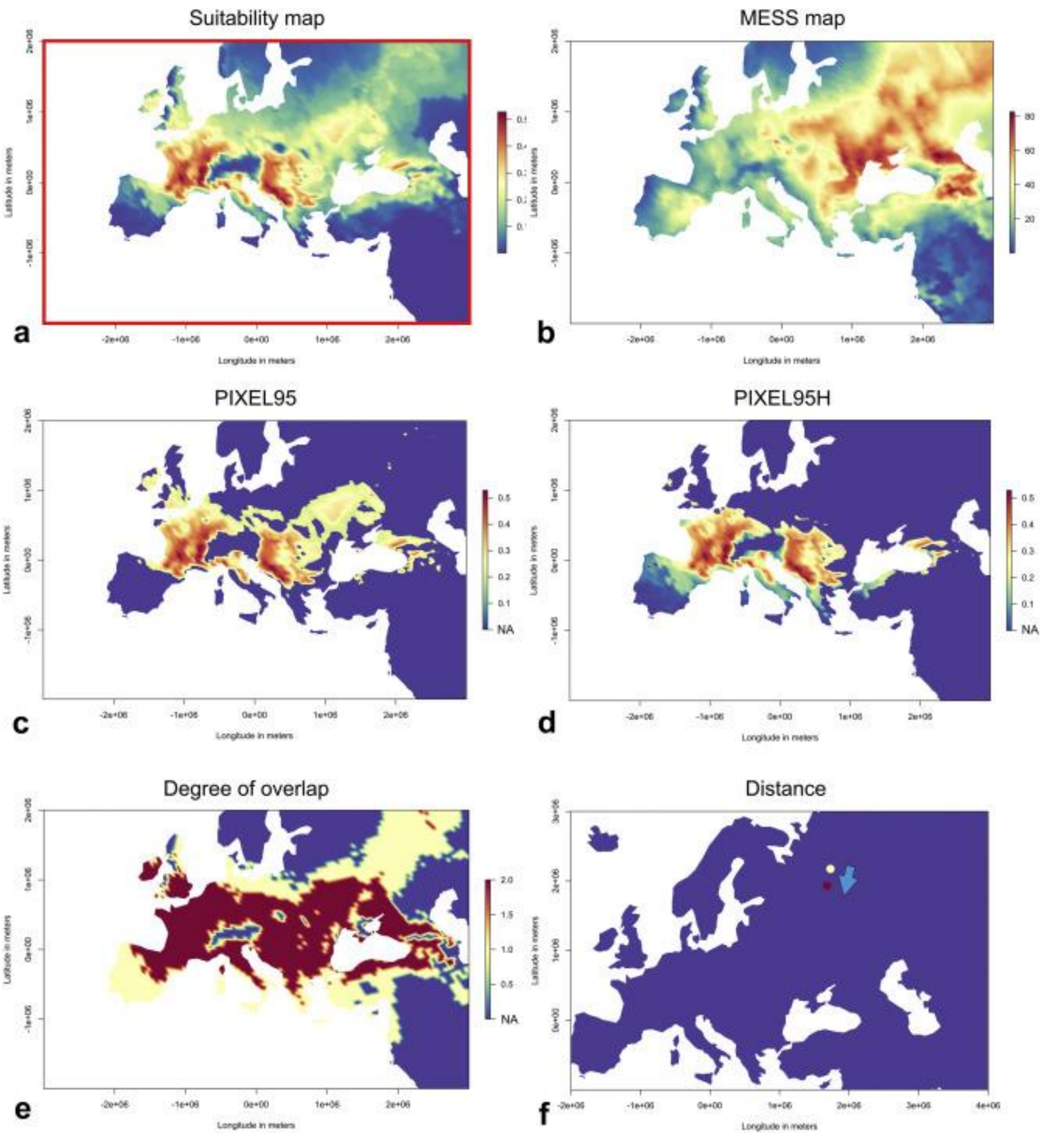

Figure 1. SDMs output (A) and the derived variables (B,C,D,E,F) used in the analyses. We present data for the wolly mammoth during the Last Glacial Maximum (~24 ka) as an example. A) Suitability map of the species. Colour gradient indicates increasing values of suitability from the lowest (violet) to the highest (red). All the other variables were derived from this map. B) Raw MESS map used to compute the CLIMATIC PLASTICITY of the species. C) PIXEL95 is the map showing suitability values higher than the 95th percentile for the considered species. D) PIXEL95H is the map of species suitability values included in the space delimitated by the *Homo sapiens* PIXEL95. E) Map showing the degree of overlap between the predicted distribution of *H. sapiens* and the wolly

mammoth. Red pixels indicate the geographical overlap, yellow values indicate not-overlapping regions and violet pixels indicate no predicted geographic distributions. F) Map showing wolly mammoth's distribution centres in two consecutive time intervals. The yellow point indicates the distribution centre during ~28 ka and the red one indicates the distribution at ~24 ka. The arrow indicates the computed Euclidean distance between the two centres. This figure represents a truncated portion of the whole study area, Eurasia, corresponding to *H. sapiens* territories with high suitability values.

We performed a multinomial logistic regression between species ecological categories and predictors, setting a single category as the reference. This helps telling the ecological differences between categories in reference to human presence and climatic variability. The regressions were computed over consecutive time bins, but they were repeated adopting a temporal moving window approach to account for fossil localities age uncertainty. For the temporal window approach, we took predictors averages computed over three consecutives, overlapping temporal intervals. For instance, for five consecutive bins 1, 2, 3, 4, and 5, the first group of bins spans from 1 to 3, the second from 2 to 4, the third from 3 to 5 and so on. This way, we get new predictor maps each one averaged over three original consecutive ones, except for the penultimate interval, whose moving window spans over two intervals only (i.e. intervals 4 and 5 in the fictionary example above). Under each approach, we calculated multinomial logistic regressions on the entire species pool, and then by testing herbivorous and carnivorous taxa separately.

To further investigate spatial association between mammal fauna and *H. sapiens*, we calculated statistical relationships between *H. sapiens* suitability values inside its PIXEL95 map and the corresponding suitability values of each mammal species inside PIXEL95H, averaging suitabilities over all time bins. We performed linear regressions both univariate (i.e., species by species) and multivariate (all herbivorous species together), as to explore whether *H. sapiens* was associated to different species under different climatic conditions. We ranked species by partial regression coefficients, and applied Wilcoxon Signed-Rank test comparing pairs of consecutive bins for the identity (and rank) of the herbivore species most associated to *H. sapiens*. This analysis tells whether the rank-abundance (actually rank-suitability) distribution of large herbivores within the human range did change from one period to the next.

We finally assessed the differences in mean and variance of climate conservatism between *H. sapiens* and its most positively associated species as emerged from the regression models illustrated above. Before testing for differences, climate conservatism values were standardized separately for each time bin by dividing each species climate conservatism by the highest value for the given time bin. Climate conservatism differences in mean were tested using Wilcoxon Signed-Rank test, while differences in variance were evaluated using modified Brown-Forsythe Levene-type test (Fox, 2002).

3. Results

3.1 SDM evaluation

SDMs reached excellent predictive performances for most of the species (sensu Swets, 1988), reporting AUC values between 0.884 and 0.980, with a median value of 0.944 and only three species scoring AUCs < 0.9. Boyce index values ranged in between 0.136 and 0.981, with a median value of 0.793. Only three species reported Boyce < 0.5. According to the MESS analysis results, negligible or no extrapolation effect emerged in SDMs predictions for each species and time interval (Table S2).

3.2 Multinomial logistic regressions

When including all the species in the multinomial logistic regressions, extinct large carnivores (slope = -1.412; p value = 0.003), extant medium carnivores (slope = -0.672, p value = 0.026), extinct medium herbivores (slope= -3.060, p value = 0.002) and extant medium-sized herbivores (slope = -0.856, p value <0.001) showed a significantly lower overlap with *H. sapiens* geographic range than the reference (i.e., extinct large herbivores). In addition, extinct large carnivores showed significantly higher values of abundance in PIXEL95 map than the reference (slope = 1.014, p value = 0.049; the AIC of the complete model is 541.952, see Fig. 2 and Supplementary Table S3.1 for detailed results).

When considering herbivore species only, both extinct and extant medium herbivores showed a significantly lower overlap with *H. sapiens* geographic range than the reference group (extinct large herbivores; slope = -2.470, p value = 0.010; slope = -0.737, p value = 0.001, respectively). Besides, extant medium herbivores reported a significantly higher abundance than reference group within the most suitable portion of *H. sapiens* geographic extent (i.e., PIXEL95H; slope = 2.650, *p* value = 0.041; Fig. 2; the AIC of the complete model is 219.660).

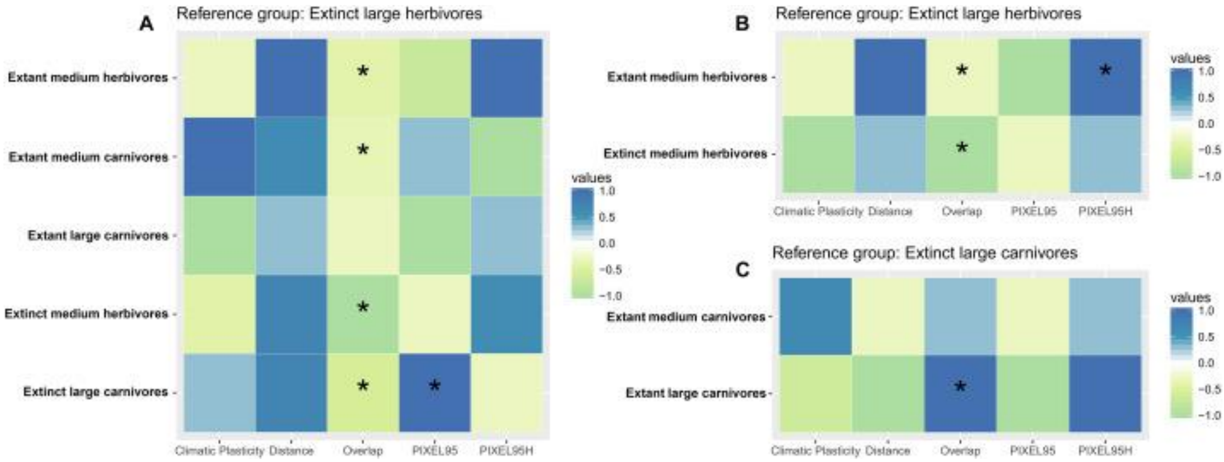

Figure 2. The relationship between humans and different ecological groups of the a) entire megafauna, b) herbivores and c) carnivores analysed separately. In blue tones, the focal ecological group has higher values than the reference group, the opposite applies to green tones. Climatic Plasticity = the similarity in climatic conditions experienced by individual species across temporal intervals. Distance = the distance between the centroid of the species distributions across intervals. Overlap = degree of overlap between each group and the human range. PIXEL95 = extent of areas of high suitability per group. PIXEL95H = extent of areas of high suitability per group within the core of geographic range of *H. sapiens*.

According to multinomial regressions on carnivore species only, large-sized extant carnivores exhibited a significantly higher overlap with *H. sapiens* range than the reference group (extinct large carnivores; slope = 2.226, p value = 0.022; Fig. 2; the AIC of the complete model is 114.461). The complete list of all the regression results (including the temporal window approach) is available in the Table S3.

3.3 Species-wise regression models on suitability values

Overall, we found positive and significant relationships between the averaged suitability values of focal species and those of *H. sapiens*. For ease of interpretation, we divided our results according to the sign and magnitude of the regressions slopes (Fig. 3). Specifically, we found positive and significant relationships between *H. sapiens* and the following species (ordered with decreasing slope values): *V.*

vulpes, *E. ferus, C. crocuta, C. elaphus, B. primigenius, R. rupicapra, S. scrofa, U. spelaeus, S. hemitoechus, C. capreolus, C. ibex, E. hydruntinus, E. antiquus, R. tarandus, C. lupus and P. leo* (see Table S4). *L. lynx*, *A. alces*, *M. giganteus*, *B. priscus* showed a negative and significant relationship (see Table S4).

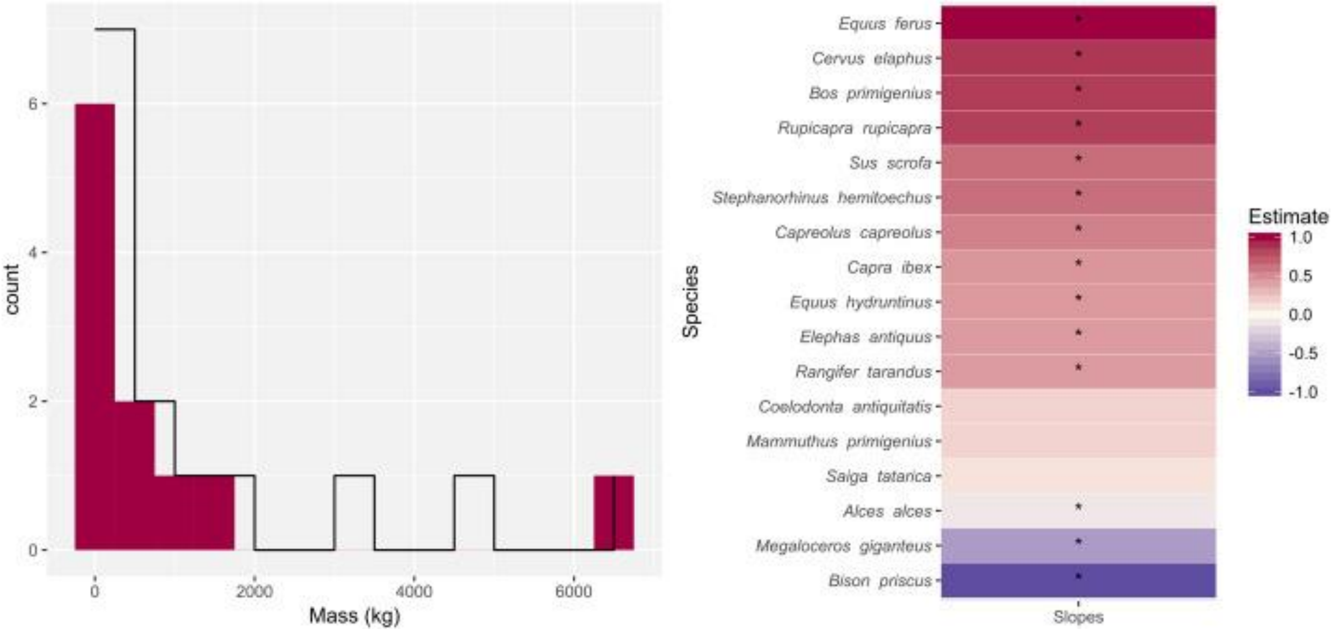

Figure 3. Left: body size distribution of herbivore megafauna species associated with humans (red bars) and total body size distribution (open bars). Right: results of the regression of suitability of individual species versus human suitability. Significant regression slopes are indicated with the asterisk. Positive relationships are represented by red tones, negative relationships by blue tones.

3.4 Multiple regression models on suitability values

We found significant and positive relationships between several species and *H. sapiens* suitability values (Fig. 4; all the regressions results can be found in the Table S5). For the time bin 40-36 ka, we found significant and positive relationships for *E. ferus*, *S. scrofa*, *U. spelaeus* and *B. primigenius*. Positive and significant results for *S. scrofa*, *E. ferus* and *C. crocuta* emerged for the interval 36-32 ka. For the temporal bin 32-28 ka, we found the following species positively associated to *H. sapiens*: *E. ferus*, *B. primigenius* and *U. spelaeus*. During the interval 28-24 ka, *S. scrofa*, *C. crocuta*, *R. tarandus* and *U. spelaeus* were positively related to *H. sapiens*. During the time bin 24-20 ka, we found *C. crocuta*, *R. tarandus*, *E. ferus* and *U. spelaeus* to be positively related to humans. For the interval 20-16 ka, regression models show a positive relationship between *S. scrofa*, *C. crocuta*, *V. vulpes* and *B. primigenius* to be positively related to

H. sapiens suitability values. For the interval 16-12 ka, we found *C. elaphus, E. ferus B. primigenius, U. spelaeus* and *M. primigenius* to be positively related to humans. During the last interval (12-8 ka), we found positive and significant relationships between *H. sapiens* and *C. elaphus*, *M. primigenius*, *P. leo* and *V. vulpes* (see Table S5.1 and S5.2 for detailed results and negative associations).

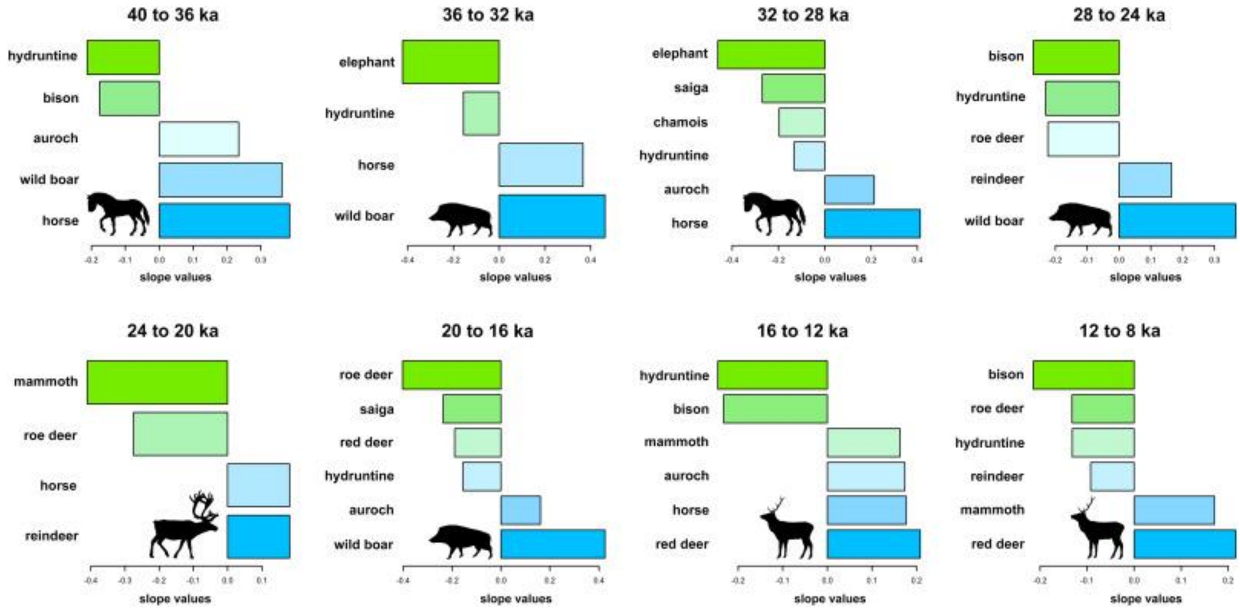

Figure 4. Plot of the species statistically associated to humans per time period, partitioned into 4 kyr long intervals. The bars in blue tone represent species positively associated to humans, bars in green tones represent species negatively associated to humans.

Wilcoxon signed rank test indicated a significant change in the faunal composition related to *H. sapiens* PIXEL95 for the temporal intervals 32-24, 24-16 and 20-12 ka (w = 50, p = 0.016; w = 75, p = 0.047; w = 70, p = 0.029, respectively; see Table S6 for detailed results).

3.5 Differences in climatic conservatism between Homo sapiens and other large mammals

We calculated differences in mean and variance of climatic conservatism between *H. sapiens* and the species group including *E. ferus*, *C. elaphus, B. primigenius, R. rupicapra* and *S. scrofa* as these taxa showed a significant, positive association with *H. sapiens* (see above). In particular, *H. sapiens* showed a significantly higher mean climate conservatism along the time bins (w = 267, p = 0.003; Fig. 5) than the selected fauna, also showing a significantly lower variance (L = 1.74, p = 0.048).

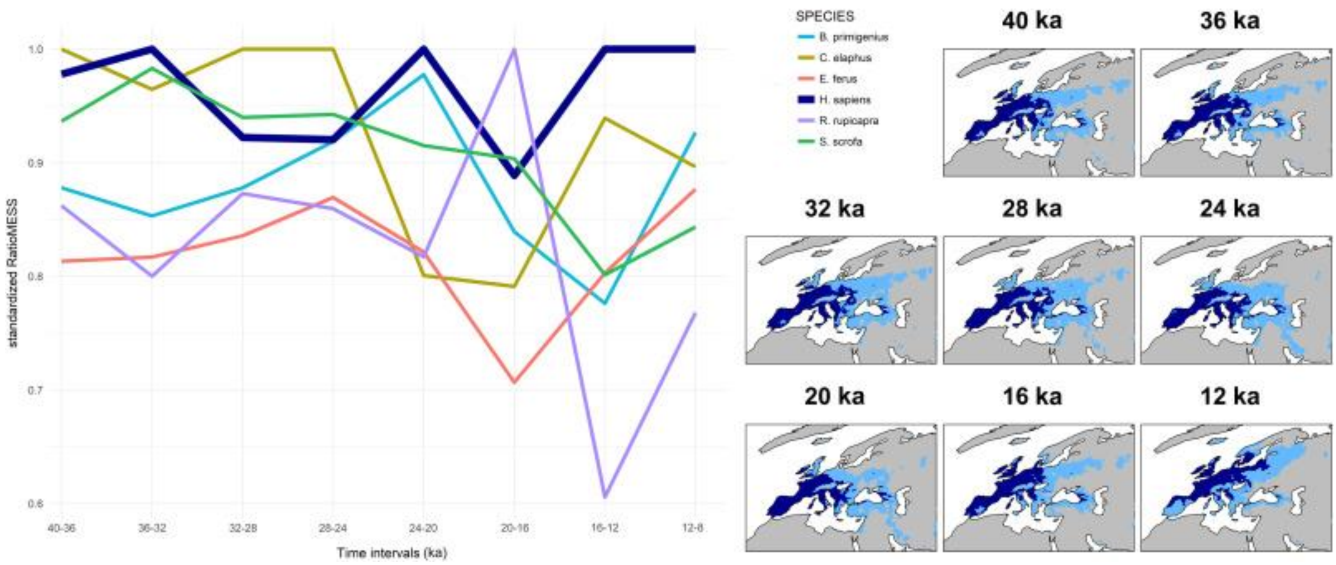

Figure 5. Climatic plasticity across temporal intervals in *H. sapiens* and the species most closely associate to it (left), and evolution of *H. sapiens* suitability maps (right). Dark blue indicates the core of *H. sapiens* distribution (i.e., above the 95th percentile of suitability values), while light blue refers to the entire *H. sapiens* distribution. This figure represents a truncated portion of the whole study area, Eurasia, corresponding to *H. sapiens* territories with high suitability values.

4. Discussion

Extinct large herbivores presented the highest geographic range overlap with *H. sapiens* (Fig. 2a, b). This indicates humans theoretically had very good chance to encounter the extinct megafauna, in keeping with the overkill scenario. However, extant medium-sized herbivores showed significantly higher values of suitability than extinct large herbivores within the core of human distribution (i.e., PIXEL95H, Fig. 2b). Taken together, the results indicate humans were more abundant in habitat patches where populations of extant medium-sized herbivores were abundant. In keeping with our findings, the archaeological record indicates that species of deer, the auroch, and the wild boar were humans' preferred preys (Stewart, 2004; Stiner and Kuhn, 2006; Stiner et al., 2008). Although the exploitation of proboscidean carcasses seems to be a typical behavior of Paleolithic humans (Shipman, 2015), evidence for direct killing of mammoths and elephants is rare (Gaudzinski et al., 2005). The record also tells human hunters started focusing their foraging activities on the reproductive core (prime adults) of small game species (such as deer and bovids) at least since 100 ka (Stiner and Kuhn, 2006; Stiner, 2013). Hunting prime adults could be potentially dangerous to the prey populations as it can unsettle their long-term survival. Yet, by switching between alternative prey or food sources (Zaatari et al., 2016) according to their availability (Fig. 4), and expanding their dietary niche as to include seafood, small mammals, tortoises, and birds (Stiner, 2013; Zaatari et al., 2016), humans may have favoured long-term survival of their preferred prey. The focus on prime adults (which are the most difficult individuals to take down and kill), the disproportionate presence of prey heads in archaeological sites (Stiner, 2013), and the extensive evidence for meat sharing (Hill et al., 2009; Hill and Hurtado, 2009; Apicella, 2014) all point to the prosocial importance of hunting, rather than to its relevance with subsistence. These results suggest a form of switch selection (Murdoch, 1969) in which a generalist predator (in this case humans) selects the most abundant prey in the habitat it occupies, or when all of the available prey species are patchily distributed over the predator search range (Cornell, 1976). The rank abundance of prey species within the core of human distribution changed along with climatic changes (Fig. 4). Feral horse and wild boar were the species most closely associated to humans up to some 24 ka. At that time, the ice sheets reached their maximum coverage (Clark et al., 2009), and the cold-adapted species (e.g. reindeer) became the most easily available prey (Fig. 4). As the deglaciation started at some 18 ka, the wild boar turned out the most abundant prey again. During the end of the Pleistocene, rapid and intense changes in global temperatures forced large mammal species to long distance dispersal (Raia et al., 2012) far exceeding the latitudinal shifts observed in humans (Pushkina and Raia, 2008). This must have effectively changed the prey spectrum to Paleolithic people a number of times, favoring switches among preferred prey and creating variable threats across different parts of species geographical ranges. This change is also evident at the middle to upper Paleolithic cultural transition (Stewart, 2004). Crucially, we found humans were the species with the greatest climatic similarity with itself (i.e., climatic conservatism) across time (Fig. 5). Interestingly, such strong climatic tolerance is typical of carnivorous mammals as well and might explain the positive relationship between humans and extant large carnivores (Fig. 2a, c). This is further supported by the evidence that extant carnivores might have overcome end Pleistocene extinction by virtue of such wide climatic tolerance (Di Febbraro et al., 2017).

In contrast, extinct large carnivores did show little overlap to humans (Fig. 2a), which suggests they might have gone extinct primarily by climatic effects.

Our results suggest that humans stood their grounds across periods of changing climates, by modifying natural environments to their needs (Sullivan et al., 2017) and may have opportunistically switched among different prey species as their availability waxed and waned. This has potentially important consequences on prey extinction risk. Because the populations of the most abundant prey are usually controlled by habitat quality, rather than by predation (Hopcraft et al., 2010), by hunting upon the most abundant prey, humans might have unintentionally focused on those enduring the lowest extinction risk. Our findings suggest that *H. sapiens* was not the main factor in Eurasian megafauna extinction, although it is still possible that human exploitation contributed to amplify the vulnerability of some taxa to climate change (Malhi et al., 2016) especially for slow-reproducing prey (Johnson, 2002). It would be interesting to reproduce the same kind of study on New World and Oceania faunas, where the human arrival strikingly coincides with the end Pleistocene large mammals extinction (but see Lima-Ribeiro and Diniz-Filho, 2013; Holen et al., 2017). It would also be interesting to take in consideration species social system (since gregarious species are hard to find, except where the herds roam). Our approach is based on modeled distributions and climatic preferences of species. As with any modeling approach, this has major advantages (scale, ease of interpretation) as well as limitations (resolution, precision). Moreover, an important assumption is that species populations really were more abundant where the habitat was better suited to them. The archaeological record is dense with site-by-site information about prey consumption style and prey choice, derived directly from fossil evidence of human activity on prey carcasses, that could be tested to stress the OFT hypothesis. Despite all of these caveats, this study provides evidence that humans excelled in exploiting their preys during the late Pleistocene, and contrary to the common complaint against Paleolithic hunters, that they could hardly be blamed for the extinction of Eurasian megafauna.

5. Conclusion

Late Pleistocene *Homo sapiens* climatic niche was similar to those of modern, medium-sized herbivores. Although strongly overlapping to humans in terms of geographic range, the extinct megafauna was presumably rare within humans' optimal habitat patches. This suggests that Paleolithic hunters had stronger association to extant rather than extinct herbivorous species. Although climatic coincidence is no direct proof of human preference in terms of hunting, the results presented here suggest humans had lower opportunity to kill extinct megafauna individuals. Our modelling results concur with evidence coming from the archaeological record, suggesting that medium-sized extant herbivores such as wild boar and deer are more common than extinct megafauna in Late Paleolithic contexts.

Acknowledgments

We are grateful to Mikael Fortelius, Anna Loy, Luigi Maiorano for the insightful (sometimes lengthy) discussion about the data and idea developed here.

Author contribution F.C., M.D.F., L.R., M.L.R., L.R. and P.R. conceived the study. M.M., A.M., S.C., C.S., and A.L. collected the data, prepared the figures and computed some of the analyses. All authors contributed to collecting data, performing the analyses, and writing the manuscript.

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Supplementary Information for: Macroevolutionary trends of brain size in primates

Endocranial volume (ECV) results

Table S1. Endocranial volumes. A) ANOVA performed on ECV, taken clades with distinct evolutionary rates as factors. B) Group means.

A					
		ANOVA			
	Df	Sum Sq.	Mean Sq.	F	*p* value
ECV	3	197.830	65.940	296.800	**< 0.001**
Residuals	49	10.890	0.220		
		Pairwise comparison			
group a	**group b**	difference	lwr	upr	*p* value
Saguinus	Hominins	-4.224	-4.736	-3.713	**< 0.001**
Lorisiformes	Hominins	-4.638	-5.110	-4.165	**< 0.001**
Cheirogaleidae & *Lepilemur*	Hominins	-4.874	-5.386	-4.362	**< 0.001**
Lorisiformes	*Saguinus*	-0.414	-0.886	0.059	0.106
Cheirogaleidae & *Lepilemur*	*Saguinus*	-0.650	-1.161	-0.138	0.008
Cheirogaleidae & *Lepilemur*	Lorisiformes	-0.236	-0.709	0.237	0.550
B					
Clade	**Means**				
Hominins	6.491				
Saguinus	2.267				
Lorisiformes	1.853				
Cheirogaleidae & *Lepilemur*	1.617				

Table S2. Standard Major Axis regression slope comparisons for ECV data. Groups as in table S1.

STANDARD MAJOR AXIS ANALYSIS						
	group a	**group b**	***p* value**	**Test Stat.**	**Slope1**	**Slope2**
phenotype	Hominins	*Saguinus*	**< 0.001**	41.139	0.358	-0.044
	Hominins	Lorisiformes	**< 0.001**	45.336	0.358	-0.048
	Hominins	Cheirogaleidae & *Lepilemur*	**< 0.001**	28.403	0.358	-0.066
	Hominins	others	**< 0.001**	39.033	0.358	0.079
	Saguinus	Lorisiformes	0.766	0.088	-0.044	-0.048
	Saguinus	Cheirogaleidae & *Lepilemur*	0.208	1.588	-0.044	-0.066
	Saguinus	others	**0.013**	6.216	-0.044	0.079
	Lorisiformes	Cheirogaleidae & *Lepilemur*	0.280	1.166	-0.048	-0.066

absolute rates	Lorisiformes	others	**0.010**	6.635	-0.048	0.079
	Cheirogaleidae & *Lepilemur*	others	0.437	0.604	-0.066	0.079
	Hominins	*Saguinus*	**< 0.001**	32.779	0.874	0.133
	Hominins	Lorisiformes	**0.000**	70.972	0.874	0.055
	Hominins	Cheirogaleidae & *Lepilemur*	**< 0.001**	24.708	0.874	0.175
	Hominins	others	**0.000**	75.898	0.874	-0.068
	Saguinus	Lorisiformes	**< 0.001**	8.880	0.133	0.055
	Saguinus	Cheirogaleidae & *Lepilemur*	0.384	0.757	0.133	0.175
	Saguinus	others	**0.004**	8.142	0.133	-0.068
	Lorisiformes	Cheirogaleidae & *Lepilemur*	**< 0.001**	14.887	0.055	0.175
	Lorisiformes	others	0.275	1.190	0.055	-0.068
	Cheirogaleidae & *Lepilemur*	others	**< 0.001**	15.196	0.175	-0.068
relative rates	Hominins	Saguinus	**< 0.001**	28.852	0.998	-0.170
	Hominins	Lorisiformes	**< 0.001**	53.719	0.998	0.101
	Hominins	Cheirogaleidae & *Lepilemur*	**< 0.001**	18.635	0.998	-0.257
	Hominins	others	**< 0.001**	64.250	0.998	0.102
	Saguinus	Lorisiformes	0.069	3.318	-0.170	0.101
	Saguinus	Cheirogaleidae & *Lepilemur*	0.184	1.767	-0.170	-0.257
	Saguinus	others	**0.029**	4.761	-0.170	0.102
	Lorisiformes	Cheirogaleidae & *Lepilemur*	**< 0.001**	10.943	0.101	-0.257
	Lorisiformes	others	0.946	0.005	0.101	0.102
	Cheirogaleidae & *Lepilemur*	others	**< 0.001**	15.520	-0.257	0.102

Table S3. Regression statistics for ECV and ECV rates against diversification rates. A) Linear model results performed on ECV and ECV rates regressed against diversification rates. B) Phylogenetic generalized least squares (PGLS) results for diversification rates and ECV values comparison.

A				**B**			
	Linear Model				**PGLS**		
	ECV~DR				**DR~ECV**		
	Estimate	Std. Err	p value	AIC	BIC	logLik	lambda
(Intercept)	5.372	0.164	< 0.001	215.756	230.779	-103.878	0.998
DR	0.923	0.084	< 0.001				
					Value	Std.Error	p-value
	ECVrates~DR			(Intercept)	1.510	0.271	0.000
	Estimate	Std. Err	p value	ECV	0.000	0.040	0.994
(Intercept)	0.869	0.208	< 0.001				
DR	0.343	0.106	0.001				

Encephalization quotient (EQ) results

Table S4. Standard Major Axis regression slope comparisons for EQ data. Hominins are contrasted to the rest of Primates.

STANDARD MAJOR AXIS ANALYSIS						
	group a	group b	*p* value	Test Stat.	Slope 1	Slope 2
phenotype	Hominins	others	0.000	52.003	0.232	0.037
absolute rate	Hominins	others	0.000	71.824	0.957	-0.076
relative rate	Hominins	others	0.000	77.758	1.365	0.114

Table S5. Regression statistics for EQ and EQ rates against diversification rates. A) Linear model results performed on EQ and EQ rates regressed against diversification rates. B) PGLS results for diversification rates and EQ values comparison.

A				B			
Linear Model				**PGLS**			
EQ~DR				**DR~EQ**			
	Estimate	Std. Err	*p*value	AIC	BIC	logLik	lambda
(Intercept)	0.996	0.067	< 0.001	35.231	50.279	-13.615	0.964
DR	0.434	0.034	< 0.001				
					Value	Std.Error	*p*value
EQrates~DR				(Intercept)	-0.722	0.168	0.000
	Estimate	Std. Err	*p*value	EQ	0.067	0.030	0.027
(Intercept)	1.651	0.199	< 0.001				
DR	0.646	0.102	< 0.001				

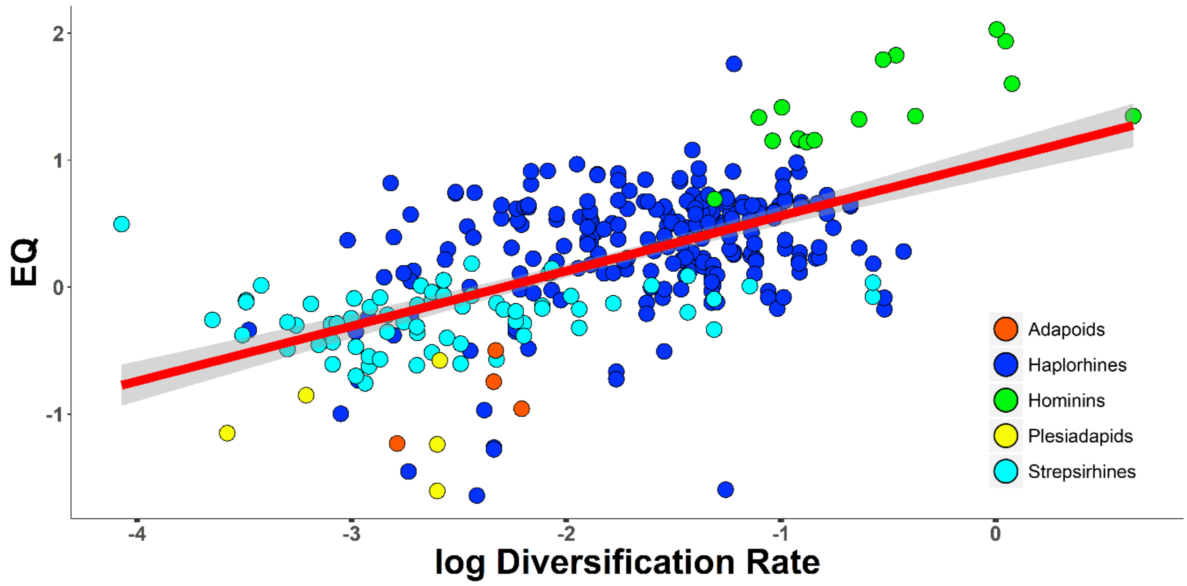

Figure S1. Regression plot between encephalization quotient (EQ) values and diversification rates.

Body mass results

Table S6. *search.trend* results for body mass with selected groups.

	Phenotype		Absolute rate		Relative rate	
	slope	*p* value	slope	*p* value	slope	*p* value
Colobinae	0.051	0.320	-0.031	**0.030**	0.262	**0.000**
Pitheciidae	0.019	0.250	0.008	**0.000**	0.020	0.220
Indriidae	0.011	0.180	0.001	0.070	0.013	0.070

Table S7. Standard Major Axis analysis results for body mass for groups showing distinct evolutionary rates.

STANDARD MAJOR AXIX ANALYSIS						
	group a	**group b**	***p* value**	**Test Stat.**	**Slope 1**	**Slope 2**
phenotype	Colobinae	Pitheciidae	0.022	5.234	-0.068	0.133
	Colobinae	Indriidae	0.006	7.487	-0.068	0.146
	Colobinae	others	0.032	4.595	-0.068	0.109
	Pitheciidae	Indriidae	0.726	0.122	0.133	0.146
	Pitheciidae	others	0.331	0.944	0.133	0.109
	Indriidae	others	0.108	2.585	0.146	0.109
abs.rate	Colobinae	Pitheciidae	0.000	14.037	-0.323	0.105
	Colobinae	Indriidae	0.000	24.219	-0.323	0.078
	Colobinae	others	0.000	38.665	-0.323	-0.068
	Pitheciidae	Indriidae	0.258	1.282	0.105	0.078

rel.rate	Pitheciidae	others	0.031	4.626	0.105	-0.068
	Indriidae	others	0.423	0.642	0.078	-0.068
	Colobinae	Pitheciidae	0.000	22.478	0.657	0.165
	Colobinae	Indriidae	0.000	33.524	0.657	0.129
	Colobinae	others	0.000	53.951	0.657	0.102
	Pitheciidae	Indriidae	0.350	0.873	0.165	0.129
	Pitheciidae	others	0.020	5.401	0.165	0.102
	Indriidae	others	0.193	1.695	0.129	0.102

Table S8. *search.trend* results for body mass for Hominins only.

	Phenotype		**Absolute rate**		**Relative rate**	
	slope	*p* value	slope	*p* value	slope	*p* value
Total	0.022	**0.000**	-0.004	0.200	0.017	0.120
Hominins	0.098	0.100	0.442	**0.000**	0.759	**0.000**

Table S9. Standard Major Axis analysis results for body mass for Hominins only.

STANDARD MAJOR AXIS ANALYSIS						
	group a	group b	*p* value	Test Stat.	Slope 1	Slope 2
phenotype	Hominins	others	0.000	14.085	0.249	0.106
abs.rate	Hominins	others	0.000	75.308	0.793	-0.068
rel.rate	Hominins	others	0.000	77.591	1.145	0.103

Pradel's models results

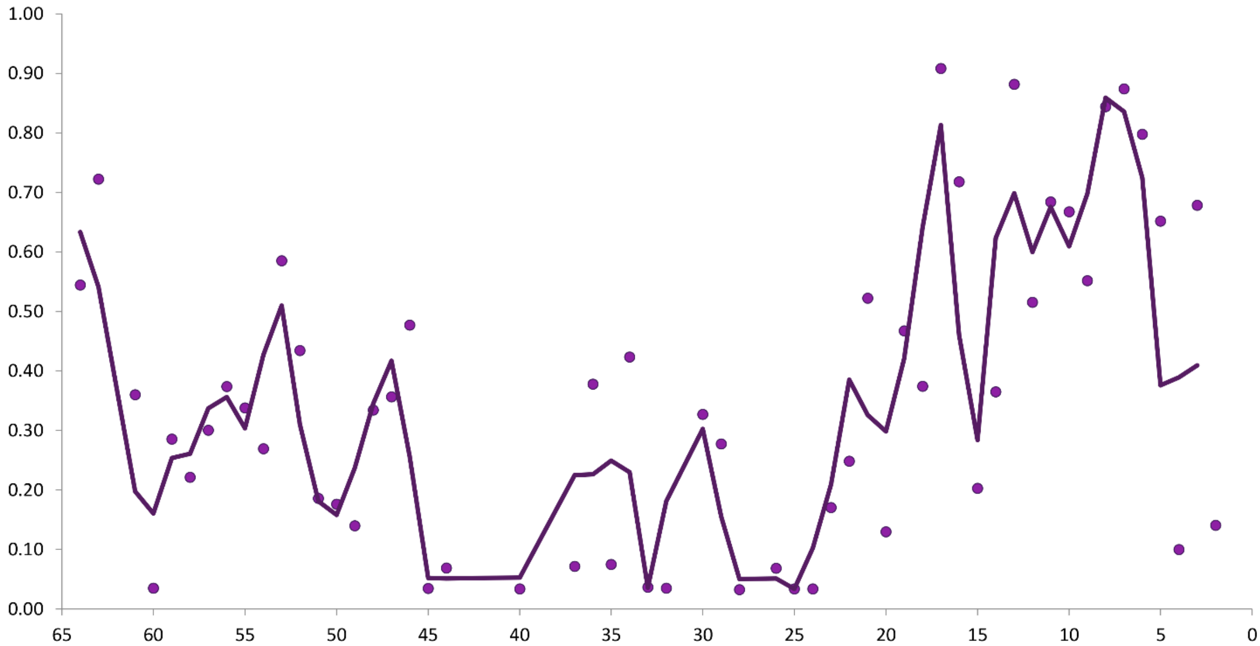

Figure S2. Sampling probability (p) estimation for the primate fossil record during the last 65 million years.

Searching for evolutionary trends

The *search.trend* function is available within the package RRphylo (Raia et al. 2018). The function takes an object produced by the function RRphylo and regresses both phenotypes and phenotypic evolutionary rates against their distance from the tree root.

In particular, the absolute rate values are regressed against the age of the nodes while accounting for heteroskedasticity by means of generalized least squares regression (Kariya and Kurata, 2004) using the function *gls* in the package nlme (Pinheiro et al., 2018). The phenotypes versus age regression follows a linear regression model. In both cases, the significance of the regression slopes is assessed by means of randomization. The function randomly produces a family of 100 Brownian phenotypes whose phylogenetic mean is set to be the same as the RRphylo estimate, and computes the regression slopes (for both random phenotypes and rates). Then it calculates the rank of the real regression slope against the Brownian slopes.

Simulation experiments

In order to evaluate the power of *search.trend*, we set a simulation experiment. We started by producing 100 random, non-ultrametric trees of 100 species each by using the function *rtree* in the package ape (Pardis et al., 2004). For each tree, we used a modified version of the *setBM* function in the package RRphylo. The new version of *setBM* allows to specify the intensity of the changes in rates and phenotypic means as to produce a vector of tip values showing 1) no trend in the phenotypic mean and constant increase in phenotypic variance over time ("brown"), 2) a trend of exponential increase or decrease of the phenotypic variance over time ("trend"), and 3) a vector of tip values showing a significant change in the mean phenotype over time ("drift"). The "brown" case represents Brownian motion. The "drift" case simulates a phenotypic trend in time (e.g. Cope's rule). The "trend" case represents a change in the rate of phenotypic evolution over time. In detail, under the "drift" case, the mean phenotypes changes according to a scalar "ds". Under the "trend" case, the phenotypic range grows or decreases exponentially over time according to the scalar "es". With either ds = 0 or es = 1 the simulated phenotype will have no trend in either mean or variance (i.e. "brown"). The sign of es and ds will determine whether the phenotypic variance and phenotypic means, respectively, will either grow exponentially or decrease over time.

To search for trends in phenotypic means and variances, we regressed the rates at individual branches and the phenotypes, against the age of the corresponding nodes. Type II error was assessed as the percentage of simulations where the simulated phenotypic trend either in the mean ("drift") or variance ("trend") was not identified. Type I error was assessed by the percentage of false positives (i.e. "brown" phenotypes showing either a significant "drift" or "trend" in the phenotypic mean or rates, respectively).

Results

Univariate In the "drift" case (i.e. phenotypic trend in mean value), the incidence of false negative findings (Type II error) is 0%. Those of false positives is 6%. In the "trend" case, the corresponding figures are 1% and 5%, respectively (Table S10).

Table S10. The distribution of Type I and Type II error rates (in percentage) for *search.trend* assessed on phenotypes simulated to possess a trend in the mean phenotypic value over time (Drift), a trend in the phenotypic variance over time (Trend). Significance (at $\alpha = 0.05$) is assessed as both the p-value of the phenotype versus age, or evolutionary rate versus age regressions, and by comparing the respective regression slopes to a family of 100 slopes obtained after simulating phenotypes according to the Brownian motion model of evolution.

	Univariate	
Model	Type I	Type II
Drift	6	0
Trend	5	1

Supplementary Information for: Unexpectedly rapid evolution of mandibular shape in hominins

The Primate Tree

To build the Primate tree we started by downloading the consensus Bayesian inference phylogeny of extant primates from the 10KTrees website. We removed extant species we had no mandible shape data for from this tree, and then added fossil taxa we had mandible shape data, by relying on published accounts of their phylogenetic position and age. Our main reference for high-level relationships of extinct primates was the phylogenetic analysis of Pattison et al. (2014). Further topological and chronological inference about early "plesiadapiforms" and early strepsirrhines were taken from Chester and Bloch (2013), Silcox et al. (2009), and Franzen et al. (2009). Similarly, we supplemented the phylogenetic and age information on anthropoids following Ducrocq (2001), Ross et al. (1998), Gunnell and Miller (2001), Bajpai et al. (2008), and Jaeger (1998); on apes following Harrison (1986), Begun (1994), Begun and Gulec (1998), Moyà-Solà et al. (2009), Alba et al. (2010); on hominins following Dembo et al. (2015); on New World monkeys following Guedes and Salles (2005), and Horovitz and MacPhee (1999); on early catarrhines following Thomas (1991), Benefit (1999), and Williams et al. (2007); and on lemurs after Herrera and Davalos (2016), and Godfray and Jungers (2010). Additional, fossil calibration dates were taken from Pozzi et al. (2014). Each tip (species) age was set at the species last occurrence in the fossil record, as detailed in the supplementary material. By using tip ages and calibrated nodes, we assigned unknown node ages applying the calibration method in Brusatte et al. (2008). The resulting tree includes 153 extant and 58 extinct species. The number of fossil species is limited by the availability of realistically complete fossil primate mandibles. Nonetheless, we strove to maintain temporal and phylogenetic homogeneity in sampling. Therefore, the tree includes 4 Paleocene, 16 Eocene, 5 Oligocene, and 7 Miocene species, which is reasonable given the great diversity of Eocene primates (Gingerich 1977, Jaeger et al., 2010), and the well-known paucity of the Oligocene primate record (Tavaré et al. 2002). One hundred fifty-five haplorrhines, and 32 lemuriformes are present in the tree, the remaining taxa belong to either adapiformes or "plesiadapiformes".

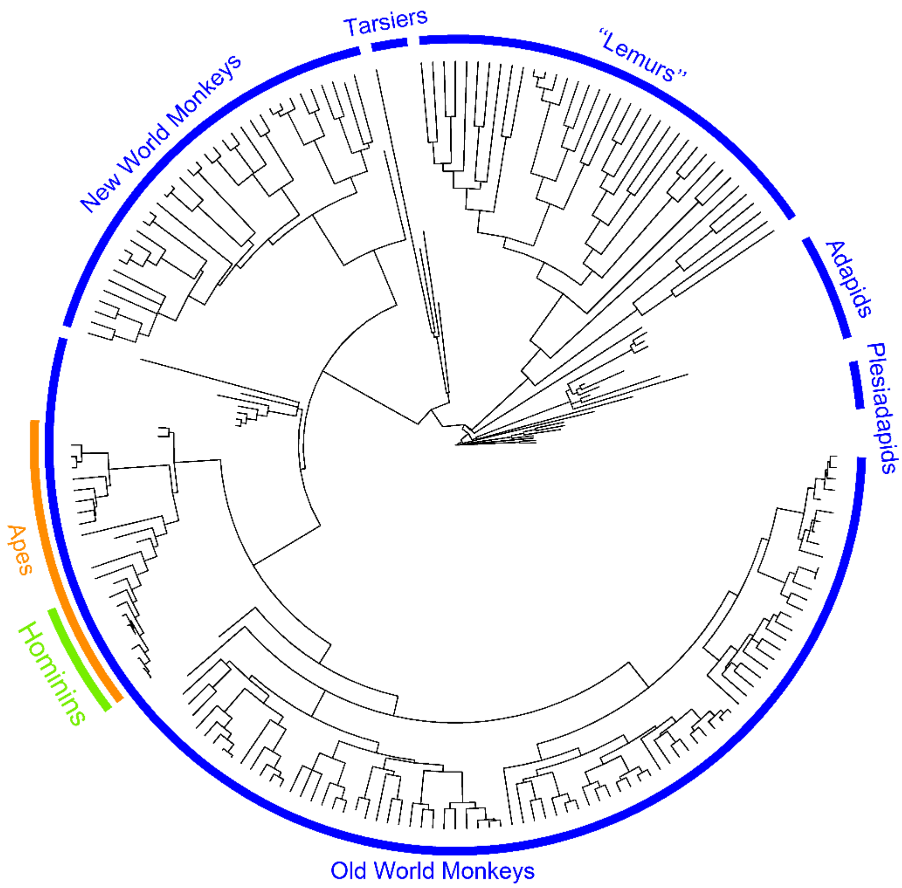

Figure S1. The composite Primate phylogenetic tree used in this study

Phylogenetic tree for the FULL dataset (211 species)

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Phylogenetic tree for the SMALL dataset (158 species)

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us:1.274028,Chiropotes_satanas:1.274028):1):7.368851,(Pithecia_monachus:4.404566,Pithecia_irrora
ta:4.404566):5.238313):9.753209,(Callicebus_moloch:7.360073,Callicebus_personatus:7.360074):12.
036014):3.336691)Platyrrhini:24.079043)Anthropoidea:22.028211,Tarsius_tarsier:68.83896599)Ha
plorrhini:4.162986,((((Nycticebus_coucang:9.665419738,Nycticebus_pygmaeus:9.665419361):9.7903
78029,Loris_tardigradus:19.45579739):12.15699407,(Arctocebus_calabarensis:23.9235999,Perodicti
cus_potto:23.9235999):7.689192815):25.86193922,(((((Lepilemur_edwardsi:6.637754958,Lepilemu
r_ruficaudatus:6.637754519):4.336452246,Lepilemur_dorsalis:10.97420739):21.67410611,(Phaner_f
urcifer:29.04135939,((Cheirogaleus_medius:15.46912778,Cheirogaleus_major:15.4691259):7.985212
736,(((Microcebus_murinus:8.143206591,Microcebus_rufus:8.143206115):6.475598094,Mirza_coque
reli:14.61880155):3.085775202,Allocebus_trichotis:17.7045755):5.749761886):5.587020128):3.606
952223):3.812019197,((((Lemur_catta:13.5357503,(Hapalemur_griseus:9.257548571,Hapalemur_si
mus:9.257550202):4.278199473):6.95432819,(((Eulemur_albifrons:1.318481143,Eulemur_fulvus:1.3
18480829):1.91382626,Eulemur_cinereiceps:3.232307089):2.459661883,Eulemur_mongoz:5.691969
6):14.79811203):4.649877796,Varecia_variegata:25.13995441):9.150383621,((Avahi_laniger:23.985
15889,(Propithecus_diadema:12.92449488,Propithecus_verreauxi:12.92449614):11.0606615):1.611
236567,Indri_indri:25.5963942):8.693945704):2.169989647):15.0818657,Daubentonia_madagascari
ensis:51.54219463)Lemuridae:5.932532289):15.52934531):1):3);

Evolutionary rate analysis results

With the FULL dataset a significant rate shift applies to the clade including the genus *Homo* and the Australopiths. Potential shifts are estimated according to variation in the multivariate Brownian rate, yet the same results apply by analyzing RRphylo rates (Fig. S2). We estimated whether the shift located at the clade parental to humans and the australopiths, as applied to RRphylo rates, is significant as well. To this aim, we first calculated the multivariate rate by taking the Euclidean Norm of the vector of individual variables rates (variables are the relative warp scores) per branch. Then we took the average difference between the absolute values of the multivariate RRphylo rates of the hominin clade and rates attached to the branches of the rest of the tree. Then, we assessed significance by computing 10,000 average differences obtained by randomizing rates across the tree branches. With the FULL dataset, this test indicates that the branches belonging to the hominin clade are significantly higher than background rates at $p < 0.0001$. The average multivariate rate difference is 0.065. With the SMALL dataset the average difference in the multivariate rates between the hominin clade and the rest of the tree is again significant at $p < 0.0001$, yet the computed average multivariate rate difference is slightly smaller than with the FULL dataset at 0.025.

Accounting for phylogenetic uncertainty in node age and topology

The distribution of evolutionary rates depends on the distribution of branch lengths and on the tree topology (Bapst 2014). Every phylogenetic tree represents at best a phylogenetic hypothesis, which should be evaluated against alternative topologies, and branch lengths. To account for phylogenetic uncertainty, we wrote a Rcode that changes the tree topology and branch lengths. For every given species, the function swaps the phylogenetic position up to two nodes distance. For instance, the topology ((A,(B,C)),D) could be swapped to the forms ((C,D),(A,B)); (((B,D),A),C) and so on. In addition, each node age is randomly set at any age between the age of its parental node, and the age of its oldest daughter node. We applied the tree swapping function 100 times, computed RRphylo rates at each time, and draw the difference in mean absolute rates between the hominin clade and the rest of the tree each time. The distribution of mean absolute rate differences (Fig. S3) still points to higher absolute rates in the hominin clade branches, and it is statistically significant, as assessed by means of a t-test ($t = -10.227$, $df = 11.482$, $p << 0.0001$).

Table S1. Results of the multivariate rate shift test

	# shifted nodes	AICc	mod.likelihoods	species included	
				node # 1	node # 2
FULL	1	-2924.288	1486.876	*Homo neanderthalensis, Homo sapiens, Homo heidelbergensis, Homo erectus, Homo habilis, Homo naledi, Australopithecus sediba, Australopithecus africanus, Paranthropus boisei, Australopithecus afarensis*	
FULL size free	1	-2936.846	1493.156	*Homo neanderthalensis, Homo sapiens, Homo heidelbergensis, Homo erectus, Homo habilis, Homo naledi, Australopithecus sediba, Australopithecus africanus, Paranthropus boisei, Australopithecus afarensis*	
FULL size and shape	2	1375.089	-676.2225	*Cercocebus galeritus, Cercocebus torquatus, Cercocebus atys, Mandrillus leucophaeus, Mandrillus sphinx, Lophocebus albigena, Theropithecus gelada, Theropithecus baringensis, Theropithecus brumpti, Theropithecus oswaldi, Papio anubis, Papio hamadryas, Papio papio, Papio cynocephalus, Parapapio whitei*	*Cercopithecinae*
	2	1389.588	-683.4718	*Cercocebus galeritus, Cercocebus torquatus, Cercocebus atys, Mandrillus leucophaeus, Mandrillus sphinx, Lophocebus albigena, Theropithecus gelada, Theropithecus baringensis, Theropithecus brumpti, Theropithecus oswaldi, Papio anubis, Papio hamadryas, Papio papio, Papio cynocephalus, Parapapio whitei, Macaca arctoides, Macaca anderssoni, Macaca sinica, Macaca fuscata, Macaca nigra, Macaca silenus, Macaca fascicularis, Macaca mulatta, Macaca thibetana, Macaca sylvanus*	*Cercopithecinae*
SMALL	1	-3310.757	1618.144	*Homo neanderthalensis, Homo sapiens, Homo heidelbergensis, Homo erectus, Australopithecus africanus, Paranthropus boisei, Australopithecus afarensis*	

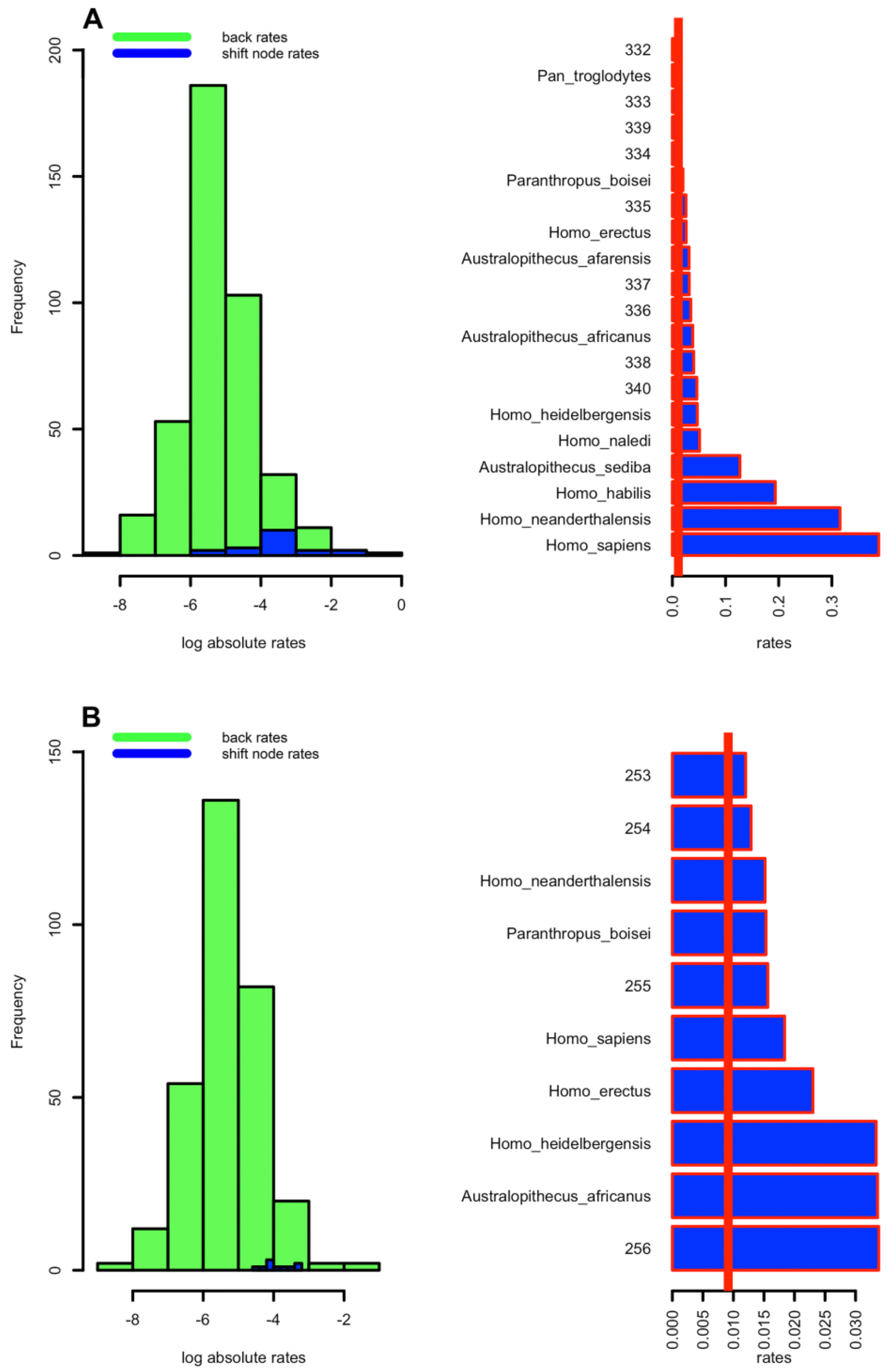


Figure S2. Left, frequency distribution of the rates calculated by RRphylo partitioned into background rates (green) and the rates of shifted nodes (blue) for the FULL dataset (A) and SMALL dataset (B). On the right, rates calculated by RRphylo for the branches belonging to the shifted node for the FULL dataset (A) and SMALL dataset (B). The red vertical line represents the average rate calculated over the entire tree.

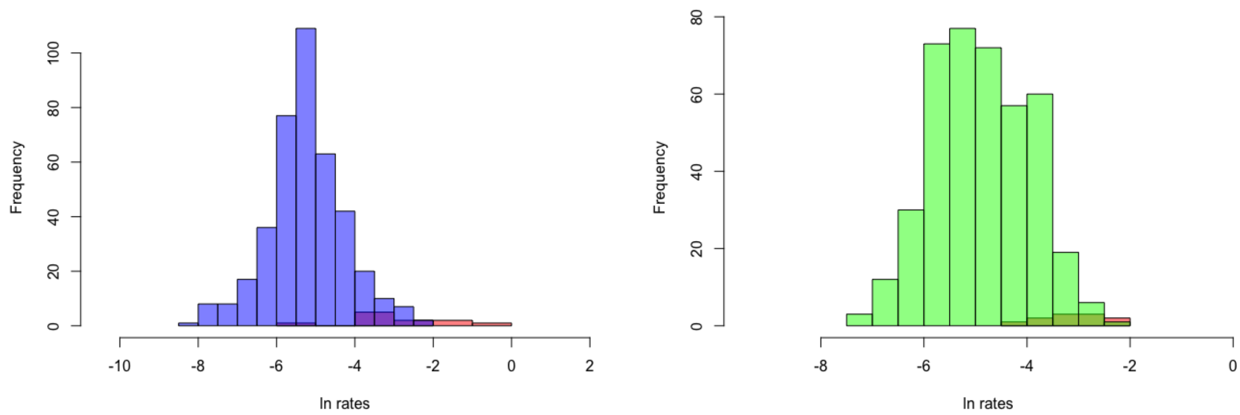


Figure S3. Distribution of multivariate rates computed by the RRphylo method for the hominin clade as compared to the rest of the tree. The histogram to the left refers to the rates actually computed with the phylogeny of the FULL dataset (211 species). The background rates are in violet, the rates for the branches of the hominin clade are in orange. To the right, the distribution of the same rates averaged over 100 phylogenetic trees derived from the FULL dataset tree after randomly changing topology and branch lengths.

Geometric Morphometrics of Primate mandibles

We used Geometric Mophometrics (Gmm, Rohlf & Marcus, 1993; Klingenberg, 2010) to extract morphological data. This method permits to retrieve shape information of anatomical objects after removing non-shape variation (i.e. as related to size, position and orientation of the objects) by applying Generalized Procrustes Superimposition (GPA, Rohlf and Slice 1990). By using the TpsRelw software ver. 1.53 (Rohlf, 2013b) we performed Relative Warps Analysis on aligned coordinates (RWA, Bookstein 1991; Rohlf 1993; Zelditch et al. 2002) to decompose shape variation into orthogonal axes of maximum variance.

For this study we collected (either by taking pictures directly, from digital sources, or from published pictures) 731 digital images of primate hemimandibles, belonging to 211 species (148 extant, 63 extinct). The number of mandibles per species ranges from 1 to 13 (median = 3, mean = 3.48). The requirements for picture inclusion in the dataset were the presence of anatomical regions where landmarks had to be placed, absence of distortions and breakages on the bone, and orientation perpendicular to the picture plane. Fortunately, being the hemimandible a flat bone, these features were easily recognizable, even on samples taken from published resources. The pictures we took directly derive from Meloro et al. (2015).

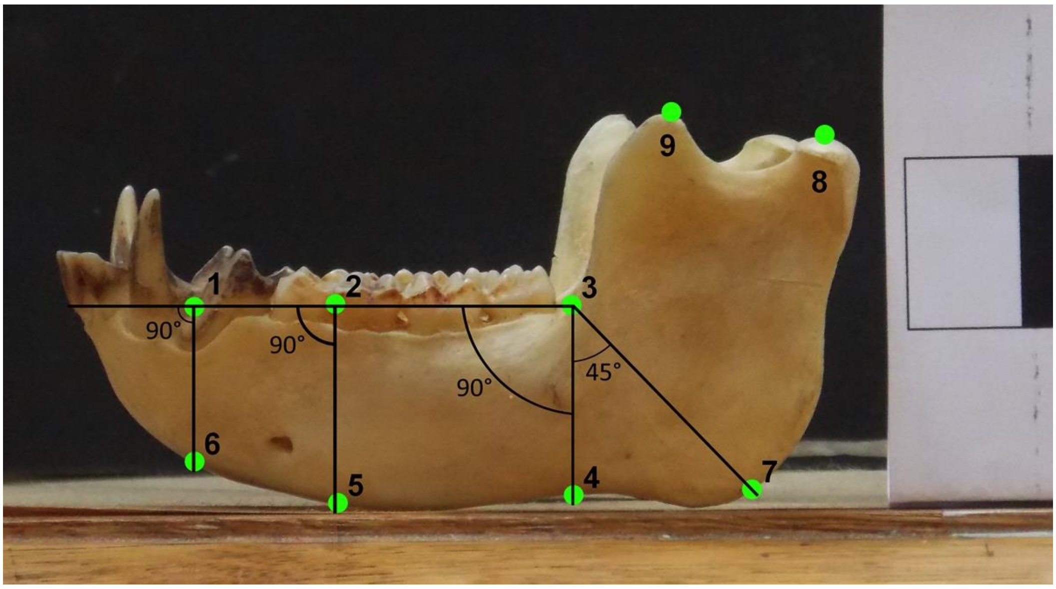


Figure S4. The Landmark configuration used in this study as applied to a Mona monkey *Cercopithecus mona* left hemimanbible. Landmarks definitions: 1) anterior tip of premolar-tooth row; 2) posterior tip of premolar-tooth row; 3) lower tip of ascending ramus; 4-5-6) intersections of the orthogonal projections of landmarks 3, 2 and 1 to the lower border of the hemimandible; 7) Intersection of the forty-five degrees projection of landmark 3 to the mandible border; 8) uppermost point of the mandibular condyle; 9) uppermost point of the mandibular coronoid.

We used tpsDig2 software (Rohlf, 2013) to digitize 9 landmarks as to adequately describe the lower jaw profile (Fig. S4). Gmm also returns the Centroid Size, an index that permits to get back the information related to size that are removed by GPA. We regressed the natural logarithm of centroid size (lncs) and body mass estimates taken from the literature, to assess whether lncs works good as a proxy for body size. The regression is highly significant and positive (slope = 0.300, R^2= 0.844, $p < 0.001$, Fig. S5).

Shape variance was decomposed into 14 axes (Relative Warps). We performed the Gmm analyses twice: on the full dataset, and on a dataset deprived from pictures we obtained from literature. The former dataset (FULL) consists of 211 species, the reduced dataset (SMALL) includes pictures for 158 species (145 extant, 13 extinct).

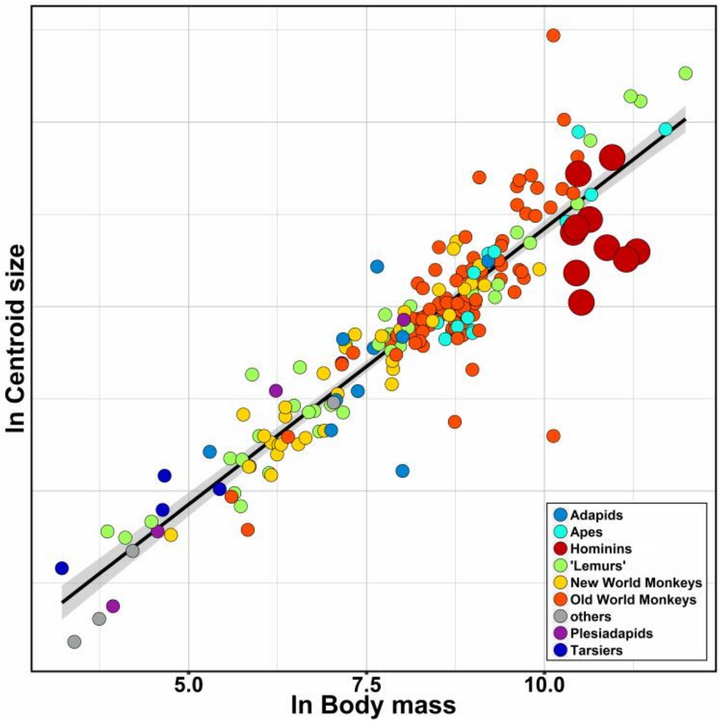


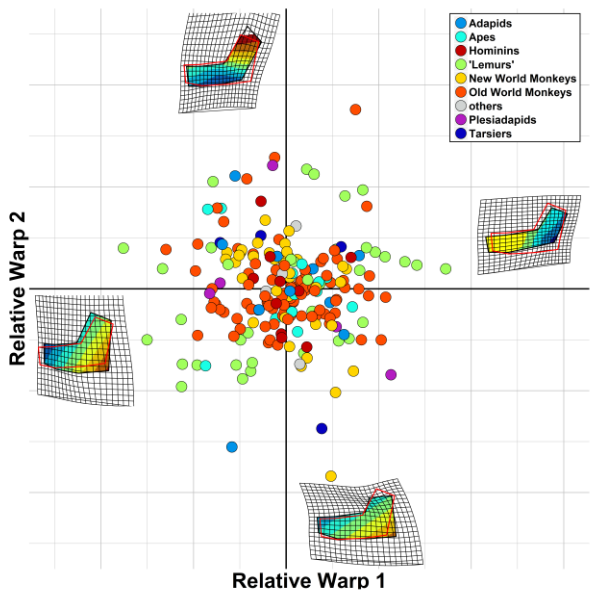
Figure S5. The regression between the centroid size (y) and body mass (x).

With the FULL dataset, RW1 and RW2 axes describe 38.59% and 19.50% of shape variance, respectively. Positive values of RW1 are associated to jaws with slender mandibular corpus and elongated surface of attachment for the masseter. Negative values of RW2 are associated to mandibles with stronger angle and lower ramus (Fig. 1 in the main manuscript). Mandible with narrow gonial angle and high ramus occur at positive values of RW2. Specimens belonging to the same higher-level taxon show similar morphologies, except for lemurs, which spread across the morphospace. This indicates there is strong shape conservatism in primate mandibles. To confirm this hypothesis, we estimated phylogenetic signal using function *physignal* (in R package Geomorph) and found it is significant ($K_{multiple}$ = 0.274, p = 0.001).

Table S2. Results of GPA decomposition of shape for the four datasets analysed

211 Full		
eigenvalues %	Variance	Cumulative %
0.00743	39.44	39.44
0.00405	21.50	60.93

0.00259	13.76	74.69
0.00165	8.77	83.46
0.00097	5.15	88.61
211 Size Free		
eigenvalues %	Variance	Cumulative %
0.00315	33.00	33.00
0.00237	24.88	57.88
0.00118	12.36	70.23
0.00090	9.44	79.67
0.00060	6.34	86.01
211 Size and Shape		
eigenvalues %	Variance	Cumulative %
19.44259	94.34	94.34
0.39962	1.94	96.28
0.30655	1.49	97.77
0.14447	0.70	98.47
0.11897	0.58	99.05
158 Full		
eigenvalues %	Variance	Cumulative %
0.00746	44.35	44.35
0.00318	18.89	63.24
0.00220	13.06	76.30
0.00149	8.87	85.16
0.00093	5.53	90.69



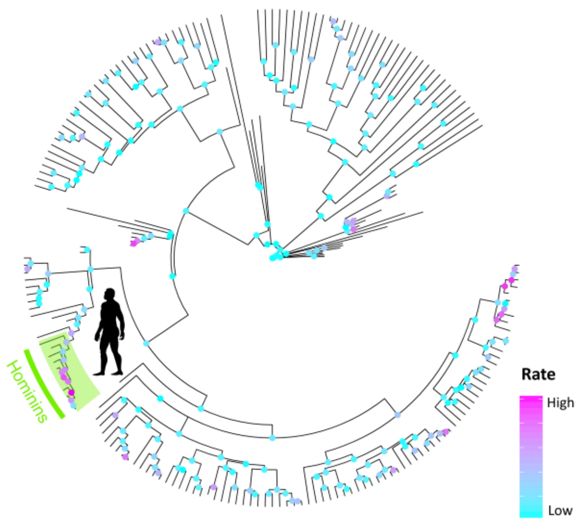


Figure S6. GPA shape decomposition (left) and analysis of rate variation (right) in the size free shape space (without allometric effects). The clade showing a significant rate shift is highlighted with a colour box (right). Silhouettes were downloaded from Phylopic (credits as in Figure 2).

On the FULL dataset we performed a second GPA eliminating allometry, in order to account for potentially large scaling effects linked to the wide body size range in the data (Zelditch et al. 2012). To this aim, we regressed the aligned coordinates versus lncs and took the residuals to use to perform GPA. With the 'size free' dataset, the first two RWs explain 32.9% and 24.9% of the shape variance, respectively (Table S2, Fig. S6, S7). We additionally repeated GPA in the 'size and shape' space, and obtained 15 new axes, in particular RW1 and RW2 explain 94.35% and 2.3% of shape variance respectively (Fig. S8).

Eventually, on the SMALL dataset we obtained 14 RWs. RW1 explains 44.35% and RW2 18.88% of shape variance. Along these axes the deformations are qualitatively the same that we obtained from first GPA with 211 species (Fig. S9).

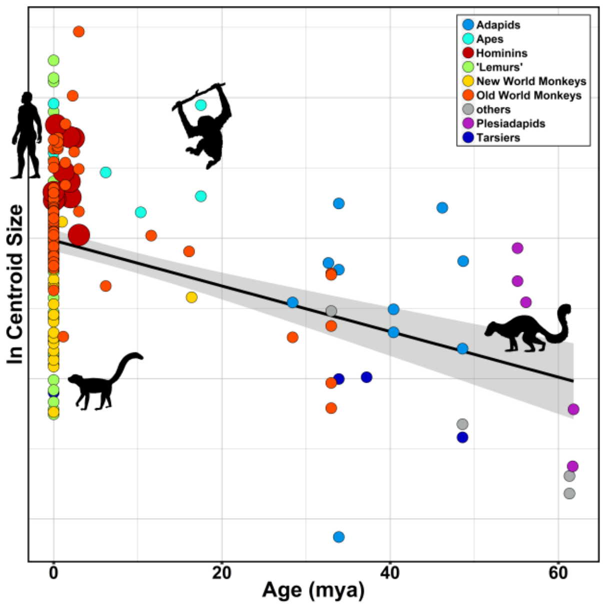


Figure S7. Regression plot of centroid size against age. Silhouettes were downloaded from Phylopic: credits for lemuriformes (http://phylopic.org/image/eefe8b60-9a26-46ed-a144-67f4ac885267/), available for reuse under Attribution-ShareAlike 3.0 Unported (https://creativecommons.org/licenses/by-sa/3.0/) go to Smokeybjb; credits for *Plesiadapis* (http://phylopic.org/image/b6ff5568-0712-4b15-a1fd-22b289af904d/), available for reuse under Attribution-ShareAlike 3.0 Unported (https://creativecommons.org/licenses/by-sa/3.0/) go to Nobu Tamura (image modified by Michael Keesey).

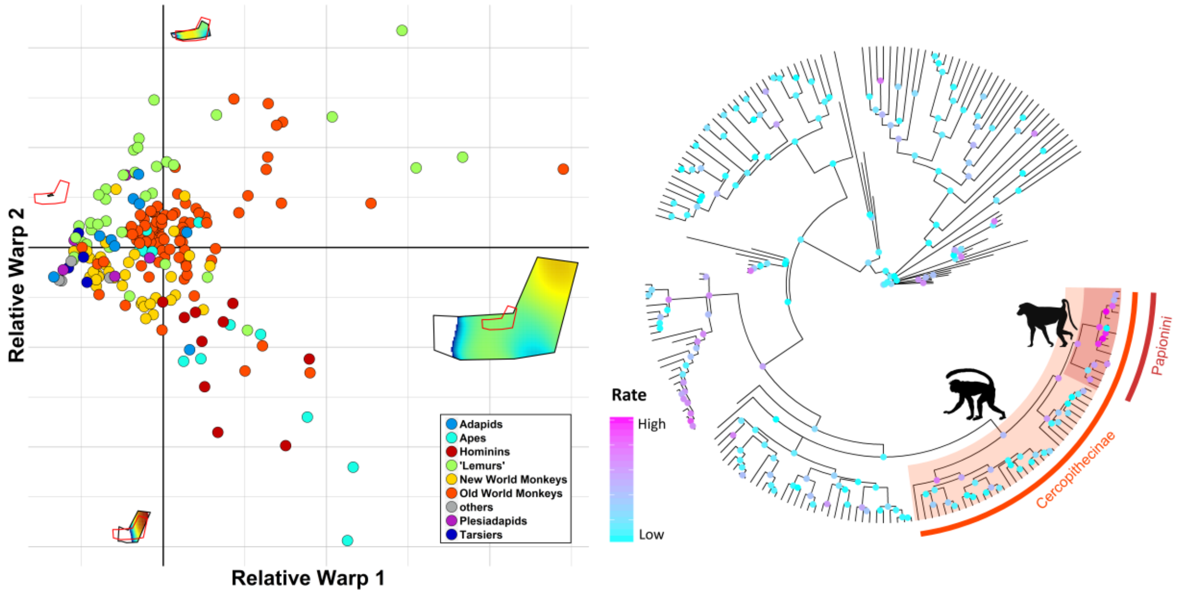


Figure S8. GPA shape decomposition (left) and analysis of rate variation (right) in the size and shape space. Clades showing a significant rate shift are highlighted with a color box (right). Silhouettes were downloaded from Phylopic under Public Domain: *Cercopithecus* (http://phylopic.org/image/eccbb404-c99f-41f9-8785-01a7f57f1269/); *Papio* (http://phylopic.org/image/72f2f854-f3cd-4666-887c-35d5c256ab0f/).

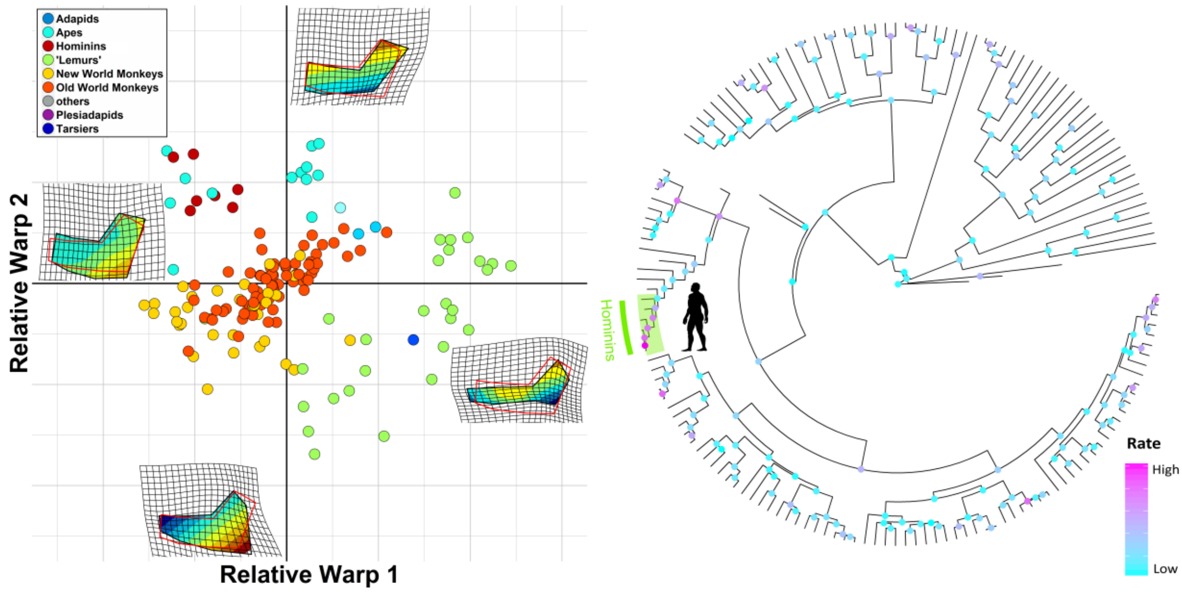


Figure S9. GPA shape decomposition (left) and analysis of rate variation (right) in the size and shape space performed using the SMALL dataset. The clade showing a significant rate shift are highlighted with a colour box (right). Silhouettes were downloaded from Phylopic (credits as in Figure 2).

Table S3. Multivariate Angle results, individual species

A - angles from the ancestor of all great apes		
group	**species**	**angle_from_mrca**
ape	Dryopithecus_brancoi	40.332
ape	Gorilla_gorilla	34.587
ape	Pan_troglodytes	6.887
ape	Pongo_pygmaeus	24.197
aus	Australopithecus_afarensis	36.526
aus	Australopithecus_africanus	122.976
aus	Paranthropus_boisei	45.222
hom	Homo_erectus	48.625
hom	Homo_habilis	78.939
hom	Homo_heidelbergensis	66.786
hom	Homo_neanderthalensis	83.380
hom	Homo_sapiens	89.903

B - angles from the ancestor of all apes		
group	**species**	**angle_from_mrca**
APE	Dryopithecus_brancoi	61.814
APE	Gorilla_gorilla	76.678
APE	Pan_troglodytes	107.036
APE	Pongo_pygmaeus	64.086
APE	Proconsul_heseloni	69.151
APE	Proconsul_nyanzae	36.779
AUS	Australopithecus_afarensis	126.771
AUS	Australopithecus_africanus	51.551
AUS	Paranthropus_boisei	116.622
HOM	Homo_erectus	130.859
HOM	Homo_habilis	149.716
HOM	Homo_heidelbergensis	114.342
HOM	Homo_neanderthalensis	124.944
HOM	Homo_sapiens	52.296
HYLO	Hylobates_lar	73.274
HYLO	Hylobates_moloch	128.053
HYLO	Hylobates_muelleri	95.934
HYLO	Hylobates_pileatus	101.629
HYLO	Nomascus_concolor	111.712
HYLO	Nomascus_gabriellae	85.880
HYLO	Nomascus_leucogenys	71.046
HYLO	Symphalangus_syndactylus	97.170

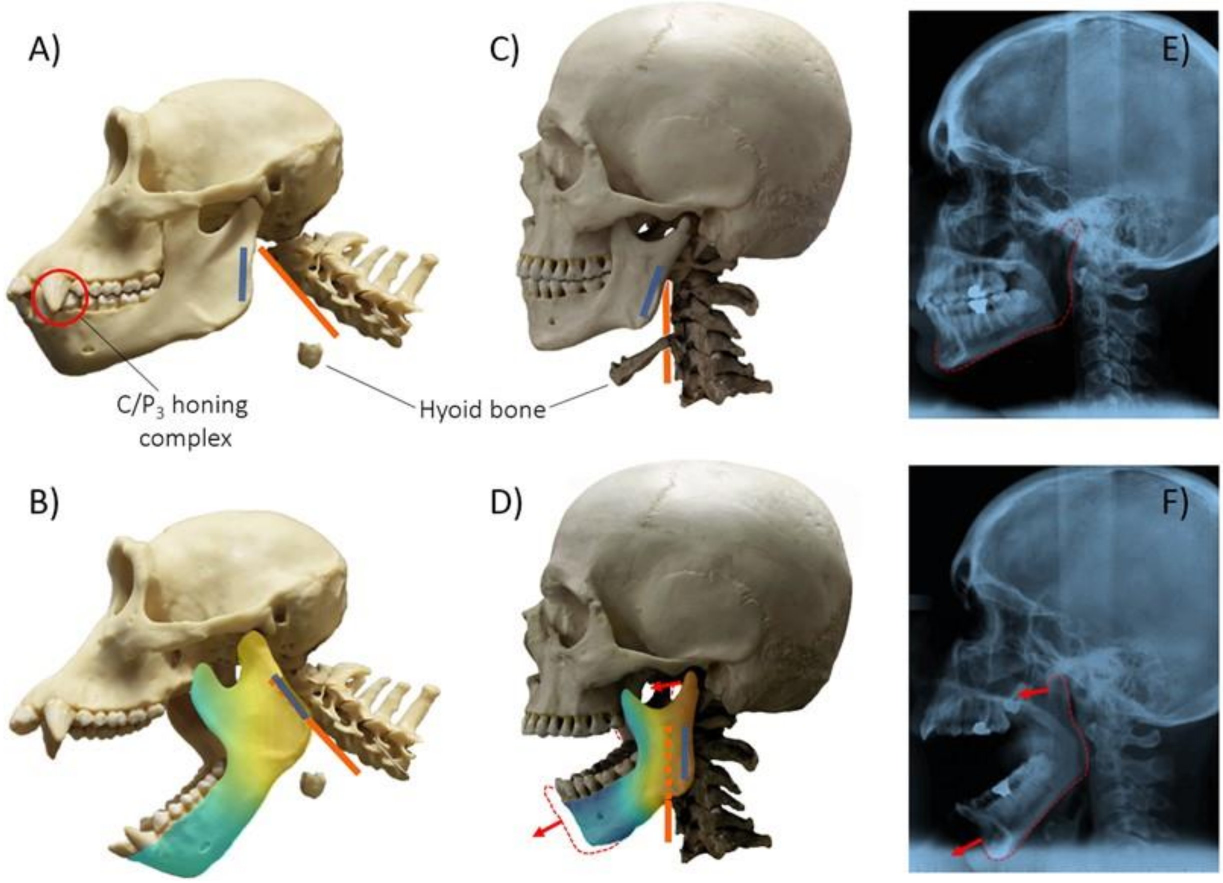


Figure S10. In humans and other bipedal hominins (C-F), the posterior margin of the mandible (blue line) rotates backward when the mouth is opened, would compress the blood vessels, nerves, the upper portion of the respiratory tract, and other neck structures anteriorly to the vertebral column (orange line). In order to avoid the potentially dangerous effects of this mandibular compression the condyles move forwards on the roof of the articular fossa (ca. 20 mm according to ref 22, producing a rotational and translational movement of the whole mandible (red arrows) that ultimately preserves space between the posterior edge of the mandible and neck organs (E-F). In quadrupedal primates (A-B), the vertebral column inserts posteriorly on the cranial base, saving space in the neck region during mouth opening. The rotational and translational movement of the mandible on the condyles, that in humans and in australopiths is significantly more pronounced than in non-bipedal primates (Marroig & Cheverud 2005), prevents the presence of tall canines and the correct functioning of the C/P3 honing complex. Consequently, in all bipedal hominins the honing complex is lost, and premolars are relaxed by the honing function. The image was generated by using CorelDraw (http://www.coreldraw.com). Skulls belong to the collection of the Museum of Anthropology in Rome, La Sapienza University. Pictures belong to Dr. Luca Russo.

Supplementary Information for: Reproducing the internal and external anatomy of fossil bones

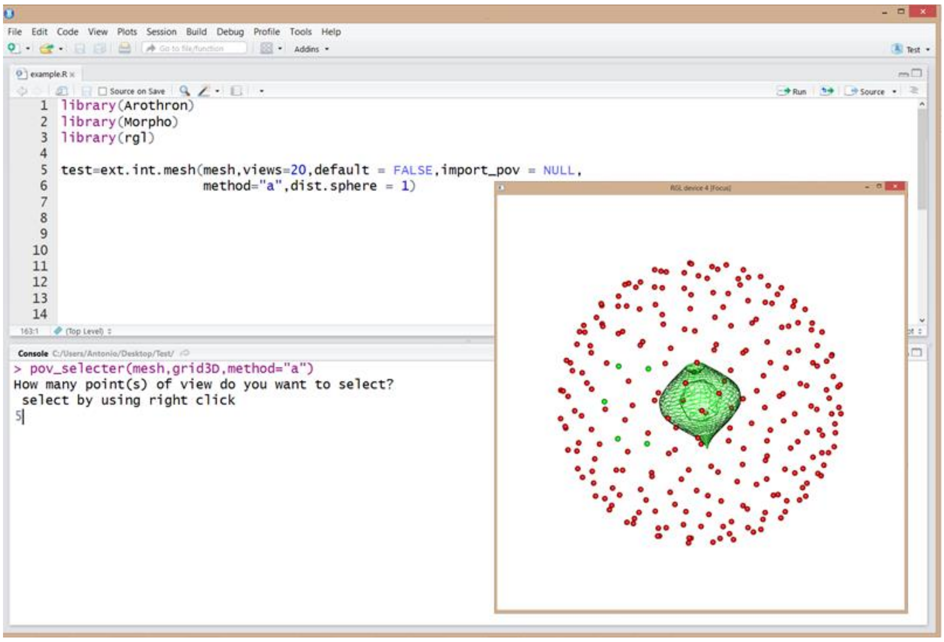


Figure S1. The Arothron R package offers the possibility to select the POVs directly in the R environment by an interactive 3D plot by using the right-click.

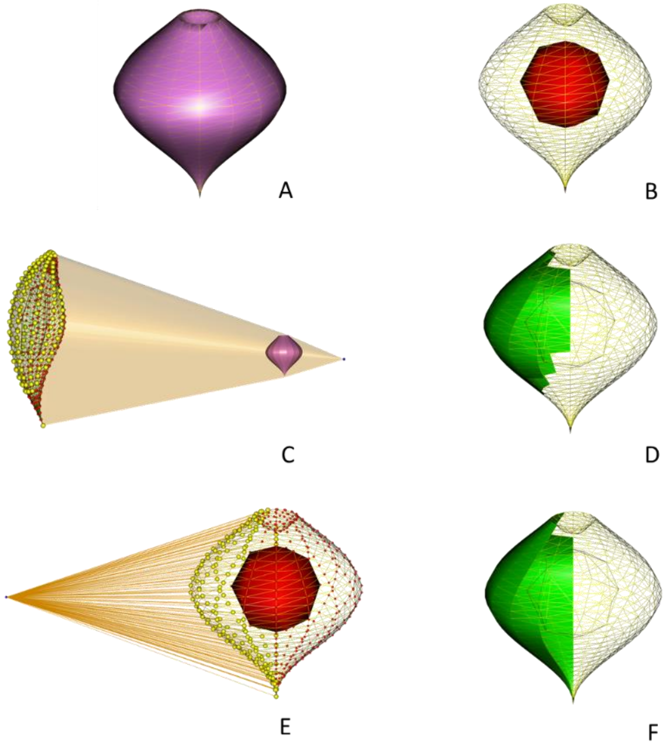


Figure S2. CA-LSE method applied on a 3D model (A) composed by two different meshes (B) via Arothron (C, D) and Morpho (E, F) R packages. The Arothron package applies the HPR operator method (C) which consists in the spherical flipping of the surface and the subsequent construction of a convex hull. The Morpho package uses the calculation of the intersection between the mesh and the POV (in blue).

Table S1: Range time (by the unit second) requested by the two methods (CA-LSE and AST-3D) applied to each case study (full surface and decimated one to 500000 facets) reported in the main text. Test run with a computer workstation (Intel Core i7 7700 3.60 GHz, 16 GB RAM memory) and 4 cores.

3D model	**POV**	**Full surface**	**Decimated surface**
		CA-LSE	
Skull	50	21.65-66.75	12.1-37.07
***Malleus* bone**	50	13.39-42.23	14.17-41.98
Tooth	50	91.17-338.44	13.08-46.42
		AST-3D	
Endocast	55	22.02-51.61	12.11-31.31
Maxillary sinus	19	7.87-24.11	4.37-14.83

Supporting Information 1

CA-LSE application

In this section, we report the CA-LSE method applied to two different case-studies: Kr-d1 (a Neanderthal deciduous tooth) and PO 2010 US23 (a modern human *malleus* bone).

Neanderthal tooth, via Arothron

Load data into the R workspace

```
library(Arothron)
library(rgl)
data(krd1_tooth)
```

Set 50 POVs (views argument) to be taken around the 3D model of the tooth. The parameter that defines the radius of the sphere for HPR operator is set to 3 for this case-study.

```
ca_lse_krd1<-ext.int.mesh(mesh= krd1_tooth, views=50, param1=3, default=TRUE, import_pov = NULL,expand=1, scale.factor=1)
vis_inv_krd1<-out.inn.mesh(ca_lse_krd1, krd1_tooth, plot=TRUE)
```

Isolate the biggest element of the invisible mesh

```
inv_mesh<-vcgIsolated(vis_inv_krd1$invisible)
```

Plot the visible and not visible (dental pulp) component of the mesh

```
open3d()
shade3d(inv_mesh,col=2)
```

```
open3d()
shade3d(vis_inv_krd1$visible, col=3)
```

Neanderthal tooth via Morpho

Load data into the R workspace

```
library(Morpho)
library(rgl)
data(krd1_tooth)
```

Set 50 POVs, using argument in the getOuterViewpoints(), to be taken around the object.

```
POV_krd1<-getOuterViewpoints(x=krd1_tooth,n=50)
ca_lse_krd1<-virtualMeshScan(x=krd1_tooth, viewpoints= POV_krd1$viewpoints)
```

Isolate the biggest element of the not visible mesh

```
inv_mesh<-vcgIsolated(ca_lse_krd1$invisible)
```

Plot the visible and not visible (dental pulp) component of the mesh

```
open3d()
shade3d(inv_mesh,col=2)
open3d()
shade3d(ca_lse_krd1$visible, col=3)
```

Human malleus *bone via Arothron*

Load library and data

```
library(Arothron)
library(rgl)
data(malleus_bone)
```

Set 50 POVs to be taken around the object.

```
ca_lse_malleus<-ext.int.mesh(mesh= malleus_bone, views=50, param1=3, default=TRUE, import_pov = NULL, expand=1, scale.factor=1)
vis_inv_malleus<-out.inn.mesh(ca_lse_malleus, malleus_bone, plot=TRUE)
inv_mesh<- vis_inv_malleus$invisible
```

Keep only the not visible mesh

```
inv_mesh<-ca_lse_malleus$invisible
```

Plot the visible and not visible (inner microstructure) component of the mesh

```
open3d()
shade3d(inv_mesh,col=2)
open3d()
shade3d(ca_lse_malleus$visible, col=3)
```

Human malleus *bone via Morpho*

Load library and data

```
library(Morpho)
libraru(rgl)
data(malleus_bone)
```

Set 50 POVs to be taken around the object.

```
POV_malleus<-getOuterViewpoints(x=malleus_bone, n=50)
ca_lse_malleus<-virtualMeshScan(x= malleus_bone, viewpoints= POV_malleus$viewpoints)
```

Store in the object inv_mesh the not visible component of the mesh

```
inv_mesh<-ca_lse_malleus$invisible
```

Plot the visible and not visible (inner microstructure) component of the mesh

```
open3d()
shade3d(inv_mesh,col=2)
open3d()
shade3d(ca_lse_malleus$visible, col=3)
```

Supporting Information 2

AST-3D application

AST-3D method was applied on a modern human cranium (FU-3115) to build its endocast and the right maxillary sinus.

Human endocast, in Arothron

Load library and data

```
library(Arothron)
library(rgl)
data(human_skull)
data(endo_set)
```

Set 55 POVs sampled into the endocranial cavity (endo_set)

```
ast3d_endocast<-ext.int.mesh(mesh=human_skull,   views=50,   param1=1.0,   default=FALSE,
import_pov = TRUE,expand=1, matrix_pov =endo_set, scale.factor=1)
vis_inv_endo<-out.inn.mesh(ast3d_endocast,human_skull,plot=TRUE)
```

Keep the biggest part of the visible component (endocast)

```
vis_mesh<-vcgIsolated(vis_inv_endo$visible)
```

Plot the visible and not visible component of the mesh

```
open3d()
shade3d(vis_mesh,col=3)
open3d()
shade3d(vis_inv_endo$invisible, col=2)
```

Human endocast, in Morpho

Load library and data

```
library(Morpho)
library(rgl)
data(human_skull)
data(endo_set)
```

Set 55 POVs sampled into the endocranial cavity (endo_set)

```
ast3d_endocast<-virtualMeshScan(human_skull,endo_set,offset = 0.05)
```

Keep the biggest part of the visible component (endocast)

```
vis_mesh<-vcgIsolated(ast3d_endocast$visible)
```

Plot the visible and not visible component of the mesh

```
open3d()
shade3d(vis_mesh,col=3)
open3d()
shade3d(ast3d_endocast$invisible,col=2)
```

Maxillary sinus, in Arothron

Load library and data

```
library(Arothron)
library(rgl)
data(human_skull)
data(sinus_set)
```

Set 19 POVs sampled into the right maxillary sinus (sinus_set)

```
ast3d_sinus<-ext.int.mesh(mesh=human_skull,    views=50,    param1=0.1,    default=FALSE,
import_pov = TRUE,expand=1, matrix_pov = sinus_set, scale.factor=1)
vis_inv_sinus<-out.inn.mesh(ast3d_sinus,human_skull,plot=TRUE)
```

Keep the biggest part of the visible component (maxillary sinus)

```
vis_mesh<-vcgIsolated(vis_inv_sinus$visible)
```

Plot the visible and not visible component of the mesh

```
open3d()
shade3d(vis_mesh,col=3)
open3d()
shade3d(vis_inv_sinus$invisible, col=2)
```

Maxillary sinus, in Morpho

Load library and data

```
library(Morpho)
library(rgl)
data(human_skull)
data(sinus_set)
```

Set 19 POVs sampled into the right maxillary sinus (sinus_set)

```
ast3d_sinus<-virtualMeshScan(human_skull,sinus_set,offset = 0.05)
```

Keep the biggest part of the visible component (maxillary sinus)

```
vis_mesh<-vcgIsolated(ast3d_sinus$visible)
```

Plot the visible and not visible component of the mesh

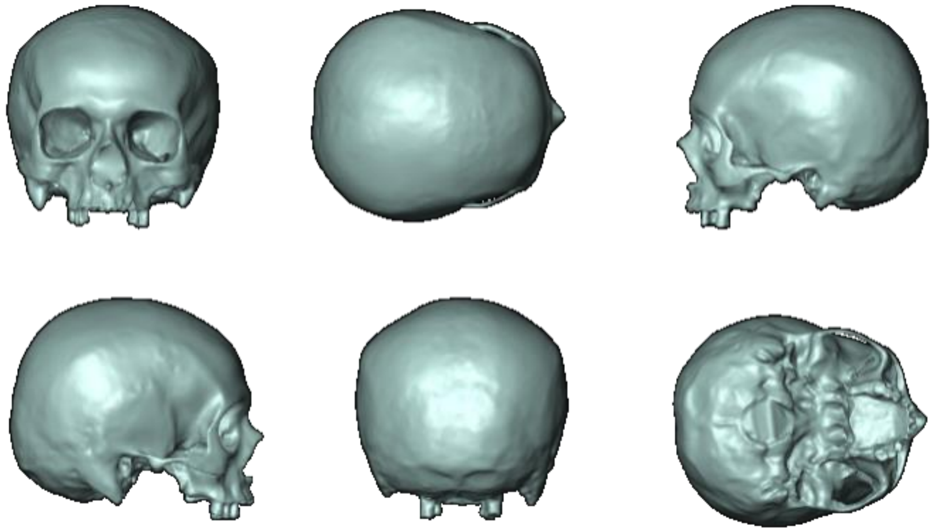
```
open3d()
shade3d(vis_mesh,col=3)
open3d()
shade3d(ast3d_sinus$invisible,col=2)
```

Supporting Information 3

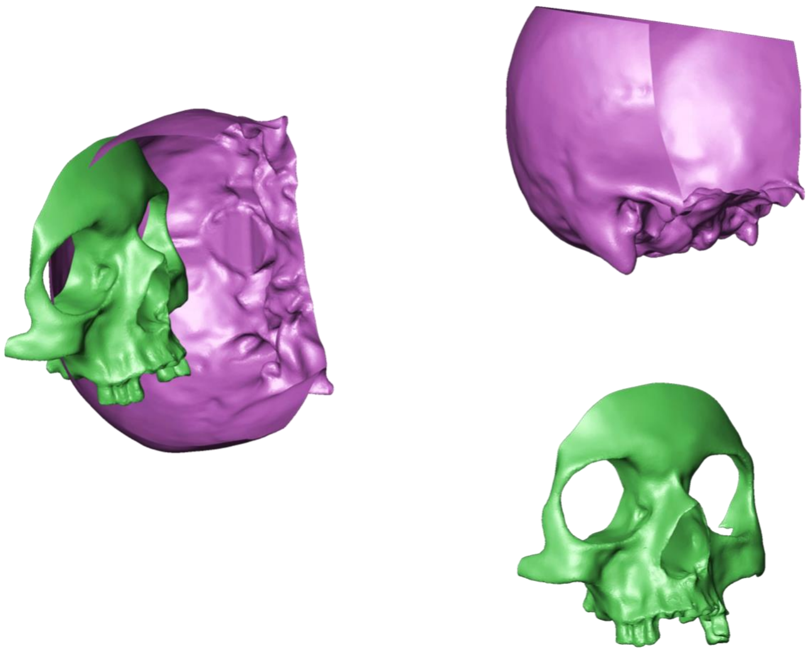
The video tutorial for the application of both methods is available at:

https://doi.org/10.1002/ajpa.23493

Supplementary Information for: A new tool for digital alignment in Virtual Anthropology



Supp. Figure 1. The 3D model of *Homo sapiens* used as case-study to test the efficiency of the digital alignment tool. The skull named Bol_2548 belonging to the "Bolognesi" collection of the Museo of Anthropology "G. Sergi" is reported on frontal, superior, left lateral, right lateral, posterior and ventral anatomical views.



Supp. Figure 2. The two halves of the 3D model Bol_2548 divided, rotated, translated on the Cartesian system coordinates.

Supp. Table 1. List of materials used in the primate case study

Species	Specimen	Sex	Repository	DOI
Alouatta caraya	MCZ-28096_M3129	F	MorphoSource	10.17602/M2/M2852
Alouatta caraya	PRICT_559	F	KUPRI	-
Alouatta caraya	PRICT_859	F	KUPRI	-
Alouatta caraya	PRICT_959	F	KUPRI	-
Alouatta caraya	MCZ-25812_M3127	M	MorphoSource	10.17602/M2/M2850
Alouatta caraya	MCZ-28095_M3128	M	MorphoSource	10.17602/M2/M2851
Alouatta caraya	PRICT_561	M	KUPRI	-
Alouatta caraya	PRICT_858	M	KUPRI	-
Alouatta caraya	PRICT_961	M	KUPRI	-
Alouatta palliata	DU-LP-18_M4152	F	MorphoSource	-
Alouatta palliata	MCZ-28096_M3129	F	MorphoSource	10.17602/M2/M2852
Alouatta palliata	MCZ-29609_M3143	F	MorphoSource	10.17602/M2/M2866
Alouatta palliata	PRICT_558	F	KUPRI	-
Alouatta palliata	USNM79400	F	Smithsonian	-
Alouatta palliata	DU-LP-02_M6148	M	MorphoSource	-
Alouatta palliata	DU-LP-26_M4185	M	MorphoSource	-
Alouatta palliata	USNM240407	M	Smithsonian	-
Alouatta palliata	USNM-337553_M9532	M	Morphosource	-
Alouatta palliata	USNM-339919_M9534	M	Morphosource	-
Ateles geoffroy	MCZ-10138	F	Morphosource	10.17602/M2/M2917
Ateles geoffroy	PRICT-540	F	KUPRI	-
Ateles geoffroy	USNM281801	F	Smithsonian	-
Ateles geoffroy	USNM291064	F	Smithsonian	-
Ateles geoffroy	USNM337695	F	Smithsonian	-
Ateles geoffroy	PRICT-42	M	KUPRI	-
Ateles geoffroy	PRICT-551	M	KUPRI	-
Ateles geoffroy	USNM-291055_M9462	M	Morphosource	-
Ateles geoffroy	USNM336202	M	Smithsonian	-
Ateles geoffroy	USNM337702	M	Smithsonian	-
Cebus albifrons	USNM281568	F	Smithsonian	-

Cebus albifrons	USNM281570	F	Smithsonian	-
Cebus albifrons	USNM281573	F	Smithsonian	-
Cebus albifrons	USNM281576	F	Smithsonian	-
Cebus albifrons	USNM281582	F	Smithsonian	-
Cebus albifrons	USNM281571	M	Smithsonian	-
Cebus albifrons	USNM281578	M	Smithsonian	-
Cebus albifrons	USNM281579	M	Smithsonian	-
Cebus albifrons	USNM281584	M	Smithsonian	-
Cebus albifrons	USNM281591	M	Smithsonian	-
Gorilla gorilla	CT_UCL-1146	F	NESPOS	-
Gorilla gorilla	CT-UCL-CA9a	F	NESPOS	-
Gorilla gorilla	USNM252577	F	Smithsonian	-
Gorilla gorilla	CT_LA20.86	M	NESPOS	-
Gorilla gorilla	CT_LA22.86	M	NESPOS	-
Gorilla gorilla	PRICT_24	M	KUPRI	-
Gorilla gorilla	PRICT_1347	M	KUPRI	-
Gorilla gorilla	PRICT_1493	M	KUPRI	-
Homo sapiens	VA-014	F	NESPOS	-
Homo sapiens	VA-029	F	NESPOS	-
Homo sapiens	VA-030	F	NESPOS	-
Homo sapiens	VA-031	F	NESPOS	-
Homo sapiens	VA-033	F	NESPOS	-
Homo sapiens	ULAC-955	M	NESPOS	-
Homo sapiens	ULAC-958	M	NESPOS	-
Homo sapiens	ULAC-978	M	NESPOS	-
Homo sapiens	ULAC-985	M	NESPOS	-
Homo sapiens	ULAC-998	M	NESPOS	-
Hylobates lar	PRICT-1287	F	KUPRI	-
Hylobates lar	MCZ_41411	F	Morphosource	10.17602/M2/M2959
Hylobates lar	MCZ-41412	F	Morphosource	10.17602/M2/M2961
Hylobates lar	MCZ_41416	F	Morphosource	10.17602/M2/M2965
Hylobates lar	USNM083262	F	Smithsonian	-
Hylobates lar	PRICT-459	M	KUPRI	-

Hylobates lar	USNM111970	M	Smithsonian	-
Hylobates lar	USNM111988	M	Smithsonian	-
Hylobates lar	USNM111989	M	Smithsonian	-
Macaca cyclopis	PRICT-1418	F	KUPRI	-
Macaca cyclopis	PRICT-1450	F	KUPRI	-
Macaca cyclopis	PRICT-1452	F	KUPRI	-
Macaca cyclopis	PRICT-1453	F	KUPRI	-
Macaca cyclopis	PRICT-324	M	KUPRI	-
Macaca cyclopis	PRICT-355	M	KUPRI	-
Macaca cyclopis	PRICT-1156	M	KUPRI	-
Macaca cyclopis	PRICT-1424	M	KUPRI	-
Pan troglodytes	SMF-PA-PC-50	F	NESPOS	-
Pan troglodytes	LA8-86	F	NESPOS	-
Pan troglodytes	LA10-86	F	NESPOS	-
Pan troglodytes	UCL-13D	F	NESPOS	-
Pan troglodytes	USNM174699	F	Smithsonian	-
Pan troglodytes	LA6-86	M	NESPOS	-
Pan troglodytes	LA24-25-86	M	NESPOS	-
Pan troglodytes	PRICT-147	M	KUPRI	-
Pan troglodytes	PRICT-344	M	KUPRI	-
Pan troglodytes	SMF-PA-PC-51	M	NESPOS	-
Papio hamadryas	PRICT-397	F	KUPRI	-
Papio hamadryas	PRICT-406	F	KUPRI	-
Papio hamadryas	PRICT-415	F	KUPRI	-
Papio hamadryas	PRICT-424	F	KUPRI	-
Papio hamadryas	PRICT-816	F	KUPRI	-
Papio hamadryas	PRICT-404	M	KUPRI	-
Papio hamadryas	PRICT-417	M	KUPRI	-
Papio hamadryas	PRICT-419	M	KUPRI	-
Papio hamadryas	PRICT-423	M	KUPRI	-
Papio hamadryas	PRICT-802	M	KUPRI	-
Pongo abelii	USNM143596	F	Smithsonian	-
Pongo abelii	USNM143597	F	Smithsonian	-

Pongo abelii	USNM143600	F	Smithsonian	-
Pongo abelii	USNM143602	F	Smithsonian	-
Pongo abelii	USNM270807	F	Smithsonian	-
Pongo abelii	PRICT-513	M	KUPRI	-
Pongo abelii	USNM143590	M	Smithsonian	-
Pongo abelii	USNM143593	M	Smithsonian	-
Pongo abelii	USNM143594	M	Smithsonian	-
Pongo abelii	USNM267325	M	Smithsonian	-
Pongo pygmaeus	MCZ-35719_M5096	F	Morphosource	10.17602/M2/M4615
Pongo pygmaeus	MCZ-37518_M5094	F	Morphosource	10.17602/M2/M4613
Pongo pygmaeus	OR-28801	F	NESPOS	-
Pongo pygmaeus	OR-55206	F	NESPOS	-
Pongo pygmaeus	PRICT-736	F	KUPRI	-
Pongo pygmaeus	CT_HACB.OL.45	M	NESPOS	-
Pongo pygmaeus	LA89-86	M	NESPOS	-
Pongo pygmaeus	OR-799	M	NESPOS	-
Pongo pygmaeus	UCL.CA28	M	NESPOS	-
Pongo pygmaeus	UCL-CA28-JS4	M	NESPOS	-
Symphalangus syndactylus	USNM143580	F	Smithsonian	-
Symphalangus syndactylus	USNM271048	F	Smithsonian	-
Symphalangus syndactylus	USNM283563	F	Smithsonian	-
Symphalangus syndactylus	USNM519573	F	Smithsonian	-
Symphalangus syndactylus	MCZ-36031_M4876	M	Morphosource	10.17602/M2/M4444
Symphalangus syndactylus	PRICT-753	M	KUPRI	-
Symphalangus syndactylus	PRICT-1011	M	KUPRI	-
Symphalangus syndactylus	USNM141160	M	Smithsonian	-
Symphalangus syndactylus	USNM143577	M	Smithsonian	-
Theropithecus gelada	AMNH-M-238034	F	Morphosource	-
Theropithecus gelada	AMNH-M-ED1_M12045	F	Morphosource	-
Theropithecus gelada	PRICT-1028	F	KUPRI	-
Theropithecus gelada	USNM319992	F	Smithsonian	-
Theropithecus gelada	PRICT-446	M	KUPRI	-
Theropithecus gelada	PRICT-447	M	KUPRI	-

Theropithecus gelada	USNM305107	M	Smithsonian	-
Theropithecus gelada	USNM319992	M	Smithsonian	-

Supp. Table 2. List of the landmark used. Are reported the names, description and number in sampling order. The bi-lateral landmarks are reported as double numbered, as sampled in right-left order. All points are from White and Folkens (2000), excepted the ones marked with *, defined by the authors and the ones marked with ° (Ireland, 2010) and † (Stedman, 2006).

N°	Landmark	Definition
1	Prosthion (pro)	The midline point at the most anterior point on the alveolar process of the maxillae
2	Nasospinale (nsp)	The point where a line tangent to the inferiormost points of the two inferior curves of the anterior nasal aperture margin crosses the midline
3	Nasion (nas)	The midline point where the two nasal bones and the frontal intersect
4	Glabella (gla)	The most anterior midline point on the frontal bone, usually above the frontonasal suture
5	Bregma (bre)	The ectocranial point where the coronal and sagittal sutures intersect
6	Lambda (lam)	The ectocranial midline point where the sagittal and lambdoid sutures (or their projections in case of difficult localization) intersect
7	Opisthocranion (opc)	The midline ectocranial point at the farthest chord length from glabella
8	Opisthion (opi)	The midline point at the posterior margin of the foramen magnum
9	Basion (bas)	The midline point on the anterior margin of the foramen magnum
10	Sphenobasion (spb)	The point where the midsagittal plane intersects the basilar suture
11	Hormion (hor)	The most posterior midline point on the vomer, where it intersects the sphenoid bone
12	Staphilion (sta)	The point on the median palatine suture where a line drawn between the deepest parts of the notches (free edges) at the rear of the palate crosses the midline.
13	Staurion (str)°	The point where the transverse palatine suture intersects the median palatine suture
14	Incisive foramina (inf)	The point where the midsagittal plane intersects a line tangent to the rearmost margins of the incisive foramina
15	Orale (ora)	The midline point on the hard palate where a line drawn tangent to the posterior margins of the central incisor alveoli crosses the midline
16-17	External canine process (ecp)*	The most posterior point of the external canine alveolar process
18-19	Internal canine process (icp)*	The most posterior point of the internal canine alveolar process
20-21	Maxillary tuberosity process (mtp)*	The most inferior-posterior point of the maxillary tuberosity

22-23	Alare (ala)	The most lateral point on the margin of the anterior nasal aperture
24-25	Orbitale (orb) - *modified*	The point where the inferior orbital margin crosses the zygomaticomaxillary suture
26-27	Frontomalare orbitale (fmo)	The point where the frontozygomatic suture crosses the inner orbital rim
28-29	Frontomalare temporale (fmt)	The point where the frontozygomatic suture crosses the outer orbital rim
30-31	Lacrimale (lac)	The point where the posterior lacrimal crest meets the frontolacrimal suture
32-33	Zygomaxillare (zma)	The most inferior point on the zygomaticomaxillary suture
34-35	Zygotemporale superior (zts)*	The most superior point on the zygomaticotemporal suture
36-37	Zygotemporale inferior (zti)*	The most inferior point on the zygomaticotemporal suture
38-39	Porion (por)	The uppermost point on the margin of the external acoustic meatus
40-41	Auditory meatus inferior (ami)*	The lowermost point on the margin of the external acoustic meatus
42-43	Asterion (ast)	The point in where the lambdoid, parietomastoid, and occipitomastoid sutures meet
44-45	Anterior condyle (aco)*	The most anterior point of the occipital condyle
46-47	Posterior condyle (pco)*	The most posterior point of the occipital condyle
48-49	Lateral condyle (lco)*	The most lateral point of the occipital condyle
50-51	Basioccipital margin (bom)	The most lateral point where the spheno-occipital synchondrosis and basioccipital margin meet
52-53	Medial pterygoid plate (mpp)*	The point at the base of the medial pterygoid plates, corresponding with the pterygoid tubercle
54-55	Pyramidal process (pps)	The point where the pyramidal process of the maxillary bone meets the pterygoid fissure
56-57	Lateral pterygoid inflection (lpi)*	The inflection point in the posterior margin of the lateral pterygoid plate
58-59	Lateral pterygoid lateral (lpl)*	The most lateral point of the lateral pterygoid plate
60-61	Pterygo maxillare (pmx)†	The point at which the pterygoid process of sphenoid bone and pterygoid process of maxilla begin to form the pterygomaxillary fissure

Supp. Table 3. List of landmarks used in the *Homo sapiens* case study, with labels and definitions

No.	Label	Landmark definition
Cranial base		
1	sph	The point where the midsagittal plane intersects the basilar suture.
2	bas	The midline point of the anterior margin of the foramen magnum.
3	ops	The midline point at the posterior margin of the foramen magnum.
4-5	aba	The most anterior and lateral point on the basilar part of occipital bone.
6-7	car	The closest point to PMS of carotid canal margin
8-9	jlp	The most lateral point of the jugular process.
10-11	aoc	The most superior point of the occipital condyle.
12-13	ioc	The most inferior point of the occipital condyle.
14-15	loc	The most lateral point of the occipital condyle.
16-17	por	The uppermost point of the margin of the external acoustic meatus.
Facial complex		
18	gla	The most forwardly projecting point in the mid-sagittal plane at the lower margin of the frontal bone, which lies above the nasal root and between the superciliary arches.
19	nas	The point where the frontonasal sutures meet the mid-sagittal plane.
20	rhi	The lowest point of the internasal suture in mid-sagittal plane.
21	nsp	The lowest point of the inferior margin of the nasal aperture as projected on the mid-sagittal plane
22	ips	The midline point at the inferior tip of the bony septum between the upper central incisors.
23-24	ala	The most lateral points of the nasal aperture.
25-26	orb	The point at the lowest part of the orbital rims.
27-28	fto	The point located on the lateral orbital rims where it crosses the zygo-frontalis suture. More specifically, it is situated on the orbital end of the fronto-jugal suture.
29-30	zmi	The lowest point on the zygo-maxillary suture.
31-32	zms	The point located on the superior margin of the zygomatic arch in the proximity of the temporo-zygomatic suture.

Supp. Table 4. List of materials used in the *Homo sapiens* case study

Species	Specimen	Sex	Repository
Homo sapiens	*VA-011*	*M*	*NESPOS*
Homo sapiens	*VA-013*	*F*	*NESPOS*
Homo sapiens	*VA-014*	*F*	*NESPOS*
Homo sapiens	*VA-020*	*M*	*NESPOS*
Homo sapiens	*VA-022*	*M*	*NESPOS*
Homo sapiens	*VA-029*	*F*	*NESPOS*
Homo sapiens	*VA-030*	*F*	*NESPOS*
Homo sapiens	*VA-031*	*F*	*NESPOS*
Homo sapiens	*VA-033*	*M*	*NESPOS*
Homo sapiens	*OL-0794*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-0866*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-0869*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-0886*	*F*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1068*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1112*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1187*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1192*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1193*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1197*	*F*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1199*	*F*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1214*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1282*	*M*	*NESPOS (Olóriz collection)*
Homo sapiens	*OL-1428*	*F*	*NESPOS (Olóriz collection)*
Homo sapiens	*BOL-2524*	*M*	*Museo “G. Sergi” (Bolognesi collection)*
Homo sapiens	*BOL-2525*	*M*	*Museo “G. Sergi” (Bolognesi collection)*
Homo sapiens	*BOL-2526*	*M*	*Museo “G. Sergi” (Bolognesi collection)*
Homo sapiens	*BOL-2527*	*M*	*Museo “G. Sergi” (Bolognesi collection)*
Homo sapiens	*BOL-2528*	*M*	*Museo “G. Sergi” (Bolognesi collection)*
Homo sapiens	*BOL-2529*	*M*	*Museo “G. Sergi” (Bolognesi collection)*
Homo sapiens	*BOL-2530*	*M*	*Museo “G. Sergi” (Bolognesi collection)*

Homo sapiens	*BOL-2531*	*M*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2532*	*M*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2533*	*M*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2535*	*M*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2536*	*M*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2537*	*M*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2538*	*M*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2539*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2540*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2541*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2542*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2543*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2544*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2545*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2546*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2547*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2548*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2550*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2551*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2552*	*F*	*Museo "G. Sergi" (Bolognesi collection)*
Homo sapiens	*BOL-2553*	*F*	*Museo "G. Sergi" (Bolognesi collection)*

Supp. Table 5

Species	Sex	Alouatta caraya	Alouatta palliata	Ateles geoffroyi	Cebus albifrons	Gorilla gorilla	Homo sapiens	Hylobates lar	Pan troglodytes	Pongo abelii	Pongo pygmaeus	Symphalangus syndactylus	Macaca cyclopis	Papio hamadryas	Therapithecus gelada
Alouatta caraya	F	0.01	0.00	0.01	0.01	0.05	0.03	0.01	0.01	0.03	0.02	0.04	0.04	0.01	0.02
Alouatta caraya	M	0.04	0.06	0.09	0.12	0.28	0.21	0.09	0.09	0.17	0.13	0.21	0.21	0.08	0.13
Alouatta palliata	F	0.02	0.01	0.02	0.02	0.12	0.08	0.02	0.02	0.07	0.05	0.09	0.09	0.03	0.05
Alouatta palliata	M	0.10	0.06	0.07	0.07	0.42	0.31	0.08	0.11	0.29	0.23	0.34	0.34	0.13	0.21
Ateles geoffroyi	F	0.05	0.04	0.02	0.03	0.24	0.15	0.03	0.05	0.14	0.11	0.18	0.18	0.06	0.10
Ateles geoffroyi	M	0.04	0.03	0.02	0.05	0.21	0.13	0.03	0.04	0.12	0.09	0.16	0.16	0.04	0.09
Cebus albifrons	F	0.05	0.03	0.03	0.01	0.16	0.10	0.03	0.04	0.10	0.08	0.13	0.13	0.05	0.07
Cebus albifrons	M	0.03	0.02	0.02	0.01	0.13	0.08	0.02	0.03	0.08	0.06	0.10	0.10	0.03	0.05
Gorilla gorilla	F	0.05	0.05	0.05	0.06	0.02	0.03	0.05	0.04	0.02	0.03	0.02	0.02	0.04	0.04
Gorilla gorilla	M	0.05	0.05	0.05	0.05	0.02	0.03	0.05	0.04	0.03	0.03	0.02	0.02	0.04	0.04
Homo sapiens	F	0.32	0.33	0.29	0.36	0.28	0.08	0.29	0.26	0.20	0.26	0.26	0.26	0.25	0.30
Homo sapiens	M	0.21	0.22	0.21	0.24	0.16	0.05	0.21	0.18	0.10	0.16	0.14	0.14	0.17	0.18
Hylobates lar	F	0.12	0.09	0.07	0.07	0.41	0.27	0.05	0.11	0.27	0.22	0.33	0.33	0.12	0.21
Hylobates lar	M	0.03	0.02	0.02	0.03	0.15	0.09	0.01	0.03	0.09	0.07	0.11	0.11	0.03	0.06
Macaca cyclopis	F	0.01	0.01	0.01	0.01	0.04	0.02	0.01	0.00	0.02	0.02	0.03	0.03	0.01	0.01
Macaca cyclopis	M	0.01	0.01	0.01	0.01	0.04	0.02	0.01	0.00	0.02	0.01	0.03	0.03	0.01	0.01
Pan troglodytes	F	0.24	0.27	0.26	0.33	0.18	0.17	0.26	0.22	0.07	0.16	0.13	0.13	0.20	0.20
Pan troglodytes	M	0.19	0.21	0.21	0.25	0.13	0.12	0.20	0.18	0.05	0.12	0.09	0.09	0.16	0.15
Papio hamadryas	F	0.01	0.01	0.01	0.01	0.03	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01
Papio hamadryas	M	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.01
Pongo abelii	F	0.06	0.07	0.07	0.08	0.06	0.04	0.06	0.06	0.02	0.04	0.03	0.03	0.05	0.05
Pongo abelii	M	0.09	0.10	0.10	0.11	0.04	0.07	0.10	0.09	0.04	0.06	0.03	0.03	0.08	0.08
Pongo pygmaeus	F	0.30	0.32	0.33	0.41	0.18	0.23	0.32	0.28	0.10	0.21	0.11	0.12	0.25	0.26
Pongo pygmaeus	M	0.30	0.33	0.34	0.40	0.17	0.23	0.33	0.30	0.14	0.23	0.13	0.12	0.27	0.28
Symphalangus syndactylus	F	0.03	0.03	0.03	0.05	0.13	0.07	0.03	0.03	0.07	0.05	0.09	0.09	0.02	0.05
Symphalangus syndactylus	M	0.03	0.03	0.03	0.05	0.13	0.08	0.03	0.02	0.07	0.05	0.09	0.09	0.02	0.05
Therapithecus gelada	F	0.06	0.07	0.07	0.09	0.16	0.10	0.07	0.04	0.08	0.04	0.11	0.11	0.05	0.04
Therapithecus gelada	M	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01

Supp. Table 6

Species	Sex	*Alouatta caraya*	*Alouatta palliata*	*Ateles geoffroyi*	*Cebus albifrons*	*Gorilla gorilla*	*Homo sapiens*	*Hylobates lar*	*Pan troglodytes*	*Pongo abelii*	*Pongo pygmaeus*	*Symphalangus syndactylus*	*Macaca cyclopis*	*Papio hamadryas*	*Therapithecus gelada*
Alouatta caraya	F	12.58	1.05	1.06	-20.67	57.73	42.84	1.95	12.71	43.54	34.25	49.86	49.83	18.19	24.09
Alouatta caraya	M	-8.07	-19.54	-19.52	-45.77	48.94	30.95	-18.44	-5.45	31.79	20.57	39.42	39.40	1.16	8.30
Alouatta palliata	F	12.68	2.82	2.56	-18.84	58.37	43.70	3.44	14.03	44.39	35.24	50.61	50.59	19.42	25.24
Alouatta palliata	M	20.59	12.48	11.38	-8.08	62.14	48.80	12.18	21.82	49.43	41.11	55.09	55.07	26.72	32.01
Ateles geoffroyi	F	13.75	3.74	4.15	-17.39	58.88	44.39	4.62	15.09	45.07	36.03	51.22	51.20	20.41	26.15
Ateles geoffroyi	M	5.36	-5.62	-6.27	-28.80	54.89	38.99	-4.65	6.83	39.73	29.82	46.48	46.45	12.67	18.97
Cebus albifrons	F	30.69	22.65	22.66	6.26	66.96	55.32	23.36	31.77	55.86	48.60	60.80	60.78	36.04	40.66
Cebus albifrons	M	23.91	15.08	15.09	-3.97	63.73	50.94	15.86	25.09	51.54	43.57	56.97	56.95	29.79	34.85
Gorilla gorilla	F	-89.83	-111.86	-111.83	-158.35	10.72	-22.38	-109.92	-86.88	-20.89	-40.78	-7.36	-7.40	-75.17	-62.53
Gorilla gorilla	M	-122.04	-147.81	-147.78	-202.19	-6.74	-43.15	-145.54	-118.59	-41.40	-64.67	-25.58	-25.63	-104.89	-90.11
Homo sapiens	F	-49.67	-67.03	-67.01	-103.69	28.66	3.89	-65.50	-47.34	4.69	-10.99	15.36	15.32	-38.10	-28.14
Homo sapiens	M	-69.50	-89.17	-89.14	-130.68	19.20	-10.41	-87.44	-66.87	-7.94	-25.70	4.14	4.10	-56.41	-45.12
Hylobates lar	F	15.73	5.95	5.96	-14.69	59.83	45.67	7.60	17.04	46.33	37.50	52.34	52.32	22.24	27.85
Hylobates lar	M	7.94	-2.74	-2.73	-25.29	56.12	40.65	-2.03	9.37	41.37	31.73	47.93	47.91	15.05	21.18
Macaca cyclopis	F	5.02	-6.00	-5.98	-29.26	54.73	38.77	-5.03	7.36	39.52	29.56	46.29	46.26	12.36	18.68
Macaca cyclopis	M	-1.19	-12.93	-12.92	-37.72	51.76	34.76	-11.90	0.43	35.56	24.95	42.77	42.75	6.63	13.36
Pan troglodytes	F	-58.67	-77.08	-77.06	-115.94	24.36	-2.29	-75.46	-56.21	-1.16	-17.67	10.26	10.23	-46.41	-35.85
Pan troglodytes	M	-63.63	-82.62	-82.59	-122.69	22.00	-5.49	-80.95	-61.09	-4.69	-21.35	7.46	7.42	-50.99	-40.10
Papio hamadryas	F	-18.85	-32.65	-32.63	-61.75	43.34	23.38	-31.43	-17.01	24.31	13.00	32.78	32.75	-9.67	-1.76
Papio hamadryas	M	-56.43	-74.58	-74.56	-112.89	25.43	-0.85	-72.98	-54.00	0.38	-18.11	11.53	11.49	-44.34	-33.93
Pongo abelii	F	-53.13	-70.90	-70.88	-108.41	27.00	1.28	-69.34	-50.75	2.48	-13.57	14.67	13.36	-41.30	-31.11
Pongo abelii	M	-92.56	-114.90	-114.87	-162.06	8.21	-24.14	-112.94	-89.57	-22.63	-42.80	-9.99	-8.95	-77.68	-64.86
Pongo pygmaeus	F	-65.77	-85.00	-84.98	-125.60	20.98	-6.87	-83.31	-63.19	-5.57	-22.94	6.25	6.85	-52.96	-41.93
Pongo pygmaeus	M	-84.13	-105.50	-105.47	-150.59	12.23	-18.71	-103.62	-81.27	-17.26	-36.56	-4.14	-4.67	-69.91	-57.65
Symphalangus syndactylus	F	-9.42	-22.12	-22.11	-48.92	47.84	29.46	-21.00	-7.72	30.32	18.85	38.11	38.09	-1.09	6.31
Symphalangus syndactylus	M	-7.61	-20.10	-20.08	-46.45	48.70	30.62	-19.00	-5.94	31.47	20.19	39.14	39.12	0.79	7.87
Therapithecus gelada	F	-18.49	-32.24	-32.22	-61.26	43.52	23.61	-31.03	-16.65	24.54	12.12	32.99	32.96	-9.34	-1.66
Therapithecus gelada	M	-39.21	-55.36	-55.34	-89.45	33.64	10.25	-53.94	-37.04	11.35	-3.24	21.27	21.24	-28.45	-22.54

Supp. Table 7. Procrustes distance calculated between: i) starting model (SM) and manual alignments (MA); disarticulated model (DM) and comparative sample; iii) starting model and digital alignments (DTA). The distances referred to the specimen identified as the best aligned model are reported in bold.

Procrustes Distance	Specimen	Type
0	Bol_2548	SM
0.008665433	Bol_2548 (DM)	SM vs MA
0.017518539	Bol_2548 (DM)	DTA vs DM
0.003203384	Bol_2548 (DM)	DTA vs DM
0.01403628	Bol_2548 (DM)	DTA vs DM
0.00723805	Bol_2548 (DM)	DTA vs DM
0.015440436	Bol_2548 (DM)	DTA vs DM
0.012118726	Bol_2548 (DM)	DTA vs DM
0.013699488	Bol_2548 (DM)	DTA vs DM
0.004374641	Bol_2548 (DM)	DTA vs DM
0.014652752	Bol_2548 (DM)	DTA vs DM
0.011078101	Bol_2548 (DM)	DTA vs DM
0.009643	Bol_2524	DTA vs DM
0.009247	Bol_2525	DTA vs DM
0.012116	Bol_2526	DTA vs DM
0.007672	Bol_2527	DTA vs DM
0.008976	Bol_2528	DTA vs DM
0.007864	Bol_2529	DTA vs DM
0.008062	Bol_2530	DTA vs DM
0.007657	Bol_2531	DTA vs DM
0.008803	Bol_2532	DTA vs DM
0.011114	Bol_2533	DTA vs DM
0.011091	Bol_2535	DTA vs DM
0.009664	Bol_2536	DTA vs DM
0.009404	Bol_2537	DTA vs DM
0.009022	Bol_2538	DTA vs DM
0.011375	Bol_2539	DTA vs DM
0.007549	Bol_2540	DTA vs DM
0.009007	Bol_2541	DTA vs DM
0.007583	Bol_2542	DTA vs DM
0.008646	Bol_2543	DTA vs DM
0.01016	Bol_2544	DTA vs DM
0.009494	Bol_2545	DTA vs DM
0.007201	**Bol_2546 (Tool)**	DTA vs DM
0.010989	Bol_2547	DTA vs DM
0.009155	Bol_2550	DTA vs DM
0.010415	Bol_2551	DTA vs DM
0.008585	Bol_2552	DTA vs DM
0.008785	Bol_2553	DTA vs DM

0.079326	OL_0794	DTA vs DM
0.05997	OL_0866	DTA vs DM
0.065155	OL_0869	DTA vs DM
0.072334	OL_0886	DTA vs DM
0.06257	OL_1068	DTA vs DM
0.061571	OL_1112	DTA vs DM
0.067286	OL_1187	DTA vs DM
0.064343	OL_1192	DTA vs DM
0.064251	OL_1193	DTA vs DM
0.054762	OL_1197	DTA vs DM
0.056636	OL_1199	DTA vs DM
0.071677	OL_1214	DTA vs DM
0.053731	OL_1282	DTA vs DM
0.060775	OL_1428	DTA vs DM
0.049861	VA_011	DTA vs DM
0.071424	VA_013	DTA vs DM
0.072735	VA_014	DTA vs DM
0.073138	VA_020	DTA vs DM
0.062077	VA_022	DTA vs DM
0.059928	VA_029	DTA vs DM
0.073368	VA_030	DTA vs DM
0.060386	VA_031	DTA vs DM
0.060643	VA_033	DTA vs DM
0.006577	Bol_2524	DTA vs SM
0.006511	Bol_2525	DTA vs SM
0.011579	Bol_2526	DTA vs SM
0.006604	Bol_2527	DTA vs SM
0.013961	Bol_2528	DTA vs SM
0.002698	Bol_2529	DTA vs SM
0.005012	Bol_2530	DTA vs SM
0.005659	Bol_2531	DTA vs SM
0.004713	Bol_2532	DTA vs SM
0.007079	Bol_2533	DTA vs SM
0.005485	Bol_2535	DTA vs SM
0.004522	Bol_2536	DTA vs SM
0.00564	Bol_2537	DTA vs SM
0.004517	Bol_2538	DTA vs SM
0.010699	Bol_2539	DTA vs SM
0.005974	Bol_2540	DTA vs SM
0.005285	Bol_2541	DTA vs SM
0.005872	Bol_2542	DTA vs SM
0.003754	Bol_2543	DTA vs SM
0.009565	Bol_2544	DTA vs SM
0.004414	Bol_2545	DTA vs SM

0.004655	**Bol_2546 (Tool)**	DTA vs SM
0.008363	Bol_2547	DTA vs SM
0.005743	Bol_2550	DTA vs SM
0.007106	Bol_2551	DTA vs SM
0.00428	Bol_2552	DTA vs SM
0.004131	Bol_2553	DTA vs SM
0.00578	OL_0794	DTA vs SM
0.007487	OL_0866	DTA vs SM
0.007764	OL_0869	DTA vs SM
0.006398	OL_0886	DTA vs SM
0.005186	OL_1068	DTA vs SM
0.003928	OL_1112	DTA vs SM
0.008788	OL_1187	DTA vs SM
0.003314	OL_1192	DTA vs SM
0.006127	OL_1193	DTA vs SM
0.003785	OL_1197	DTA vs SM
0.00826	OL_1199	DTA vs SM
0.003824	OL_1214	DTA vs SM
0.007476	OL_1282	DTA vs SM
0.006112	OL_1428	DTA vs SM
0.002287	VA_011	DTA vs SM
0.009583	VA_013	DTA vs SM
0.004324	VA_014	DTA vs SM
0.005862	VA_020	DTA vs SM
0.005204	VA_022	DTA vs SM
0.006842	VA_029	DTA vs SM
0.003147	VA_030	DTA vs SM
0.010993	VA_031	DTA vs SM
0.009978	VA_033	DTA vs SM

Supplementary R Code

```
# Running DTA in R
# DTA is a tool developed in R environment and available on Arothron R package (Profico et al., 2015).  We supply the an example script with data.
## Install the Arothron R package and load the library
install.packages("Arothron")
library(Arothron)
require(Morpho)
require(vegan)
require(rgl)
require(compositions)
## Load the disarticulated model of the Homo sapiens case study
data(DM_base_sur)
data(DM_face_sur)
## Load the landmark configurations associated to the DM
data(DM_set)
## Load the reference sample
data(RMs_sets)
## Define the landmarks belonging to the first and second module
mod_1<-c(1:17) #cranial base
mod_2<-c(18:32) #facial complex
## Define the paired landmarks for each module (optional symmetrization process)
pairs_1<-cbind(c(4,6,8,10,12,14,16),c(5,7,9,11,13,15,17))
pairs_2<-cbind(c(23,25,27,29,31),c(24,26,28,30,32))
## Run DTA
ex.dta<-dta(RM_sample=RMs_sets,      mod_1=mod_1,      mod_2=mod_2,      pairs_1=pairs_1, pairs_2=pairs_2,DM_mesh_1=DM_base_sur,  DM_mesh_2=DM_face_sur,  DM_set_1=  DM_set[mod_1,], DM_set_2=DM_set[mod_2,],method="procrustes")
## Print the name of the best RM
ex.dta$AM_id
## Save the mesh and the landmark set of the AM
AM_mesh<-ex.dta$AM_mesh
AM_set<-ex.dta$AM_set

wire3d(AM_mesh,col=3)
spheres3d(AM_set,add=TRUE)
```

Supplementary Information for: Fragmentation of Neanderthals' pre-extinction distribution by climate change

Data Set S1. Raw data with human species the site is attributed to (species), the site geographical coordinates (long, lat) and name (site name), uncalibrated age and range (uncal age, plus/minus), calibrated age with range, and the calibration method (calBP, calBP CI95, calBP CI95, calibration_curve), calibration specimen code (lab code) and method (method)

Data Set S1 is also vailable at: https://doi.org/10.1016/j.palaeo.2018.01.031

species	long	lat	uncal age	plus/ minus	cal method	calBP	calBP CI95	calBP CI95	site name	lab code	met hod
Homo neanderthalensis	10.33	52.18	33970	360	IntCal13	38193	36788.90	39597.10	Salzgitter-Lebenstedt	KIA-34481	AMS
Homo neanderthalensis	34.08	44.83	34940	1020	IntCal13	39079	36260.35	41897.65	Kabazi II	OxA-4135	AMS
Homo neanderthalensis	34.08	44.83	35100	850	IntCal13	39240	36709.20	41770.80	Kabazi II	OxA-4771	AMS
Homo neanderthalensis	10.97	45.51	35400	750	IntCal13	39771	37710.45	41831.55	Fumane	OxA-21796	AMS
Homo neanderthalensis	2.23	43.14	35425	1140	IntCal13	39393.5	36416.68	42370.33	Caune de Belvis [Belvis]	AA-7390	AMS
Homo neanderthalensis	-6.05	42.48	35500	650	IntCal13	40044.5	38333.08	41755.93	Sopeña Cave	GrA-39761	AMS
Homo neanderthalensis	33.88	44.73	35510	1170	IntCal13	39445	36426.85	42463.15	Starosel'e	OxA-4134	AMS
Homo neanderthalensis	1.10	45.02	36000	550	IntCal13	40401	38880.05	41921.95	Rochette	GrN-4362	AMS
Homo neanderthalensis	-0.64	45.75	36000	700	IntCal13	40370.5	38598.28	42142.73	Saint-Césaire	OxA-21699	AMS
Homo neanderthalensis	-2.48	43.06	36000	700	IntCal13	40370.5	38598.28	42142.73	Labeko Koba	OxA-22559	AMS
Homo neanderthalensis	33.88	44.73	36160	1250	IntCal13	39916.5	36824.73	43008.28	Starosel'e	OxA-4133	AMS
Homo neanderthalensis	40.00	44.17	36200	750	IntCal13	40497.5	38646.43	42348.58	Mezmaiskaya	OxA-21836	AMS
Homo neanderthalensis	-0.64	45.75	36200	750	IntCal13	40497.5	38646.43	42348.58	Saint-Césaire	OxA-18099	AMS
Homo neanderthalensis	-0.42	45.44	36490	1360	IntCal13	40208	36906.75	43509.25	Chez-Pinaud I	KIA-29228	AMS
Homo neanderthalensis	7.54	43.78	36540	240	IntCal13	41082.5	40382.83	41782.18	Riparo Bombrini	OxA-19292	AMS
Homo neanderthalensis	-2.48	43.06	36550	750	IntCal13	40736.5	38897.78	42575.23	Labeko Koba	OxA-21792	AMS
Homo neanderthalensis	10.97	45.51	36650	350	IntCal13	41107	40178.85	42035.15	Fumane	LTL-571A	AMS
Homo neanderthalensis	-0.64	45.75	36650	750	IntCal13	40813	38986.15	42639.85	Saint-Césaire	OxA-21700	AMS
Homo neanderthalensis	18.11	49.58	36750	800	IntCal13	40868	38956.60	42779.40	Certova Dira Cave	OxA-22447	AMS
Homo neanderthalensis	7.54	43.78	36770	210	IntCal13	41316	40746.95	41885.05	Riparo Bombrini	OxA-20361	AMS
Homo neanderthalensis	-2.48	43.06	36850	800	IntCal13	40950.5	39051.93	42849.08	Labeko Koba	OxA-22653	AMS
Homo neanderthalensis	16.09	46.31	37000	600	IntCal13	41243	39831.30	42654.70	Vindija	VERA-0109	AMS
Homo neanderthalensis	3.76	47.59	37000	1000	IntCal13	41017	38754.10	43279.90	Grotte du Renne at Arcy-sur-Cure	OxA-21594	AMS

Homo neanderthalensis	-2.73	43.00	37100	1000	IntCal13	41099	38824.70	43373.30	Arrillor	OxA-6106	AMS
Homo neanderthalensis	3.76	47.59	37200	0	IntCal13	41728	41691.90	41764.10	Grotte du Renne at Arcy-sur-Cure	OxA-17577	AMS
Homo neanderthalensis	-0.64	45.75	37200	1000	IntCal13	41190.5	38901.48	43479.53	Saint-Césaire	OxA-21636	AMS
Homo neanderthalensis	0.90	44.56	37270	257	IntCal13	41709.5	41137.13	42281.88	Peyrony	MAMS-14111	AMS
Homo neanderthalensis	2.75	42.16	37300	800	IntCal13	41382.5	39589.38	43175.63	L'Arbreda	OxA-21662	AMS
Homo neanderthalensis	-0.41	42.14	37330	490	IntCal13	41574.5	40447.33	42701.68	Fuentes de San Cristobal	GrA-33904	AMS
Homo neanderthalensis	1.25	44.86	37400	370	IntCal13	41740	40922.05	42557.95	Pech-de-l'Aze IV	OxA-V-2333-36	AMS
Homo neanderthalensis	-2.48	43.06	37400	800	IntCal13	41474.5	39694.68	43254.33	Labeko Koba	OxA-22560	AMS
Homo neanderthalensis	0.90	44.56	37500	181	IntCal13	41898.5	41505.68	42291.33	Peyrony	MAMS-14588	AMS
Homo neanderthalensis	3.76	47.59	37510	275	IntCal13	41882.5	41295.88	42469.13	Grotte du Renne at Arcy-sur-Cure	EVA-40	AMS
Homo neanderthalensis	1.07	45.00	37600	900	IntCal13	41667.5	39636.88	43698.13	Le Moustier	OxA-2300-19	AMS
Homo neanderthalensis	-2.48	43.06	37700	900	IntCal13	41781.5	39743.28	43819.73	Labeko Koba	OxA-21777	AMS
Homo neanderthalensis	-5.08	43.29	37710	470	IntCal13	41934	40949.80	42918.20	El Conde	Beta-230416	AMS
Homo neanderthalensis	3.76	47.59	37710	533	IntCal13	41885	40746.90	43023.10	Grotte du Renne at Arcy-sur-Cure	EVA-56	AMS
Homo neanderthalensis	3.76	47.59	37740	307	IntCal13	42033	41402.20	42663.80	Grotte du Renne at Arcy-sur-Cure	EVA-36	AMS
Homo neanderthalensis	-2.48	43.06	37800	900	IntCal13	41890	39845.60	43934.40	Labeko Koba	OxA-22563	AMS
Homo neanderthalensis	4.54	44.33	37850	550	IntCal13	42004.5	40858.33	43150.68	Saint-Marcel-d'Ardeche	OxA-19623	AMS
Homo neanderthalensis	4.54	44.33	37850	600	IntCal13	41967	40693.05	43240.95	Saint-Marcel-d'Ardeche	OxA-19625	AMS
Homo neanderthalensis	3.76	47.59	37900	900	IntCal13	41991	39942.80	44039.20	Grotte du Renne at Arcy-sur-Cure	OxA-21565	AMS
Homo neanderthalensis	-2.48	43.06	37900	900	IntCal13	41991	39942.80	44039.20	Labeko Koba	OxA-22564	AMS
Homo neanderthalensis	-3.96	43.39	37940	400	IntCal13	42150.5	41352.03	42948.98	Covalejos, Cobalejos	GrA-33877	AMS
Homo neanderthalensis	10.33	52.18	37950	540	IntCal13	42103.5	41001.98	43205.03	Salzgitter-Lebenstedt	KIA-34482	AMS
Homo neanderthalensis	3.76	47.59	37980	284	IntCal13	42201	41631.95	42770.05	Grotte du Renne at Arcy-sur-Cure	EVA-30	AMS
Homo neanderthalensis	-2.48	43.06	38000	900	IntCal13	42090	40044.65	44135.35	Labeko Koba	OxA-22561	AMS
Homo neanderthalensis	1.35	44.77	38000	2000	IntCal13	41502	37006.60	45997.40	Roc de Combe	OxA-1443	AMS
Homo neanderthalensis	3.76	47.59	38070	311	IntCal13	42257.5	41640.48	42874.53	Grotte du Renne at Arcy-sur-Cure	EVA-42	AMS
Homo neanderthalensis	-2.48	43.06	38100	900	IntCal13	42185.5	40150.13	44220.88	Labeko Koba	OxA-22562	AMS
Homo neanderthalensis	0.88	45.23	38100	1000	IntCal13	42153.5	39901.53	44405.48	Combe Sauniere	OxA-6503	AMS
Homo neanderthalensis	3.76	47.59	38100	1300	IntCal13	42015	39075.70	44954.30	Grotte du Renne at Arcy-sur-Cure	OxA-21557	AMS
Homo neanderthalensis	7.54	43.78	38140	250	IntCal13	42311	41814.15	42807.85	Riparo Bombrini	OxA-19291	AMS
Homo neanderthalensis	0.83	46.67	38150	290	IntCal13	42314	41740.20	42887.80	Le Moustier	EVA-13	AMS

Homo neanderthalensis	40.00	44.17	38200	900	IntCal13	42276.5	40251.58	44301.43	Mezmaiskaya	OxA-21826	AMS
Homo neanderthalensis	40.00	44.17	38200	1000	IntCal13	42245.5	40002.08	44488.93	Mezmaiskaya	OxA-21827	AMS
Homo neanderthalensis	3.76	47.59	38200	1200	IntCal13	42177	39489.45	44864.55	Grotte du Renne at Arcy-sur-Cure	OxA-21595	AMS
Homo neanderthalensis	0.83	46.67	38210	420	IntCal13	42341	41517.35	43164.65	Le Moustier	MAMS-10824	AMS
Homo neanderthalensis	-5.08	43.29	38250	390	IntCal13	42372.5	41609.18	43135.83	El Conde	Beta-210572	AMS
Homo neanderthalensis	0.57	44.85	38300	500	IntCal13	42407	41419.00	43395.00	Barbas III	Gif-9591LSN	AMS
Homo neanderthalensis	3.76	47.59	38300	1300	IntCal13	42213	39307.90	45118.10	Grotte du Renne at Arcy-sur-Cure	OxA-8451 (LYON-894)	AMS
Homo neanderthalensis	16.09	46.31	38310	2130	IntCal13	41811	37063.85	46558.15	Vindija	Ua-19009	AMS
Homo neanderthalensis	2.75	42.16	38350	400	IntCal13	42443	41661.15	43224.85	L'Arbreda	OxA-19994	AMS
Homo neanderthalensis	22.58	36.78	38380	260	IntCal13	42465	41951.05	42978.95	Lakonis Cave I	OxA-19843	AMS
Homo neanderthalensis	-8.61	39.51	38390	480	IntCal13	42479	41529.95	43428.05	Oliveira Cave [Almonda cave system]	GrA-9760	AMS
Homo neanderthalensis	3.76	47.59	38400	317	IntCal13	42478.5	41858.63	43098.38	Grotte du Renne at Arcy-sur-Cure	EVA-24	AMS
Homo neanderthalensis	-2.48	43.06	38400	900	IntCal13	42458.5	40453.53	44463.48	Labeko Koba	OxA-23199	AMS
Homo neanderthalensis	3.77	47.59	38400	1600	IntCal13	42235	38781.75	45688.25	Grotte du Bison, Arcy-sur-Cure	OxA-1001 LYON-1294	AMS
Homo neanderthalensis	3.77	47.59	38400	1600	IntCal13	42235	38781.75	45688.25	Grotte du Bison, Arcy-sur-Cure	OxA-10017/LYON-1294	AMS
Homo neanderthalensis	0.83	46.67	38430	42	IntCal13	42493.5	42393.28	42593.73	Le Moustier	MAMS-10823	AMS
Homo neanderthalensis	0.93	43.15	38450	840	IntCal13	42532	40675.70	44388.30	Harregi	GrA-23555	AMS
Homo neanderthalensis	4.75	44.48	38500	1000	IntCal13	42530	40314.60	44745.40	Grotte Mandrin	OxA-X-2286-10	AMS
Homo neanderthalensis	3.76	47.59	38500	1300	IntCal13	42432	39586.75	45277.25	Grotte du Renne at Arcy-sur-Cure	OxA-X-2226-7	AMS
Homo neanderthalensis	-3.97	43.29	38500	1800	IntCal13	42348	38573.65	46122.35	El Castillo	AA-2406	AMS
Homo neanderthalensis	0.83	46.67	38540	270	IntCal13	42565.5	42029.23	43101.78	Le Moustier	MAMS-10803	AMS
Homo neanderthalensis	-0.41	42.14	38550	450	IntCal13	42604.5	41707.23	43501.78	Fuentes de San Cristobal	OxA-19934	AMS
Homo neanderthalensis	-0.41	42.14	38650	600	IntCal13	42772.5	41493.33	44051.68	Fuentes de San Cristobal	OxA-19145	AMS
Homo neanderthalensis	0.83	46.67	38650	260	IntCal13	42634.5	42112.48	43156.53	Le Moustier	EVA-19	AMS
Homo neanderthalensis	3.76	47.59	38700	1000	IntCal13	42715	40525.25	44904.75	Grotte du Renne at Arcy-sur-Cure	OxA-X-2279-46	AMS
Homo neanderthalensis	3.76	47.59	38730	333	IntCal13	42701	42036.00	43366.00	Grotte du Renne at Arcy-sur-Cure	EVA-41	AMS
Homo neanderthalensis	3.76	47.59	38760	750	IntCal13	42869.5	41278.73	44460.28	Grotte du Renne at Arcy-sur-Cure	OxA-16696	AMS
Homo neanderthalensis	10.97	45.51	38800	750	IntCal13	42903.5	41314.63	44492.38	Fumane	OxA-8022	AMS
Homo neanderthalensis	3.77	47.59	38800	1300	IntCal13	42714.5	39921.03	45507.98	Grotte du Bison, Arcy-sur-Cure	OxA-3461	AMS

Homo neanderthalensis	3.76	47.59	38800	1300	IntCal13	42714.5	39921.03	45507.98	Grotte du Renne at Arcy-sur-Cure	OxA-21574	AMS
Homo neanderthalensis	-0.47	38.80	38800	1900	IntCal13	42632	38641.05	46622.95	Cova Beneito	AA-1387	AMS
Homo neanderthalensis	0.83	46.67	38970	900	IntCal13	43034.5	41138.78	44930.23	Le Moustier	OxA-V-2384-13	AMS
Homo neanderthalensis	0.83	46.67	38970	440	IntCal13	42971	42011.50	43930.50	Le Moustier	MAMS-10831	AMS
Homo neanderthalensis	4.75	44.48	39000	1000	IntCal13	43020.5	40902.48	45138.53	Grotte Mandrin	OxA-21685	AMS
Homo neanderthalensis	3.76	47.59	39000	332	IntCal13	42911.5	42204.23	43618.78	Grotte du Renne at Arcy-sur-Cure	EVA-48	AMS
Homo neanderthalensis	3.76	47.59	39000	1300	IntCal13	42897	40134.40	45659.60	Grotte du Renne at Arcy-sur-Cure	OxA-17482	AMS
Homo neanderthalensis	3.76	47.59	39000	1400	IntCal13	42869.5	39904.08	45834.93	Grotte du Renne at Arcy-sur-Cure	OxA-X-2226-13	AMS
Homo neanderthalensis	19.21	43.25	39000	0	IntCal13	42839	42804.80	42873.20	Malisina Stijena	OxA-1895	AMS
Homo neanderthalensis	3.76	47.59	39000	0	IntCal13	42839	42804.80	42873.20	Grotte du Renne at Arcy-sur-Cure	OxA-13669	AMS
Homo neanderthalensis	3.76	47.59	39020	352	IntCal13	42944	42183.05	43704.95	Grotte du Renne at Arcy-sur-Cure	EVA-43	AMS
Homo neanderthalensis	1.69	41.53	39060	350	IntCal13	42977.5	42211.33	43743.68	Abric Romani	OxA-12025	AMS
Homo neanderthalensis	10.97	45.51	39100	1000	IntCal13	43119	41024.25	45213.75	Fumane	OxA-21736	AMS
Homo neanderthalensis	-5.08	43.29	39110	520	IntCal13	43118	41973.25	44262.75	El Conde	Beta-237338	AMS
Homo neanderthalensis	9.02	45.93	39200	1000	IntCal13	43214.5	41140.18	45288.83	Caverna Generosa	UtC-10761	AMS
Homo neanderthalensis	2.75	42.16	39200	1000	IntCal13	43214.5	41140.18	45288.83	L'Arbreda	OxA-21704	AMS
Homo neanderthalensis	16.50	43.53	39200	1230	IntCal13	43100	40509.35	45690.65	Mujina Pecina	GrA-9633	AMS
Homo neanderthalensis	3.76	47.59	39200	1300	IntCal13	43081.5	40346.93	45816.08	Grotte du Renne at Arcy-sur-Cure	OxA-17579	AMS
Homo neanderthalensis	6.94	51.22	39240	670	IntCal13	43245	41812.40	44677.60	Feldhofer Cave	ETH-19660	AMS
Homo neanderthalensis	3.64	46.41	39240	380	IntCal13	43154.5	42277.18	44031.83	Fees	OxA-14320	AMS
Homo neanderthalensis	3.76	47.59	39240	341	IntCal13	43129	42343.35	43914.65	Grotte du Renne at Arcy-sur-Cure	EVA-35	AMS
Homo neanderthalensis	3.76	47.59	39280	351	IntCal13	43170	42352.05	43987.95	Grotte du Renne at Arcy-sur-Cure	EVA-44	AMS
Homo neanderthalensis	-4.60	43.20	39280	340	IntCal13	43162.5	42370.68	43954.33	Esquilleu	OxA-19085	AMS
Homo neanderthalensis	-0.41	42.14	39290	490	IntCal13	43234.5	42133.93	44335.08	Fuentes de San Cristobal	GrA-33817	AMS
Homo neanderthalensis	3.76	47.59	39290	334	IntCal13	43167	42388.00	43946.00	Grotte du Renne at Arcy-sur-Cure	EVA-31	AMS
Homo neanderthalensis	-3.97	43.29	39300	1900	IntCal13	43110	39016.45	47203.55	El Castillo	GifA-89144	AMS
Homo neanderthalensis	3.76	47.59	39390	334	IntCal13	43250	42452.95	44047.05	Grotte du Renne at Arcy-sur-Cure	EVA-26	AMS
Homo neanderthalensis	3.76	47.59	39400	1450	IntCal13	43246.5	40221.23	46271.78	Grotte du Renne at Arcy-sur-Cure	OxA-3463	AMS

Homo neanderthalensis	3.76	47.59	39450	340	IntCal13	43301.5	42483.08	44119.93	Grotte du Renne at Arcy-sur-Cure	EVA-37	AMS
Homo neanderthalensis	0.90	44.56	39460	234	IntCal13	43236.5	42666.98	43806.03	Peyrony	MAMS-14591	AMS
Homo neanderthalensis	10.97	45.51	39490	360	IntCal13	43340.5	42475.53	44205.48	Fumane	OxA-17568	AMS
Homo neanderthalensis	18.11	49.58	39500	1100	IntCal13	43455	41220.60	45689.40	Centrova Dira Cave	OxA-22448	AMS
Homo neanderthalensis	1.35	44.77	39540	450	IntCal13	43398.5	42359.68	44437.33	Roc de Combe	GifA-101264	AMS
Homo neanderthalensis	-1.50	38.06	39650	550	IntCal13	43508	42273.00	44743.00	Cueva Anton	OxA-18672	AMS
Homo neanderthalensis	40.00	44.17	39700	1100	IntCal13	43623	41403.80	45842.20	Mezmaiskaya	OxA-21839	AMS
Homo neanderthalensis	6.82	46.98	39720	1230	IntCal13	43628.5	41147.58	46109.43	Cotencher	ETH-4506	AMS
Homo neanderthalensis	0.83	46.67	39760	1600	IntCal13	43630.5	40272.73	46988.28	Le Moustier	OxA-V-2384-11	AMS
Homo neanderthalensis	3.76	47.59	39800	900	IntCal13	43690	41834.65	45545.35	Grotte du Renne at Arcy-sur-Cure	OxA-17843	AMS
Homo neanderthalensis	0.90	44.56	39880	247	IntCal13	43582	42915.10	44248.90	Peyrony	MAMS-14589	AMS
Homo neanderthalensis	6.94	51.22	39900	620	IntCal13	43703	42327.40	45078.60	Feldhofer Cave	ETH-20981	AMS
Homo neanderthalensis	0.42	42.01	39900	0	IntCal13	43458.5	43413.38	43503.63	Los Moros I	OxA-5671	AMS
Homo neanderthalensis	0.83	46.67	39930	470	IntCal13	43686.5	42585.93	44787.08	Le Moustier	MAMS-10832	AMS
Homo neanderthalensis	3.76	47.59	39930	361	IntCal13	43648.5	42757.88	44539.13	Grotte du Renne at Arcy-sur-Cure	EVA-46	AMS
Homo neanderthalensis	3.76	47.59	39960	702	IntCal13	43763.5	42241.13	45285.88	Grotte du Renne at Arcy-sur-Cure	EVA-51	AMS
Homo neanderthalensis	-3.97	43.29	40000	2100	IntCal13	43943	39365.90	48520.10	El Castillo	AA-2405	AMS
Homo neanderthalensis	1.35	44.77	40000	1300	IntCal13	43899.5	41280.83	46518.18	Roc de Combe	GifA-101266	AMS
Homo neanderthalensis	3.76	47.59	40000	1200	IntCal13	43882	41470.90	46293.10	Grotte du Renne at Arcy-sur-Cure	OxA-21683	AMS
Homo neanderthalensis	10.97	45.51	40000	1100	IntCal13	43864.5	41645.78	46083.23	Fumane	OxA-21712	AMS
Homo neanderthalensis	10.97	45.51	40000	1100	IntCal13	43864.5	41645.78	46083.23	Fumane	OxA-21712	AMS
Homo neanderthalensis	23.04	45.61	40000	0	IntCal13	43553.5	43502.68	43604.33	Bordul Mare d'Ohaba Ponor	GrA-6036	AMS
Homo neanderthalensis	-0.64	45.75	40100	1900	IntCal13	44070	39987.85	48152.15	Saint-Césaire	OxA-21637	AMS
Homo neanderthalensis	17.92	48.56	40100	1200	IntCal13	43968.5	41551.23	46385.78	Centrova Dira Cave	OxA-24106	AMS
Homo neanderthalensis	10.97	45.51	40150	550	IntCal13	43863	42600.45	45125.55	Fumane	LTL-572A	AMS
Homo neanderthalensis	3.77	47.59	40200	1500	IntCal13	44137	41029.55	47244.45	Grotte du Bison, Arcy-sur-Cure	GrA-20477, LYON-1915	AMS
Homo neanderthalensis	40.00	44.17	40200	1200	IntCal13	44056	41629.70	46482.30	Mezmaiskaya	OxA-21824	AMS
Homo neanderthalensis	10.97	45.51	40200	1200	IntCal13	44056	41629.70	46482.30	Fumane	OxA-21809	AMS
Homo neanderthalensis	10.97	45.51	40200	1200	IntCal13	44056	41629.70	46482.30	Fumane	OxA-21809	AMS
Homo neanderthalensis	3.76	47.59	40230	395	IntCal13	43876.5	42892.78	44860.23	Grotte du Renne at Arcy-sur-Cure	EVA-27	AMS
Homo neanderthalensis	0.83	46.67	40280	650	IntCal13	43975	42527.20	45422.80	Le Moustier	OxA-V-2381-50	AMS

Homo neanderthalensis	0.83	46.67	40280	550	IntCal13	43953	42680.95	45225.05	Le Moustier	OxA-V-2382-50	AMS
Homo neanderthalensis	-2.62	42.21	40300	1600	IntCal13	44268.5	40896.48	47640.53	Pena Miel 1	OxA-5519	AMS
Homo neanderthalensis	4.75	44.48	40300	1200	IntCal13	44144	41707.25	46580.75	Grotte Mandrin	OxA-22121	AMS
Homo neanderthalensis	-5.11	43.35	40300	1200	IntCal13	44144	41707.25	46580.75	La Guelga	OxA-27958	AMS
Homo neanderthalensis	7.54	43.78	40340	390	IntCal13	43954	42970.75	44937.25	Riparo Bombrini	OxA-19862	AMS
Homo neanderthalensis	6.94	51.22	40360	760	IntCal13	44052.5	42408.53	45696.48	Feldhofer Cave	ETH-19661	AMS
Homo neanderthalensis	1.07	45.00	40400	1200	IntCal13	44232	41781.95	46682.05	Le Moustier	OxA-21789	AMS
Homo neanderthalensis	-8.61	39.51	40420	1220	IntCal13	44258	41764.25	46751.75	Oliveira Cave [Almonda cave system]	Beta-111967	AMS
Homo neanderthalensis	16.50	43.53	40430	1440	IntCal13	44380	41401.75	47358.25	Mujina Pecina	GrA-9636	AMS
Homo neanderthalensis	0.90	44.56	40440	251	IntCal13	43994.5	43283.43	44705.58	Peyrony	MAMS-14590	AMS
Homo neanderthalensis	16.50	43.53	40460	1470	IntCal13	44427	41373.70	47480.30	Mujina Pecina	GrA-9634	AMS
Homo neanderthalensis	10.97	45.51	40460	360	IntCal13	44034	43098.25	44969.75	Fumane	OxA-17566	AMS
Homo neanderthalensis	4.43	44.44	40500	1600	IntCal13	44503	41139.05	47866.95	Ranc de l'Arc	GifA-	AMS
Homo neanderthalensis	3.76	47.59	40520	389	IntCal13	44083.5	43086.48	45080.53	Grotte du Renne at Arcy-sur-Cure	EVA-34	AMS
Homo neanderthalensis	1.07	45.00	40600	1800	IntCal13	44618.5	40752.48	48484.53	Le Moustier	OxA-X-21765	AMS
Homo neanderthalensis	3.76	47.59	40600	1300	IntCal13	44470.5	41771.08	47169.93	Grotte du Renne at Arcy-sur-Cure	OxA-X-2279-18	AMS
Homo neanderthalensis	1.69	41.53	40600	900	IntCal13	44263	42350.65	46175.35	Abric Romani	NZA-2313	AMS
Homo neanderthalensis	-3.97	43.29	40700	1500	IntCal13	44683	41525.20	47840.80	El Castillo	OxA-2476	AMS
Homo neanderthalensis	1.07	45.00	40700	1300	IntCal13	44568	41845.30	47290.70	Le Moustier	OxA-X-2300-21	AMS
Homo neanderthalensis	0.74	46.42	40700	900	IntCal13	44339.5	42413.38	46265.63	Les Rochers de Villeneuve	Beta-177765	AMS
Homo neanderthalensis	0.83	46.67	40710	510	IntCal13	44241.5	43005.08	45477.93	Le Moustier	MAMS-10830	AMS
Homo neanderthalensis	1.25	44.86	40760	400	IntCal13	44259.5	43221.63	45297.38	Pech-de-l'Aze IV	OxA-V-2344-17	AMS
Homo neanderthalensis	3.76	47.59	40800	1700	IntCal13	44857	41247.95	48466.05	Grotte du Renne at Arcy-sur-Cure	OxA-21576	AMS
Homo neanderthalensis	22.88	45.81	40800	1050	IntCal13	44493.5	42262.43	46724.58	Curata de Nandru	GrA-13948	AMS
Homo neanderthalensis	0.83	46.67	40800	530	IntCal13	44309	43029.35	45588.65	Le Moustier	MAMS-10828	AMS
Homo neanderthalensis	3.76	47.59	40830	778	IntCal13	44395	42673.60	46116.40	Grotte du Renne at Arcy-sur-Cure	EVA-49	AMS
Homo neanderthalensis	3.76	47.59	40900	1300	IntCal13	44763	41988.05	47537.95	Grotte du Renne at Arcy-sur-Cure	OxA-X-2279-45	AMS
Homo neanderthalensis	3.76	47.59	40900	719	IntCal13	44426.5	42800.58	46052.43	Grotte du Renne at Arcy-sur-Cure	EVA-85	AMS
Homo neanderthalensis	3.76	47.59	40930	393	IntCal13	44383.5	43349.43	45417.58	Grotte du Renne at Arcy-sur-Cure	EVA-28	AMS
Homo neanderthalensis	3.76	47.59	40970	424	IntCal13	44416	43320.65	45511.35	Grotte du Renne at Arcy-sur-Cure	EVA-33	AMS

Homo neanderthalensis	6.82	46.98	40980	1150	IntCal13	44720	42238.60	47201.40	Cotencher	ETH-4505	AMS
Homo neanderthalensis	10.97	45.51	41000	1300	IntCal13	44856.5	42054.48	47658.53	Fumane	OxA-21733	AMS
Homo neanderthalensis	23.04	45.61	41000	0	IntCal13	44528.5	44484.33	44572.68	Bordul Mare d'Ohaba Ponor	GrN-11617	AMS
Homo neanderthalensis	17.22	49.67	41100	2300	IntCal13	44991	40232.45	49749.55	Trou al Wesse	OxA-7497	AMS
Homo neanderthalensis	10.97	45.51	41100	1300	IntCal13	44947	42117.90	47776.10	Fumane	OxA-21758	AMS
Homo neanderthalensis	0.29	45.50	41100	1300	IntCal13	44947	42117.90	47776.10	La Quina	OxA-21805	AMS
Homo neanderthalensis	33.88	44.73	41200	1800	IntCal13	45317	41443.85	49190.15	Starosel'e	OxA-4775	AMS
Homo neanderthalensis	0.83	46.67	41280	340	IntCal13	44694	43804.80	45583.20	Le Moustier	EVA-21	AMS
Homo neanderthalensis	4.43	44.44	41300	1900	IntCal13	45443	41358.00	49528.00	Ranc de l'Arc	GifA-	AMS
Homo neanderthalensis	4.54	44.33	41300	1700	IntCal13	45372.5	41686.03	49058.98	Saint-Marcel-d'Ardeche	OxA-19624	AMS
Homo neanderthalensis	0.29	45.50	41300	1000	IntCal13	44905	42648.75	47161.25	La Quina	OxA-16998	AMS
Homo neanderthalensis	3.76	47.59	41400	2000	IntCal13	45517.5	41259.13	49775.88	Grotte du Renne at Arcy-sur-Cure	OxA-17580	AMS
Homo neanderthalensis	3.76	47.59	41500	1900	IntCal13	45633	41534.70	49731.30	Grotte du Renne at Arcy-sur-Cure	OxA-X-2226-12	AMS
Homo neanderthalensis	10.97	45.51	41500	1500	IntCal13	45442.5	42116.08	48768.93	Fumane	OxA-21757	AMS
Homo neanderthalensis	0.90	44.56	41510	279	IntCal13	44933.5	44231.93	45635.08	Peyrony	MAMS-14592	AMS
Homo neanderthalensis	-3.96	43.39	41640	650	IntCal13	44989.5	43383.53	46595.48	Covalejos, Cobalejos	GrA-22814	AMS
Homo neanderthalensis	10.97	45.51	41650	650	IntCal13	44998.5	43390.63	46606.38	Fumane	OxA-X-2275-45	AMS
Homo neanderthalensis	4.75	44.48	41700	1400	IntCal13	45553	42367.65	48738.35	Grotte Mandrin	OxA-21690	AMS
Homo neanderthalensis	0.83	46.67	41730	330	IntCal13	45111.5	44300.68	45922.33	Le Moustier	EVA-17	AMS
Homo neanderthalensis	0.83	46.67	41780	600	IntCal13	45105.5	43599.28	46611.73	Le Moustier	MAMS-10829	AMS
Homo neanderthalensis	-3.86	43.36	41800	450	IntCal13	45154	44051.05	46256.95	Cueva Morin	OxA-19083	AMS
Homo neanderthalensis	16.50	43.53	41820	1740	IntCal13	45862	42018.30	49705.70	Mujina Pecina	GrA-9639	AMS
Homo neanderthalensis	3.76	47.59	41980	821	IntCal13	45409.5	43339.93	47479.08	Grotte du Renne at Arcy-sur-Cure	EVA-83	AMS
Homo neanderthalensis	16.09	46.31	42000	0	IntCal13	45344	45299.35	45388.65	Vindija	Ua-13873	AMS
Homo neanderthalensis	-2.75	43.14	42010	1280	IntCal13	45754	42724.45	48783.55	Axlor	Beta-144262	AMS
Homo neanderthalensis	0.83	46.67	42090	900	IntCal13	45567.5	43292.73	47842.28	Le Moustier	OxA-V-2381-51	AMS
Homo neanderthalensis	-3.97	43.29	42100	1500	IntCal13	45972.5	42499.78	49445.23	El Castillo	OxA-10233	AMS
Homo neanderthalensis	3.76	47.59	42120	805	IntCal13	45538	43469.85	47606.15	Grotte du Renne at Arcy-sur-Cure	EVA-77	AMS
Homo neanderthalensis	0.94	44.95	42153	652	IntCal13	45520	43863.20	47176.80	Ferrassie	S-EVA-26507	AMS
Homo neanderthalensis	4.43	44.44	42200	1600	IntCal13	46108	42438.15	49777.85	Ranc de l'Arc	GifA-	AMS
Homo neanderthalensis	-3.97	43.29	42200	2100	IntCal13	45775.5	41762.23	49788.78	El Castillo	GifA-89147	AMS
Homo neanderthalensis	0.83	46.67	42200	350	IntCal13	45507.5	44633.98	46381.03	Le Moustier	EVA-18	AMS
Homo neanderthalensis	0.94	44.95	42367	678	IntCal13	45783	44041.65	47524.35	Ferrassie	S-EVA-26508	AMS

Homo neanderthalensis	-0.64	45.75	42400	2100	IntCal13	45849.5	41906.53	49792.48	Saint-Césaire	OxA-21638	AMS
Homo neanderthalensis	18.11	49.58	42400	550	IntCal13	45772	44381.20	47162.80	Centrova Dira Cave	OxA-18568	AMS
Homo neanderthalensis	34.37	44.96	42400	0	IntCal13	45652	45606.40	45697.60	Karabi Tamchin	OxA-10883	AMS
Homo neanderthalensis	0.83	46.67	42410	400	IntCal13	45713.5	44699.38	46727.63	Le Moustier	EVA-5	AMS
Homo neanderthalensis	5.69	50.59	42500	0	IntCal13	45729.5	45684.38	45774.63	Grotte Walou	OxA-21603	AMS
Homo neanderthalensis	33.88	44.73	42500	3600	IntCal13	44320	38924.00	49716.00	Starosel'e	OxA-4887	AMS
Homo neanderthalensis	0.83	46.67	42690	750	IntCal13	46161.5	44212.58	48110.43	Le Moustier	OxA-V-2382-49	AMS
Homo neanderthalensis	1.25	44.86	42690	500	IntCal13	46038	44724.15	47351.85	Pech-de-l'Aze IV	OxA-V-2344-18	AMS
Homo neanderthalensis	10.97	45.51	42750	700	IntCal13	46207	44380.15	48033.85	Fumane	LTL-376A	AMS
Homo neanderthalensis	4.75	44.48	42800	1800	IntCal13	46181	42552.95	49809.05	Grotte Mandrin	OxA-X-2286-14	AMS
Homo neanderthalensis	0.83	46.67	42870	750	IntCal13	46350	44386.35	48313.65	Le Moustier	OxA-V-2382-48	AMS
Homo neanderthalensis	1.25	44.86	42930	450	IntCal13	46260	45040.20	47479.80	Pech-de-l'Aze IV	OxA-V-2344-14	AMS
Homo neanderthalensis	23.02	45.11	43000	1300	IntCal13	46590.5	43351.48	49829.53	Cioarei-Borosteni	GrN-13001	AMS
Homo neanderthalensis	3.76	47.59	43000	2000	IntCal13	46109.5	42413.53	49805.48	Grotte du Renne at Arcy-sur-Cure	OxA-19348	AMS
Homo neanderthalensis	22.56	36.76	43010	350	IntCal13	46277.5	45313.73	47241.28	Lakonis Cave I	OxA-19761	AMS
Homo neanderthalensis	-3.96	43.39	43050	750	IntCal13	46528.5	44538.73	48518.28	Covalejos, Cobalejos	GrA-33811	AMS
Homo neanderthalensis	1.25	44.86	43050	400	IntCal13	46350.5	45243.28	47457.73	Pech-de-l'Aze IV	OxA-V-2344-11	AMS
Homo neanderthalensis	-2.73	43.00	43100	1200	IntCal13	46679	43587.70	49770.30	Arrillor	OxA-6250	AMS
Homo neanderthalensis	-2.73	43.00	43100	1700	IntCal13	46342	42866.90	49817.10	Arrillor	OxA-6250	AMS
Homo neanderthalensis	10.33	52.18	43110	1010	IntCal13	46682	44044.80	49319.20	Salzgitter-Lebenstedt	KIA-34484	AMS
Homo neanderthalensis	6.82	46.98	43200	1080	IntCal13	46781	43972.80	49589.20	Cotencher	ETH-4507	AMS
Homo neanderthalensis	1.69	41.53	43200	1100	IntCal13	46779.5	43921.43	49637.58	Abric Romani	NZA-2314	AMS
Homo neanderthalensis	-5.11	43.35	43200	0	IntCal13	46309	46255.80	46362.20	La Guelga	OxA-20123	AMS
Homo neanderthalensis	4.75	44.48	43200	2000	IntCal13	46172.5	42536.38	49808.63	Grotte Mandrin	OxA-X-2286-13	AMS
Homo neanderthalensis	3.76	47.59	43270	929	IntCal13	46840	44398.50	49281.50	Grotte du Renne at Arcy-sur-Cure	EVA-84	AMS
Homo neanderthalensis	1.07	45.00	43300	1700	IntCal13	46404	42987.80	49820.20	Le Moustier	OxA-X-21753	AMS
Homo neanderthalensis	1.07	45.00	43300	1800	IntCal13	46337	42857.15	49816.85	Le Moustier	OxA-21790	AMS
Homo neanderthalensis	-3.97	43.29	43300	2900	IntCal13	45528.5	41280.58	49776.43	El Castillo	GifA-92506	AMS
Homo neanderthalensis	0.94	44.95	43369	291	IntCal13	46598.5	45724.98	47472.03	Ferrassie	S-EVA-26506	AMS
Homo neanderthalensis	13.91	46.11	43400	1200	IntCal13	46873.5	43903.33	49843.68	Divje Babe	RIDDL-735	AMS
Homo neanderthalensis	4.75	44.48	43400	1800	IntCal13	46367.5	42916.63	49818.38	Grotte Mandrin	OxA-22120	AMS
Homo neanderthalensis	1.69	41.53	43500	1200	IntCal13	46934.5	44022.28	49846.73	Abric Romani	NZA-2312	AMS
Homo neanderthalensis	0.57	44.85	43500	2200	IntCal13	46129	42451.55	49806.45	Barbas III	GifA-93050	AMS
Homo neanderthalensis	-3.86	43.36	43600	600	IntCal13	47008	45309.40	48706.60	Cueva Morin	OxA-19459	AMS

Homo neanderthalensis	23.04	45.61	43600	2800	IntCal13	45736	41685.20	49786.80	Bordul Mare d'Ohaba Ponor	GrN-12676	AMS
Homo neanderthalensis	-5.11	43.35	43700	800	IntCal13	47208.5	45018.28	49398.73	La Guelga	OxA-19244	AMS
Homo neanderthalensis	-4.60	43.20	43700	1400	IntCal13	46793	43746.35	49839.65	Esquilleu	OxA-19965	AMS
Homo neanderthalensis	1.25	44.86	43720	450	IntCal13	47038.5	45691.88	48385.13	Pech-de-l'Aze IV	OxA-V-2344-13	AMS
Homo neanderthalensis	-5.34	36.12	43800	1300	IntCal13	46981	44112.95	49849.05	Gorham's Cave	OxA-8525	AMS
Homo neanderthalensis	-3.97	43.29	43800	0	IntCal13	46914	46849.40	46978.60	El Castillo	OxA-10329	AMS
Homo neanderthalensis	11.40	51.81	43800	2100	IntCal13	46287.5	42760.63	49814.38	Konigsaue	OxA-7124	AMS
Homo neanderthalensis	0.90	44.56	43890	476	IntCal13	47222	45780.85	48663.15	Peyrony	MAMS-14113	AMS
Homo neanderthalensis	1.25	44.86	43910	450	IntCal13	47225.5	45846.58	48604.43	Pech-de-l'Aze IV	OxA-V-2344-12	AMS
Homo neanderthalensis	-5.34	36.12	44090	1100	IntCal13	47319	44772.05	49865.95	Gorham's Cave	Beta-184044	AMS
Homo neanderthalensis	-4.60	43.20	44100	1300	IntCal13	47133	44409.35	49856.65	Esquilleu	OxA-19966	AMS
Homo neanderthalensis	1.07	45.00	44100	1900	IntCal13	46513.5	43201.33	49825.68	Le Moustier	OxA-X-21751	AMS
Homo neanderthalensis	0.29	45.50	44200	1900	IntCal13	46544.5	43261.78	49827.23	La Quina Amont	OxA-21808	AMS
Homo neanderthalensis	-0.89	43.14	44200	2000	IntCal13	46471.5	43119.43	49823.58	Gatzarria	Ox>A-25715	AMS
Homo neanderthalensis	-5.11	43.35	44330	1200	IntCal13	47322	44777.90	49866.10	La Guelga	OxA-19245	AMS
Homo neanderthalensis	2.75	42.16	44400	1900	IntCal13	46608	43385.60	49830.40	L'Arbreda	OxA-21702	AMS
Homo neanderthalensis	1.69	41.53	44500	1200	IntCal13	47394	44918.30	49869.70	Abric Romani	NZA-2315	AMS
Homo neanderthalensis	40.00	44.17	44500	2000	IntCal13	46561.5	43294.93	49828.08	Mezmaiskaya	OxA-21825	AMS
Homo neanderthalensis	17.30	40.95	44530	2040	IntCal13	46540.5	43253.98	49827.03	Le Mura	Beta-142777	AMS
Homo neanderthalensis	1.35	44.77	44700	2900	IntCal13	45995.5	42191.23	49799.78	Roc de Combe	GifA-101262	AMS
Homo neanderthalensis	1.25	44.86	44720	700	IntCal13	47960.5	46022.98	49898.03	Pech-de-l'Aze IV	OxA-V-2333-35	AMS
Homo neanderthalensis	2.59	42.28	45000	0	IntCal13	48361.5	48290.73	48432.28	Ermitons	GrA-33814	AMS
Homo neanderthalensis	-0.55	40.51	45000	0	IntCal13	48361.5	48290.73	48432.28	Los Toros	GrA-27613	AMS
Homo neanderthalensis	-2.04	43.03	45000	0	IntCal13	48361.5	48290.73	48432.28	Abauntz	GrA-16960	AMS
Homo neanderthalensis	-3.96	43.39	45000	0	IntCal13	48361.5	48290.73	48432.28	Covalejos, Cobalejos	GrA-33812	AMS
Homo neanderthalensis	1.07	45.00	45000	2100	IntCal13	46635.5	43439.23	49831.78	Le Moustier	OxA-21791	AMS
Homo neanderthalensis	1.07	45.00	45000	2100	IntCal13	46635.5	43439.23	49831.78	Le Moustier	OxA-21791	AMS
Homo neanderthalensis	-2.68	51.23	45100	1000	IntCal13	47814.5	45738.28	49890.73	Hyaena Den	OxA-13915	AMS
Homo neanderthalensis	13.91	46.11	45100	1500	IntCal13	47328.5	44790.58	49866.43	Divje Babe	RIDDL-745	AMS
Homo neanderthalensis	1.35	44.77	45100	2100	IntCal13	46666.5	43499.68	49833.33	Roc de Combe	GifA-101265	AMS
Homo neanderthalensis	1.07	45.00	45100	2300	IntCal13	46510	43194.50	49825.50	Le Moustier	OxA-X-21754	AMS
Homo neanderthalensis	3.76	47.59	45100	2800	IntCal13	46164	42519.80	49808.20	Grotte du Renne at Arcy-sur-Cure	OxA-3465	AMS
Homo neanderthalensis	16.50	43.53	45170	2780	IntCal13	46195.5	42581.23	49809.78	Mujina Pecina	GrA-9635	AMS
Homo neanderthalensis	4.75	44.48	45200	0	IntCal13	48602	48528.85	48675.15	Grotte Mandrin	OxA-21701	AMS

Homo neanderthalensis	-2.73	43.00	45200	0	IntCal13	48602	48528.85	48675.15	Arrillor	OxA-22657	AMS
Homo neanderthalensis	0.74	46.42	45200	1100	IntCal13	47755.5	45623.23	49887.78	Les Rochers de Villeneuve	OxA-15257	AMS
Homo neanderthalensis	-3.42	37.44	45200	1270	IntCal13	47593	45306.35	49879.65	Cariguela, Carihuela	Beta-74381	AMS
Homo neanderthalensis	1.07	45.00	45200	2200	IntCal13	46614	43397.30	49830.70	Le Moustier	OxA-X-21752	AMS
Homo neanderthalensis	0.29	45.50	45200	2200	IntCal13	46614	43397.30	49830.70	La Quina Amont	OxA-21807	AMS
Homo neanderthalensis	10.33	52.18	45280	1270	IntCal13	47621.5	45361.93	49881.08	Salzgitter-Lebenstedt	KIA-34483	AMS
Homo neanderthalensis	-5.34	36.12	45300	1700	IntCal13	47205	44549.75	49860.25	Gorham's Cave	OxA-6075	AMS
Homo neanderthalensis	4.75	44.48	45300	2200	IntCal13	46643.5	43454.83	49832.18	Grotte Mandrin	OxA-21691	AMS
Homo neanderthalensis	4.75	44.48	45400	0	IntCal13	48848.5	48772.03	48924.98	Grotte Mandrin	OxA-21697	AMS
Homo neanderthalensis	-2.73	43.00	45400	1800	IntCal13	47144	44430.80	49857.20	Arrillor	OxA-6251	AMS
Homo neanderthalensis	23.04	45.61	45500	3500	IntCal13	45773.5	41758.33	49788.68	Bordul Mare d'Ohaba Ponor	GrN-14626	AMS
Homo neanderthalensis	-2.73	43.00	45600	2300	IntCal13	46647.5	43462.63	49832.38	Arrillor	OxA-22655	AMS
Homo neanderthalensis	-2.73	43.00	45600	2300	IntCal13	46647.5	43462.63	49832.38	Arrillor	OxA-22658	AMS
Homo neanderthalensis	-3.97	43.29	45700	0	IntCal13	49222	49149.80	49294.20	El Castillo	OxA-10327	AMS
Homo neanderthalensis	-2.73	43.00	45700	1200	IntCal13	47827	45762.65	49891.35	Arrillor	OxA-6084	AMS
Homo neanderthalensis	17.22	49.67	45800	0	IntCal13	49339	49268.70	49409.30	Kulna	OxA-25316	AMS
Homo neanderthalensis	17.22	49.67	45800	2400	IntCal13	46621	43410.95	49831.05	Kulna	OxA-25315	AMS
Homo neanderthalensis	0.41	42.01	45900	0	IntCal13	49452.5	49382.68	49522.33	Los Moros I	OxA-5672	AMS
Homo neanderthalensis	3.76	47.59	46000	0	IntCal13	49565.5	49495.68	49635.33	Grotte du Renne at Arcy-sur-Cure	OxA-X-2270-44	AMS
Homo neanderthalensis	3.76	47.59	46000	3800	IntCal13	45671	41558.45	49783.55	Grotte du Renne at Arcy-sur-Cure	OxA-X-2279-13	AMS
Homo neanderthalensis	40.00	44.17	46200	0	IntCal13	49787.5	49719.58	49855.43	Mezmaiskaya	OxA-21822	AMS
Homo neanderthalensis	15.38	40.00	46200	2700	IntCal13	46493.5	43162.33	49824.68	La Cala	OxA-7405	AMS
Homo neanderthalensis	3.76	47.59	46200	3800	IntCal13	45726.5	41666.68	49786.33	Grotte du Renne at Arcy-sur-Cure	OxA-17485	AMS
Homo neanderthalensis	-4.07	36.57	46300	2500	CALPAL_2007_HULU	46672	43510.40	49833.60	Zafarraya	OxA-21810	AMS
Homo neanderthalensis	-5.34	36.12	46540	1800	CALPAL_2007_HULU	50263	47483.00	53043.00	Gorham's Cave	Beta-181894	AMS
Homo neanderthalensis	17.22	49.67	46600	2600	CALPAL_2007_HULU	50769	47202.00	54336.00	Kulna	OxA-22452	AMS
Homo neanderthalensis	-5.34	36.12	46700	1900	CALPAL_2007_HULU	50489	47587.00	53391.00	Gorham's Cave	OxA-8526	AMS
Homo neanderthalensis	-4.13	36.62	46700	0	CALPAL_2007_HULU	50206	47999.00	52413.00	Zafarraya	OxA-23198	AMS
Homo neanderthalensis	-2.73	43.00	46800	0	CALPAL_2007_HULU	50333	48120.00	52546.00	Arrillor	OxA-22654	AMS
Homo neanderthalensis	0.29	45.50	46900	2700	CALPAL_2007_HULU	51183	47425.00	54941.00	La Quina Y-Z [Villebois la Valette]	OxA22154	AMS
Homo neanderthalensis	4.75	44.48	47000	2700	CALPAL_2007_HULU	51303	47517.00	55089.00	Grotte Mandrin	OxA-21698	AMS
Homo neanderthalensis	-2.68	51.23	47000	1700	CALPAL_2007_HULU	50759	47984.00	53534.00	Hyaena Den	OxA-13916	AMS
Homo neanderthalensis	4.75	44.48	47100	0	CALPAL_2007_HULU	50735	48533.00	52937.00	Grotte Mandrin	OxA-21694	AMS

Homo neanderthalensis	34.12	53.34	47160	2680	CALPAL_2007_HULU	51485	47675.00	55295.00	Khotylevo 1	CURL-17369	AMS
Homo neanderthalensis	40.00	44.17	47200	2800	CALPAL_2007_HULU	51613	47658.00	55568.00	Mezmaiskaya	OxA-21823	AMS
Homo neanderthalensis	-0.89	43.14	47200	2800	CALPAL_2007_HULU	51613	47658.00	55568.00	Gatzarria	OxA-25716	AMS
Homo neanderthalensis	4.75	44.48	47300	0	CALPAL_2007_HULU	51014	48833.00	53195.00	Grotte Mandrin	OxA-21692	AMS
Homo neanderthalensis	-3.97	43.29	47300	0	CALPAL_2007_HULU	51014	48833.00	53195.00	El Castillo	OxA-10188	AMS
Homo neanderthalensis	17.30	40.95	47360	0	CALPAL_2007_HULU	51099	48926.00	53272.00	Le Mura	Beta-142776	AMS
Homo neanderthalensis	-5.11	43.35	47400	2700	CALPAL_2007_HULU	51803	47902.00	55704.00	La Guelga	OxA-20122	AMS
Homo neanderthalensis	-0.89	43.14	47400	0	CALPAL_2007_HULU	51155	48986.00	53324.00	Gatzarria	OxA-22557	AMS
Homo neanderthalensis	1.25	44.86	47400	650	CALPAL_2007_HULU	51150	49218.00	53082.00	Pech-de-l'Aze IV	OxA-V-2344-16	AMS
Homo neanderthalensis	-5.34	36.12	47410	0	CALPAL_2007_HULU	51169	49001.00	53337.00	Gorham's Cave	Beta-184040	AMS
Homo neanderthalensis	9.02	45.93	47800	2600	CALPAL_2007_HULU	52286	48401.00	56171.00	Caverna Generosa	UtC-10763	AMS
Homo neanderthalensis	17.22	49.67	47800	0	CALPAL_2007_HULU	51711	49578.00	53844.00	Kulna	OxA-25317	AMS
Homo neanderthalensis	17.22	49.67	47800	0	CALPAL_2007_HULU	51711	49578.00	53844.00	Kulna	OxA-25313	AMS
Homo neanderthalensis	5.69	50.59	47900	3500	CALPAL_2007_HULU	52946	47978.00	57914.00	Grotte Walou	OxA-21608	AMS
Homo neanderthalensis	-5.34	36.12	47900	2100	CALPAL_2007_HULU	52157	48868.00	55446.00	Gorham's Cave	OxA-205	AMS
Homo neanderthalensis	17.22	49.67	47900	0	CALPAL_2007_HULU	51843	49710.00	53976.00	Kulna	OxA-22455	AMS
Homo neanderthalensis	4.75	44.48	48000	0	CALPAL_2007_HULU	51973	49837.00	54109.00	Grotte Mandrin	OxA-X-2287-24	AMS
Homo neanderthalensis	4.75	44.48	48200	0	CALPAL_2007_HULU	52226	50074.00	54378.00	Grotte Mandrin	OxA-21695	AMS
Homo neanderthalensis	0.29	45.50	48300	0	CALPAL_2007_HULU	52351	50188.00	54514.00	La Quina	OxA-16999	AMS
Homo neanderthalensis	11.40	51.81	48400	3700	CALPAL_2007_HULU	53773	48358.00	59188.00	Konigsaue	OxA-7125	AMS
Homo neanderthalensis	-5.31	43.38	48400	3200	CALPAL_2007_HULU	53578	48714.00	58442.00	El Sidron	OxA-21776	AMS
Homo neanderthalensis	23.02	45.11	48500	3900	CALPAL_2007_HULU	53920	48319.00	59521.00	Cioarei-Borosteni	OxA-3840-41	AMS
Homo neanderthalensis	-2.73	43.00	48500	3200	CALPAL_2007_HULU	53760	48833.00	58687.00	Arrillor	OxA-22656	AMS
Homo neanderthalensis	-5.31	43.38	48500	2600	CALPAL_2007_HULU	53372	49292.00	57452.00	El Sidron	GifA-99167	AMS
Homo neanderthalensis	4.75	44.48	48600	0	CALPAL_2007_HULU	52722	50515.00	54929.00	Grotte Mandrin	OxA-21693	AMS
Homo neanderthalensis	-2.68	51.23	48600	1000	CALPAL_2007_HULU	52722	50515.00	54929.00	Hyaena Den	OxA-13917	AMS
Homo neanderthalensis	3.76	47.59	48700	3600	CALPAL_2007_HULU	54182	48758.00	59606.00	Grotte du Renne at Arcy-sur-Cure	OxA-X-2279-44	AMS
Homo neanderthalensis	0.29	45.50	48900	3400	CALPAL_2007_HULU	54460	49146.00	59774.00	La Quina Amont	OxA-22155	AMS
Homo neanderthalensis	23.02	45.11	48900	2100	CALPAL_2007_HULU	53723	50173.00	57273.00	Cioarei-Borosteni	GrN-15053	AMS
Homo neanderthalensis	0.25	45.45	49000	3400	CALPAL_2007_HULU	54591	49263.00	59919.00	Chauverie	OxA-23693	AMS
Homo neanderthalensis	4.75	44.48	49000	0	CALPAL_2007_HULU	53233	50934.00	55532.00	Grotte Mandrin	OxA-X-2286-15	AMS
Homo neanderthalensis	17.22	49.67	49100	0	CALPAL_2007_HULU	53368	51039.00	55697.00	Kulna	OxA-25314	AMS
Homo neanderthalensis	17.22	49.67	49200	0	CALPAL_2007_HULU	53505	51144.00	55866.00	Kulna	OxA-22454	AMS
Homo neanderthalensis	17.22	49.67	49300	0	CALPAL_2007_HULU	53645	51249.00	56041.00	Kulna	OxA-22453	AMS

Homo neanderthalensis	17.22	49.67	49300	0	CALPAL_2007_HULU	53645	51249.00	56041.00	Kulna	OxA-25325	AMS
Homo neanderthalensis	-4.13	36.62	49300	0	CALPAL_2007_HULU	53645	51249.00	56041.00	Zafarraya	OxA-21813	AMS
Homo neanderthalensis	-3.32	40.95	49400	3700	CALPAL_2007_HULU	54929	49454.00	60404.00	Jarama VI	OxA-X-2310-22	AMS
Homo neanderthalensis	0.29	45.50	49600	0	CALPAL_2007_HULU	54096	51578.00	56614.00	La Quina	OxA-17001	AMS
Homo neanderthalensis	17.22	49.67	49900	0	CALPAL_2007_HULU	54650	51924.00	57376.00	Kulna	OxA-25319	AMS
Homo neanderthalensis	17.22	49.67	49900	0	CALPAL_2007_HULU	54650	51924.00	57376.00	Kulna	OxA-25324	AMS
Homo neanderthalensis	17.22	49.67	49900	0	CALPAL_2007_HULU	54650	51924.00	57376.00	Kulna	OxA-26960	AMS
Homo neanderthalensis	4.75	44.48	49900	0	CALPAL_2007_HULU	54650	51924.00	57376.00	Grotte Mandrin	OxA-21696	AMS
Homo neanderthalensis	1.07	45.00	50000	3900	CALPAL_2007_HULU	55333	49898.00	60768.00	Le Moustier	OxA-X-21750	AMS
Homo neanderthalensis	0.25	45.45	50000	3900	CALPAL_2007_HULU	55333	49898.00	60768.00	Chauverie	OxA-24096	AMS
Homo neanderthalensis	17.22	49.67	50000	0	CALPAL_2007_HULU	54907	52045.00	57769.00	Kulna	OxA-25312	AMS
Homo neanderthalensis	17.22	49.67	50000	0	CALPAL_2007_HULU	54907	52045.00	57769.00	Kulna	OxA-25322	AMS
Homo neanderthalensis	1.35	44.77	50000	400	CALPAL_2007_HULU	54489	52234.00	56744.00	Roc de Combe	GifA-101261	AMS
Homo neanderthalensis	-0.89	43.14	50300	0	CALPAL_2007_HULU	53233	50934.00	55532.00	Gatzarria	OxA-22558	AMS
Homo sapiens	22.81	37.69	32690	110	IntCal13	36631	36233.90	37028.10	Klisoura Cave 1, Klissoura Cave 1	AA-75629	AMS
Homo sapiens	-5.81	36.75	32840	210	IntCal13	37085	36152.10	38017.90	Cueva del Higueral de Valleja	OxA-12362	AMS
Homo sapiens	4.42	44.39	32870	200	IntCal13	37109.5	36201.78	38017.23	Chauvet	OxA-13976	AMS
Homo sapiens	1.50	38.06	32890	200	IntCal13	37136.5	36221.18	38051.83	Cueva Anton	OxA-21244	AMS
Homo sapiens	4.42	44.39	33000	0	IntCal13	36930.5	36871.13	36989.88	Chauvet	GifA-13133/SacA-33761	AMS
Homo sapiens	3.76	47.59	33010	182	IntCal13	37251.5	36356.13	38146.88	Grotte du Renne, Arcy-sur-Cure	EVA-93	AMS
Homo sapiens	9.75	48.38	33090	260	IntCal13	37323	36268.50	38377.50	Hohle Fels, Hohler Fels	KIA-16036	AMS
Homo sapiens	0.81	41.93	33090	350	IntCal13	37301	36066.95	38535.05	Cova Gran de Santa Linya	Beta-195431	AMS
Homo sapiens	39.03	51.39	33120	220	IntCal13	37348	36368.55	38327.45	Kostenki (Kostienki) 14 (Markina Gora)	GrA-20140	AMS
Homo sapiens	22.81	37.69	33150	120	IntCal13	37364	36648.65	38079.35	Klisoura Cave 1, Klissoura Cave 1	AA-75628	AMS
Homo sapiens	9.78	48.39	33210	300	IntCal13	37405	36282.10	38527.90	Geissenklosterle	KIA-8961	AMS
Homo sapiens	9.75	48.38	33290	270	IntCal13	37463	36396.15	38529.85	Hohle Fels, Hohler Fels	KIA-16035	AMS
Homo sapiens	10.97	45.51	33300	400	IntCal13	37480	36143.35	38816.65	Fumane	OxA-8021	AMS
Homo sapiens	-3.53	43.32	33320	310	IntCal13	37486.5	36342.23	38630.78	Cobrante	GrA-22442	AMS
Homo sapiens	4.42	44.39	33380	460	IntCal13	37584.5	36073.53	39095.48	Chauvet	GifA-9225/SacA-14234	AMS
Homo sapiens	9.78	48.39	33380	390	IntCal13	37554	36229.70	38878.30	Geissenklosterle	OxA-18718	AMS
Homo sapiens	9.78	48.39	33430	480	IntCal13	37659	36071.55	39246.45	Geissenklosterle	KIA-19558	AMS

Homo sapiens	1.01	44.94	33450	500	IntCal13	37689	36034.10	39343.90	Abri Pataud	OxA-21670	AMS
Homo sapiens	1.01	44.94	33500	500	IntCal13	37749	36089.35	39408.65	Abri Pataud	OxA-21602	AMS
Homo sapiens	1.11	45.00	33600	500	IntCal13	37852.5	36174.33	39530.68	Labattut, Labatut	OxA-21768	AMS
Homo sapiens	-0.69	43.64	33600	240	IntCal13	37750.5	36767.73	38733.28	Hyenes	Gif/LSM-11034	AMS
Homo sapiens	-1.89	43.27	33605	165	IntCal13	37821.5	37062.93	38580.08	Aitzbitarte III Ext	Ua-21158	AMS
Homo sapiens	0.94	44.95	33610	340	IntCal13	37752.5	36484.73	39020.28	Ferrassie	OxA-15218	AMS
Homo sapiens	10.97	45.51	33640	440	IntCal13	37866.5	36321.33	39411.68	Fumane	OxA-8053	AMS
Homo sapiens	1.01	44.94	33650	500	IntCal13	37901.5	36213.83	39589.18	Abri Pataud	OxA-21679	AMS
Homo sapiens	3.77	47.59	33670	450	IntCal13	37901.5	36324.03	39478.98	Bison, Arcy-sur-Ceure	Beta-180086	AMS
Homo sapiens	58.22	58.15	33670	300	IntCal13	37809	36640.50	38977.50	Kumyshanskaya	OxA-10929	AMS
Homo sapiens	19.91	50.06	33690	120	IntCal13	38091	37615.05	38566.95	Krakow Spadzista trench	Poz-51376	AMS
Homo sapiens	10.97	45.51	33700	350	IntCal13	37863.5	36533.03	39193.98	Fumane	LTL-566A	AMS
Homo sapiens	10.97	45.51	33700	350	IntCal13	37863.5	36533.03	39193.98	Fumane	OxA-6463	AMS
Homo sapiens	-8.52	39.48	33720	410	IntCal13	37927.5	36426.98	39428.03	Fonte Santa	UCIAMS-11216	AMS
Homo sapiens	26.00	47.04	33775	408	IntCal13	37980.5	36468.58	39492.43	Ceahlau Dirtu, Ceahlau-Dartu	Erl-12165	AMS
Homo sapiens	2.75	42.16	33800	550	IntCal13	38057	36229.20	39884.80	Arbreda	OxA-21674	AMS
Homo sapiens	-0.89	43.14	33800	550	IntCal13	38057	36229.20	39884.80	Gatzarria	OxA-22553	AMS
Homo sapiens	1.98	41.30	33800	350	IntCal13	37989.5	36624.83	39354.18	Canyars	Beta-273965	AMS
Homo sapiens	10.97	45.51	33890	220	IntCal13	38177.5	37329.63	39025.38	Fumane	OxA-17981	AMS
Homo sapiens	9.78	48.39	33900	280	IntCal13	38119.5	36978.08	39260.93	Geissenklosterle	KIA-17302	AMS
Homo sapiens	-0.12	38.92	33900	310	IntCal13	38119.5	36871.68	39367.33	Foradada	Beta-132349	AMS
Homo sapiens	10.17	48.52	33920	270	IntCal13	38148	37042.20	39253.80	Hohlenstein-Stadel	KIA-8949	AMS
Homo sapiens	-5.81	36.75	33950	20	IntCal13	38482.5	38422.18	38542.83	Cueva del Higueral de Valleja	OxA-12271	AMS
Homo sapiens	9.78	48.39	33950	550	IntCal13	38197	36338.80	40055.20	Geissenklosterle	OxA-21724	AMS
Homo sapiens	34.40	45.00	34050	260	IntCal13	38428	37449.50	39406.50	Buran Kaya III	GrA-40485	AMS
Homo sapiens	1.01	44.94	34050	550	IntCal13	38284	36406.80	40161.20	Abri Pataud	OxA-21672	AMS
Homo sapiens	9.78	48.39	34080	300	IntCal13	38375	37191.30	39558.70	Geissenklosterle	KIA-13076	AMS
Homo sapiens	2.75	42.16	34100	750	IntCal13	38407.5	36052.93	40762.08	Arbreda	AA-3777	AMS
Homo sapiens	17.30	48.52	34100	320	IntCal13	38373	37110.45	39635.55	Dzerava skala	Beta-173341	AMS
Homo sapiens	9.78	48.39	34100	550	IntCal13	38328.5	36442.28	40214.73	Geissenklosterle	OxA-21727	AMS
Homo sapiens	0.29	45.50	34130	700	IntCal13	38433.5	36200.53	40666.48	La Quina Aval	AA-3639	AMS
Homo sapiens	39.03	51.39	34140	340	IntCal13	38408.5	37087.53	39729.48	Kostenki (Kostienki) 14 (Markina Gora)	Beta-177778	AMS
Homo sapiens	1.01	44.94	34150	550	IntCal13	38374	36478.75	40269.25	Abri Pataud	OxA-21601	AMS
Homo sapiens	10.97	45.51	34180	270	IntCal13	38637.5	37687.98	39587.03	Fumane	OxA-19414	AMS
Homo sapiens	9.75	48.38	34190	340	IntCal13	38491	37200.90	39781.10	Hohle Fels, Hohler Fels	KIA-18880	AMS

Homo sapiens	11.90	51.30	34200	550	IntCal13	38421.5	36518.18	40324.83	Geiseltal	OxA-21726	AMS
Homo sapiens	1.01	44.94	34200	550	IntCal13	38421.5	36518.18	40324.83	Abri Pataud	OxA-21600	AMS
Homo sapiens	9.78	48.39	34220	310	IntCal13	38637	37536.90	39737.10	Geissenklosterle	KIA-8959	AMS
Homo sapiens	5.56	47.17	34250	550	IntCal13	38472	36561.55	40382.45	Grotte des Gorges	OxA-22997	AMS
Homo sapiens	-0.89	43.14	34250	550	IntCal13	38472	36561.55	40382.45	Gatzarria	OxA-22556	AMS
Homo sapiens	1.01	44.94	34300	600	IntCal13	38550	36503.70	40596.30	Abri Pataud	OxA-21671	AMS
Homo sapiens	1.10	44.99	34320	520	IntCal13	38549	36716.45	40381.55	Castanet	GifA-99166	AMS
Homo sapiens	9.78	48.39	34330	310	IntCal13	38811.5	37775.53	39847.48	Geissenklosterle	KIA-13075	AMS
Homo sapiens	-0.89	43.14	34400	550	IntCal13	38649.5	36726.23	40572.78	Gatzarria	OxA-22555	AMS
Homo sapiens	10.97	45.51	34500	270	IntCal13	39101	38294.45	39907.55	Fumane	OxA-19410	AMS
Homo sapiens	1.01	44.94	34500	600	IntCal13	38768	36701.75	40834.25	Abri Pataud	OxA-21596	AMS
Homo sapiens	0.55	44.86	34540	330	IntCal13	39113	38109.80	40116.20	Cantalouette II	OxA-23643	AMS
Homo sapiens	5.56	47.17	34550	600	IntCal13	38828	36765.55	40890.45	Grotte des Gorges	OxA-22996	AMS
Homo sapiens	39.03	51.39	34550	610	IntCal13	38825.5	36735.03	40915.98	Kostenki (Kostienki) 14 (Markina Gora)	GrA-13297	AMS
Homo sapiens	39.03	51.39	34550	610	IntCal13	38825.5	36735.03	40915.98	Kostenki (Kostienki) 14 (Markina Gora)	GrA-13279	AMS
Homo sapiens	9.75	48.38	34570	260	IntCal13	39165	38381.25	39948.75	Hohle Fels, Hohler Fels	OxA-19859	AMS
Homo sapiens	22.81	37.69	34580	220	IntCal13	39150.5	38462.23	39838.78	Klisoura Cave 1, Klissoura Cave 1	OxA-21068	AMS
Homo sapiens	-5.34	36.12	34600	900	IntCal13	38851.5	36205.28	41497.73	Gorham's Cave	OxA-10295	AMS
Homo sapiens	-2.48	43.06	34650	600	IntCal13	38947.5	36900.73	40994.28	Labeko Koba	OxA-21779	AMS
Homo sapiens	9.75	48.38	34720	280	IntCal13	39303	38451.80	40154.20	Hohle Fels, Hohler Fels	OxA-19779	AMS
Homo sapiens	1.01	44.94	34750	600	IntCal13	39062	37037.55	41086.45	Abri Pataud	OxA-21598	AMS
Homo sapiens	-2.48	43.06	34750	600	IntCal13	39062	37037.55	41086.45	Labeko Koba	OxA-21767	AMS
Homo sapiens	3.76	47.59	34750	750	IntCal13	38976.5	36589.63	41363.38	Grotte du Renne, Arcy-sur-Cure	OxA-21591	AMS
Homo sapiens	9.78	48.39	34770	310	IntCal13	39360	38432.80	40287.20	Geissenklosterle	KIA-16030	AMS
Homo sapiens	4.42	44.39	34790	250	IntCal13	39346	38551.80	40140.20	Chauvet	GrA-34333	AMS
Homo sapiens	9.78	48.39	34800	290	IntCal13	39374.5	38487.68	40261.33	Geissenklosterle	KIA-13074	AMS
Homo sapiens	9.78	48.39	34800	600	IntCal13	39121.5	37112.73	41130.28	Geissenklosterle	OxA-21742	AMS
Homo sapiens	2.75	42.16	34800	780	IntCal13	39011.5	36571.43	41451.58	Arbreda	SANU-29017	AMS
Homo sapiens	1.98	41.30	34810	360	IntCal13	39424	38367.60	40480.40	Canyars	OxA-23644	AMS
Homo sapiens	0.63	43.23	34810	210	IntCal13	39345.5	38643.93	40047.08	Grotte du Putois IV	EVA-95	AMS
Homo sapiens	-2.68	51.23	34810	540	IntCal13	39286	37557.00	41015.00	Hyaena Den	GifA-101094	AMS
Homo sapiens	1.01	44.94	34850	600	IntCal13	39194.5	37217.08	41171.93	Abri Pataud	OxA-21599	AMS

Homo sapiens	20.38	48.12	34890	250	IntCal13	39431	38622.55	40239.45	Istallosko	OxA-X-2244-32	AMS
Homo sapiens	39.03	51.39	34900	350	IntCal13	39506	38452.45	40559.55	Kostenki (Kostienki) 14 (Markina Gora)	GrA-6895	AMS
Homo sapiens	1.98	41.30	34900	340	IntCal13	39496.5	38469.08	40523.93	Canyars	OxA-24057	AMS
Homo sapiens	17.30	48.52	34900	600	IntCal13	39302.5	37389.68	41215.33	Dzerava skala	Poz-8793	AMS
Homo sapiens	9.78	48.39	34900	600	IntCal13	39302.5	37389.68	41215.33	Geissenklosterle	OxA-21738	AMS
Homo sapiens	34.40	45.00	34910	950	IntCal13	39074.5	36361.78	41787.23	Buran Kaya III	GifA-80181/SacA-12260	AMS
Homo sapiens	3.64	46.41	34940	330	IntCal13	39526	38511.40	40540.60	Fees	OxA-14166	AMS
Homo sapiens	10.97	45.51	34940	280	IntCal13	39491	38600.85	40381.15	Fumane	OxA-19412	AMS
Homo sapiens	39.03	51.39	34940	630	IntCal13	39282	37263.25	41300.75	Kostenki (Kostienki) 14 (Markina Gora)	GrA-13302	AMS
Homo sapiens	43.25	42.34	34950	600	IntCal13	39394.5	37532.03	41256.98	Bondi Cave	OxA-23904	AMS
Homo sapiens	1.98	41.30	34980	350	IntCal13	39584	38504.80	40663.20	Canyars	OxA-2416-44	AMS
Homo sapiens	23.13	37.42	34980	220	IntCal13	39499.5	38750.43	40248.58	Franchthi	OxA-20253	AMS
Homo sapiens	1.01	44.94	35000	600	IntCal13	39473.5	37649.03	41297.98	Abri Pataud	OxA-21579	AMS
Homo sapiens	-3.97	43.29	35000	600	IntCal13	39473.5	37649.03	41297.98	El Castillo	OxA-21713	AMS
Homo sapiens	1.01	44.94	35000	650	IntCal13	39342	37300.45	41383.55	Abri Pataud	OxA-21597	AMS
Homo sapiens	9.78	48.39	35010	380	IntCal13	39634.5	38475.03	40793.98	Geissenklosterle	KIA-17304	AMS
Homo sapiens	9.78	48.39	35050	600	IntCal13	39545	37751.40	41338.60	Geissenklosterle	OxA-21659	AMS
Homo sapiens	9.78	48.39	35060	370	IntCal13	39672.5	38524.43	40820.58	Geissenklosterle	KIA-16031	AMS
Homo sapiens	17.96	40.16	35080	230	IntCal13	39597.5	38808.53	40386.48	Cavallo	OxA-19254	AMS
Homo sapiens	-2.48	43.06	35100	600	IntCal13	39610	37843.00	41377.00	Labeko Koba	OxA-21778	AMS
Homo sapiens	4.42	44.39	35160	650	IntCal13	39617	37724.60	41509.40	Chauvet	GrA-32815	AMS
Homo sapiens	10.97	45.51	35180	220	IntCal13	39698	38924.70	40471.30	Fumane	OxA-17570	AMS
Homo sapiens	-8.28	51.85	35200	950	IntCal13	39270	36573.90	41966.10	Castlepook	OxA-4236	AMS
Homo sapiens	1.10	44.99	35200	1100	IntCal13	39244.5	36319.93	42169.08	Castanet	GifA-97313	AMS
Homo sapiens	-2.48	43.06	35250	650	IntCal13	39732.5	37889.03	41575.98	Labeko Koba	OxA-21840	AMS
Homo sapiens	3.48	45.17	35250	850	IntCal13	39382.5	36899.68	41865.33	Blot	OxA-3460	AMS
Homo sapiens	39.03	51.39	35280	330	IntCal13	39853.5	38754.83	40952.18	Kostenki (Kostienki) 14 (Markina Gora)	OxA-9569	AMS
Homo sapiens	20.68	52.57	35300	230	IntCal13	39842.5	39023.13	40661.88	Cieksyn	OS-84009	AMS
Homo sapiens	43.25	42.34	35300	650	IntCal13	39798.5	37984.48	41612.53	Bondi Cave	OxA-650	AMS
Homo sapiens	39.03	51.39	35330	240	IntCal13	39879.5	39025.93	40733.08	Kostenki (Kostienki) 14 (Markina Gora)	GrA-15958	AMS
Homo sapiens	3.76	47.59	35380	390	IntCal13	39953	38713.25	41192.75	Grotte du Renne, Arcy-sur-Cure	EVA-54	AMS
Homo sapiens	-2.48	43.06	35400	650	IntCal13	39939	38191.95	41686.05	Labeko Koba	OxA-21793	AMS

Homo sapiens	1.01	44.94	35400	750	IntCal13	39771	37710.45	41831.55	Abri Pataud	OxA-15216	AMS
Homo sapiens	1.69	41.53	35400	810	IntCal13	39612.5	37316.83	41908.18	Abric Romani	AA-8037A	AMS
Homo sapiens	1.26	44.88	35400	1100	IntCal13	39382	36463.60	42300.40	Caminade [Caneda]	GifA-97186	AMS
Homo sapiens	3.76	47.59	35450	750	IntCal13	39834	37803.85	41864.15	Grotte du Renne, Arcy-sur-Cure	OxA-X-2279-14	AMS
Homo sapiens	10.97	45.51	35450	1180	IntCal13	39403.5	36368.73	42438.28	Fumane	LTL-569A	AMS
Homo sapiens	2.75	42.16	35480	820	IntCal13	39733.5	37492.93	41974.08	Arbreda	OxA-3730	AMS
Homo sapiens	3.76	47.59	35500	216	IntCal13	40095.5	39335.03	40855.98	Grotte du Renne, Arcy-sur-Cure	EVA-29	AMS
Homo sapiens	39.02	51.39	35540	260	IntCal13	40124	39216.75	41031.25	Kostenki (Kostienki) 12 (Volkovskaya site)	OxA-15555	AMS
Homo sapiens	3.64	46.41	35540	280	IntCal13	40114	39145.00	41083.00	Fees	OxA-14318	AMS
Homo sapiens	-7.50	52.25	35570	110	IntCal13	40172.5	39780.63	40564.38	Ballynamintra	OxA-4252	AMS
Homo sapiens	23.13	37.42	35600	250	IntCal13	40204.5	39344.28	41064.73	Franchthi	OxA-20616	AMS
Homo sapiens	17.30	48.52	35600	400	IntCal13	40128	38869.25	41386.75	Dzerava skala	OxA-17963	AMS
Homo sapiens	12.28	52.82	35610	300	IntCal13	40178.5	39166.28	41190.73	Glasewitz	OxA-21308	AMS
Homo sapiens	10.97	45.51	35640	220	IntCal13	40267	39510.80	41023.20	Fumane	OxA-17569	AMS
Homo sapiens	6.06	51.15	35680	630	IntCal13	40174	38506.75	41841.25	Herkenbosch	Beta-178807	AMS
Homo sapiens	9.78	48.39	35700	550	IntCal13	40190.5	38651.98	41729.03	Geissenklosterle	OxA-18716	AMS
Homo sapiens	3.76	47.59	35700	650	IntCal13	40185.5	38488.33	41882.68	Grotte du Renne, Arcy-sur-Cure	OxA-17576	AMS
Homo sapiens	2.75	42.16	35700	830	IntCal13	40012.5	37891.63	42133.38	Arbreda	SANU-29016	AMS
Homo sapiens	9.75	48.38	35710	340	IntCal13	40256	39157.80	41354.20	Hohle Fels, Hohler Fels	KIA-16034	AMS
Homo sapiens	1.01	44.94	35750	700	IntCal13	40212	38438.35	41985.65	Abri Pataud	OxA-21578	AMS
Homo sapiens	9.75	48.38	35760	660	IntCal13	40222	38510.10	41933.90	Hohle Fels, Hohler Fels	KIA-19564	AMS
Homo sapiens	22.33	43.58	35780	320	IntCal13	40348.5	39328.68	41368.33	Baranica	OxA-13828	AMS
Homo sapiens	-5.83	43.31	35800	1000	IntCal13	39787.5	37148.88	42426.13	La Vina	GifA-95550	AMS
Homo sapiens	39.02	51.39	35820	230	IntCal13	40448	39686.10	41209.90	Kostenki (Kostienki) 12 (Volkovskaya site)	OxA-15482	AMS
Homo sapiens	10.97	45.51	35850	310	IntCal13	40435.5	39467.93	41403.08	Fumane	OxA-19584	AMS
Homo sapiens	2.75	42.16	35850	700	IntCal13	40276	38504.25	42047.75	Arbreda	OxA-21665	AMS
Homo sapiens	39.03	51.39	35870	250	IntCal13	40487.5	39680.48	41294.53	Kostenki (Kostienki) 14 (Markina Gora)	GrA-15962	AMS
Homo sapiens	2.75	42.16	35900	650	IntCal13	40310.5	38615.23	42005.78	Arbreda	OxA-21664	AMS
Homo sapiens	2.75	42.16	35900	860	IntCal13	40222	38132.95	42311.05	Arbreda	SANU-29019	AMS
Homo sapiens	0.29	45.50	35950	450	IntCal13	40415	39096.40	41733.60	La Quina Aval	OxA-10261/LYON-1367	AMS
Homo sapiens	17.96	40.16	36000	400	IntCal13	40508.5	39333.83	41683.18	Cavallo	OxA-19258	AMS
Homo sapiens	1.20	45.13	36000	450	IntCal13	40461	39153.80	41768.20	Badegoule-Ouest	OxA-11963	AMS

Homo sapiens	2.75	42.16	36000	700	IntCal13	40370.5	38598.28	42142.73	Arbreda	OxA-21784	AMS
Homo sapiens	39.03	51.39	36010	250	IntCal13	40615.5	39827.48	41403.53	Kostenki (Kostienki) 14 (Markina Gora)	GrA-15965	AMS
Homo sapiens	39.03	51.39	36040	250	IntCal13	40641.5	39857.28	41425.73	Kostenki (Kostienki) 14 (Markina Gora)	GrA-15957	AMS
Homo sapiens	9.78	48.39	36100	700	IntCal13	40436.5	38665.23	42207.78	Geissenklosterle	OxA-21743	AMS
Homo sapiens	22.70	43.65	36200	540	IntCal13	40569	39105.05	42032.95	Kozarnika	Gif-99706	AMS
Homo sapiens	17.96	40.16	36260	250	IntCal13	40839	40083.75	41594.25	Cavallo	OxA-19255	AMS
Homo sapiens	39.02	51.39	36280	360	IntCal13	40799.5	39788.23	41810.78	Kostenki (Kostienki) 12 (Volkovskaya site)	GrA-5551	AMS
Homo sapiens	8.80	52.34	36300	600	IntCal13	40613	39037.90	42188.10	Hahnenhugel und Sumpfmoor, Nordhemmern	Fra-24	AMS
Homo sapiens	39.03	51.39	36320	270	IntCal13	40881	40084.90	41677.10	Kostenki (Kostienki) 14 (Markina Gora)	GrA-15956	AMS
Homo sapiens	9.75	48.38	36350	540	IntCal13	40709	39286.85	42131.15	Hohle Fels, Hohler Fels	KIA-19563	AMS
Homo sapiens	9.75	48.38	36380	380	IntCal13	40869.5	39829.73	41909.28	Hohle Fels, Hohler Fels	KIA-19562	AMS
Homo sapiens	10.97	45.51	36450	400	IntCal13	40913.5	39842.38	41984.63	Fumane	LTL-573A	AMS
Homo sapiens	9.78	48.39	36490	350	IntCal13	40976.5	40020.33	41932.68	Geissenklosterle	KIA-17303	AMS
Homo sapiens	3.76	47.59	36500	1300	IntCal13	40240.5	37096.48	43384.53	Grotte du Renne, Arcy-sur-Cure	OxA-21569	AMS
Homo sapiens	-1.20	43.37	36510	610	IntCal13	40795	39244.60	42345.40	Isturitz	GifA-98232	AMS
Homo sapiens	3.76	47.59	36540	248	IntCal13	41077.5	40358.83	41796.18	Grotte du Renne, Arcy-sur-Cure	EVA-38	AMS
Homo sapiens	39.03	51.39	36540	270	IntCal13	41065.5	40295.53	41835.48	Kostenki (Kostienki) 14 (Markina Gora)	GrA-15961	AMS
Homo sapiens	9.78	48.39	36560	410	IntCal13	40995	39919.60	42070.40	Geissenklosterle	KIA-16032	AMS
Homo sapiens	1.69	41.53	36590	640	IntCal13	40843.5	39242.28	42444.73	Abric Romani	NzA-2311	AMS
Homo sapiens	-3.86	43.36	36590	770	IntCal13	40758.5	38887.48	42629.53	Cueva Morin	GifA-96263	AMS
Homo sapiens	9.78	48.39	36650	750	IntCal13	40813	38986.15	42639.85	Geissenklosterle	OxA-21745	AMS
Homo sapiens	0.31	45.06	36650	1000	IntCal13	40771.5	38532.83	43010.18	Grotte du Diable	GxA-8369	AMS
Homo sapiens	9.78	48.39	36700	450	IntCal13	41086	39945.05	42226.95	Geissenklosterle	KIA-17299	AMS
Homo sapiens	3.76	47.59	36700	900	IntCal13	40808.5	38722.78	42894.23	Grotte du Renne, Arcy-sur-Cure	OxA-17578	AMS
Homo sapiens	34.40	45.00	36700	1500	IntCal13	40417.5	36767.13	44067.88	Buran Kaya III	OXA-6868	AMS
Homo sapiens	1.69	41.53	36740	920	IntCal13	40833.5	38714.53	42952.48	Abric Romani	AA-6608	AMS
Homo sapiens	17.96	40.16	36780	310	IntCal13	41235	40415.15	42054.85	Cavallo	OxA-20631	AMS
Homo sapiens	0.84	46.88	36800	450	IntCal13	41168.5	40043.23	42293.78	Benagu-Le-Lavier	OxA-13512	AMS
Homo sapiens	-1.20	43.37	36800	860	IntCal13	40885.5	38867.23	42903.78	Isturitz	AA-69181	AMS
Homo sapiens	9.78	48.39	36820	400	IntCal13	41215	40203.25	42226.75	Geissenklosterle	KIA-17300	AMS

Homo sapiens	10.97	45.51	36850	350	IntCal13	41266	40367.30	42164.70	Fumane	LTL-577A	AMS
Homo sapiens	9.78	48.39	36850	750	IntCal13	40984	39194.20	42773.80	Geissenklosterle	OxA-21744	AMS
Homo sapiens	9.78	48.39	36850	800	IntCal13	40950.5	39051.93	42849.08	Geissenklosterle	OxA-21746	AMS
Homo sapiens	10.17	48.52	36910	490	IntCal13	41236	40039.95	42432.05	Hohlenstein-Stadel	KIA-8950	AMS
Homo sapiens	-1.20	43.37	36990	720	IntCal13	41153.5	39480.08	42826.93	Isturitz	AA-69185	AMS
Homo sapiens	-1.20	43.37	37000	1600	IntCal13	40674	36846.45	44501.55	Isturitz	AA-69179	AMS
Homo sapiens	-4.50	36.63	37005	1790	IntCal13	40659.5	36492.33	44826.68	Bajondillo	Ua-28270	AMS
Homo sapiens	13.17	51.37	37050	450	IntCal13	41372.5	40284.28	42460.73	DÃ¼rrenberg	OxA-19630	AMS
Homo sapiens	10.97	45.51	37100	240	IntCal13	41579.5	41016.63	42142.38	Fumane	OS-5872	AMS
Homo sapiens	22.70	43.65	37170	700	IntCal13	41326.5	39731.93	42921.08	Kozarnika	GifA-101050	AMS
Homo sapiens	-8.28	51.85	37200	200	IntCal13	41682	41227.90	42136.10	Castlepook	OxA-5740	AMS
Homo sapiens	-1.21	53.25	37200	1300	IntCal13	41298	38414.75	44181.25	Creswell Crags	OxA-3417	AMS
Homo sapiens	1.26	44.88	37200	1500	IntCal13	41054.5	37592.23	44516.78	Caminade [Caneda]	GifA-97185	AMS
Homo sapiens	-5.81	36.75	37220	290	IntCal13	41645.5	40983.83	42307.18	Cueva del Higueral de Valleja	OxA-12272	AMS
Homo sapiens	39.03	51.39	37240	430	IntCal13	41541	40531.15	42550.85	Kostenki (Kostienki) 14 (Markina Gora)	GrA-10948	AMS
Homo sapiens	1.69	41.53	37290	990	IntCal13	41280.5	39001.93	43559.08	Abric Romani	AA-7395	AMS
Homo sapiens	4.42	44.39	37300	340	IntCal13	41677	40908.45	42445.55	Chauvet	GrA-33650	AMS
Homo sapiens	10.97	45.51	37300	450	IntCal13	41577	40533.90	42620.10	Fumane	LTL-568A	AMS
Homo sapiens	9.78	48.39	37300	800	IntCal13	41382.5	39589.38	43175.63	Geissenklosterle	OxA-21721	AMS
Homo sapiens	9.78	48.39	37300	1800	IntCal13	40893	36694.00	45092.00	Geissenklosterle	OxA-5163	AMS
Homo sapiens	-1.20	43.37	37300	1800	IntCal13	40893	36694.00	45092.00	Isturitz	AA-69180	AMS
Homo sapiens	0.94	44.95	37379	382	IntCal13	41711.5	40859.83	42563.18	Ferrassie	S-EVA-26510	AMS
Homo sapiens	9.78	48.39	37400	800	IntCal13	41474.5	39694.68	43254.33	Geissenklosterle	OxA-21725	AMS
Homo sapiens	-5.81	36.75	37410	240	IntCal13	41820.5	41299.43	42341.58	Higueral de Valleja	Beta-318022	AMS
Homo sapiens	4.42	44.39	37410	290	IntCal13	41802.5	41174.08	42430.93	Chauvet	GrA-23135	AMS
Homo sapiens	-3.50	50.38	37500	900	IntCal13	41550	39523.65	43576.35	Bench Quarry, Bench Tunnel Cavern	OxA-13324	AMS
Homo sapiens	-1.20	43.37	37580	780	IntCal13	41647	39923.70	43370.30	Isturitz	AA-69183	AMS
Homo sapiens	1.61	42.96	37600	1300	IntCal13	41603	38680.80	44525.20	Carane 3	LYON-856	AMS
Homo sapiens	-1.49	38.07	37640	230	IntCal13	41984.5	41498.58	42470.43	La Boja	VERA-5789	AMS
Homo sapiens	25.42	42.93	37650	1450	IntCal13	41669	38498.85	44839.15	Bacho Kiro	OxA-3183	AMS
Homo sapiens	2.75	42.16	37700	1000	IntCal13	41760.5	39459.13	44061.88	Arbreda	AA-3779	AMS
Homo sapiens	2.75	42.16	37700	1000	IntCal13	41760.5	39459.13	44061.88	Arbreda	AA-3780	AMS
Homo sapiens	-3.97	43.29	37700	1800	IntCal13	41295	37166.30	45423.70	El Castillo	AA-2407	AMS
Homo sapiens	10.97	45.51	37750	400	IntCal13	42010.5	41193.98	42827.03	Fumane	LTL-570A	AMS
Homo sapiens	9.78	48.39	37800	900	IntCal13	41890	39845.60	43934.40	Geissenklosterle	OxA-21723	AMS
Homo sapiens	9.78	48.39	37800	1050	IntCal13	41836.5	39425.88	44247.13	Geissenklosterle	ETH-8267	AMS
Homo sapiens	10.97	45.51	37828	430	IntCal13	42058	41187.80	42928.20	Fumane	LTL-1795A	AMS
Homo sapiens	-8.28	51.85	37870	127	IntCal13	42151.5	41882.18	42420.83	Castlepook	OxA-4238	AMS
Homo sapiens	11.53	45.44	37900	800	IntCal13	41990.5	40199.28	43781.73	Azzurra di Paina Grotta di Paina	UtC-2042	AMS
Homo sapiens	1.69	41.53	37900	1000	IntCal13	41967.5	39694.63	44240.38	Abric Romani	AA-8037B	AMS

Homo sapiens	9.75	48.38	37940	530	IntCal13	42100.5	41021.78	43179.23	Hohle Fels, Hohler Fels	KIA-32054	AMS
Homo sapiens	9.78	48.39	38010	520	IntCal13	42167.5	41123.93	43211.08	Geissenklosterle	Beta-156090	AMS
Homo sapiens	10.97	45.51	38100	600	IntCal13	42221.5	40989.83	43453.18	Fumane	ITL-579A	AMS
Homo sapiens	0.29	45.50	38100	900	IntCal13	42185.5	40150.13	44220.88	La Quina Aval	OxQ-21707	AMS
Homo sapiens	1.16	44.81	38100	1670	IntCal13	42019	38476.45	45561.55	Grotte XVI	AA-2997	AMS
Homo sapiens	9.78	48.39	38220	430	IntCal13	42347	41503.40	43190.60	Geissenklosterle	KIA-17305	AMS
Homo sapiens	10.97	45.51	38250	700	IntCal13	42384.5	40864.98	43904.03	Fumane	OxA-8023	AMS
Homo sapiens	2.75	42.16	38350	400	IntCal13	42443	41661.15	43224.85	Arbreda	OxA-1994	AMS
Homo sapiens	9.78	48.39	38490	460	IntCal13	42556.5	41644.03	43468.98	Geissenklosterle	KIA-17301	AMS
Homo sapiens	10.97	45.51	38500	330	IntCal13	42546	41900.00	43192.00	Fumane	OxA-17567	AMS
Homo sapiens	-3.97	43.29	38500	1300	IntCal13	42432	39586.75	45277.25	El Castillo	OxA-2474	AMS
Homo sapiens	25.42	42.93	38500	1700	IntCal13	42324.5	38706.43	45942.58	Bacho Kiro	OxA-3213	AMS
Homo sapiens	10.97	45.51	38550	540	IntCal13	42652	41532.90	43771.10	Fumane	LTL-574A	AMS
Homo sapiens	9.75	48.38	38560	530	IntCal13	42655.5	41559.68	43751.33	Hohle Fels, Hohler Fels	KIA-32053	AMS
Homo sapiens	11.53	45.44	38600	1400	IntCal13	42467	39415.60	45518.40	Azzurra di Paina Grotta di Paina	UtC-2695	AMS
Homo sapiens	0.81	41.93	38640	440	IntCal13	42677.5	41790.68	43564.33	Cova Gran de Santa Linya	Beta-224299	AMS
Homo sapiens	22.70	43.65	38700	140	IntCal13	42658	42363.50	42952.50	Kozarnika	GifLSM-10994	AMS
Homo sapiens	10.97	45.51	38860	700	IntCal13	42951	41464.25	44437.75	Fumane 2	OxA-18199	AMS
Homo sapiens	9.78	48.39	38900	1000	IntCal13	42918	40774.80	45061.20	Geissenklosterle	OxA-21722	AMS
Homo sapiens	9.78	48.39	39150	750	IntCal13	43188	41601.50	44774.50	Geissenklosterle	OxA-18715	AMS
Homo sapiens	22.70	43.65	39310	100	IntCal13	43043.5	42814.08	43272.93	Kozarnika	GifA-99662	AMS
Homo sapiens	9.75	48.38	39580	600	IntCal13	43473.5	42151.58	44795.43	Hohle Fels, Hohler Fels	KIA-32052	AMS
Homo sapiens	9.78	48.39	39750	550	IntCal13	43580	42339.30	44820.70	Geissenklosterle	OxA-18714	AMS
Homo sapiens	10.97	45.51	39850	500	IntCal13	43638	42485.65	44790.35	Fumane	LTL-578A	AMS
Homo sapiens	10.97	45.51	39950	550	IntCal13	43722.5	42471.83	44973.18	Fumane	OxA-11346	AMS
Homo sapiens	-2.68	51.23	40000	1600	IntCal13	43899	40524.60	47273.40	Hyaena Den	OxA-4782	AMS
Homo sapiens	9.75	48.38	40000	500	IntCal13	43745.5	42584.13	44906.88	Hohle Fels, Hohler Fels	OxA-19781	AMS
Homo sapiens	-4.50	36.63	40000	0	IntCal13	43553.5	43502.68	43604.33	Bajondillo	Ua-16859	AMS
Homo sapiens	-4.60	43.20	40110	500	IntCal13	43821.5	42652.53	44990.48	Esquilleu	GrA-33816	AMS
Homo sapiens	9.78	48.39	40200	1600	IntCal13	44140	40760.85	47519.15	Geissenklosterle	OxA-4595	AMS
Homo sapiens	-1.20	43.37	40200	3600	IntCal13	42952.5	36257.38	49647.63	Isturitz	AA-69184	AMS
Homo sapiens	25.09	46.84	40300	0	IntCal13	43887.5	43829.08	43945.93	Baicu Izvorul Alb	AA-61831	AMS
Homo sapiens	-1.74	38.38	40500	1800	IntCal13	44500	40632.55	48367.45	El Pedernaloso	GifA-95082	AMS
Homo sapiens	17.58	45.20	40500	3800	IntCal13	42903.5	36161.83	49645.18	Kamenka	AA-26743	AMS
Homo sapiens	23.13	45.58	40550	600	IntCal13	44149.5	42767.73	45531.28	Cioclovina 1, Pestera Muierii	OxA-16328	AMS
Homo sapiens	2.59	42.28	40580	550	IntCal13	44159	42861.30	45456.70	Ermitons	GrA-33813	AMS
Homo sapiens	0.71	46.96	40600	1200	IntCal13	44411.5	41926.78	46896.23	Bordes-Fitte, Roches d'Abilly	OxA-26472	AMS
Homo sapiens	-3.97	43.29	40700	1600	IntCal13	44722.5	41349.53	48095.48	El Castillo	OxA-2475	AMS
Homo sapiens	-1.22	53.28	40900	1800	IntCal13	44990.5	41134.93	48846.08	Ash Tree Cave	OxA-4103	AMS
Homo sapiens	15.60	48.41	41000	1300	IntCal13	44856.5	42054.48	47658.53	Krems-Hundssteig	VERA-3516	AMS

Homo sapiens	-3.97	43.29	41100	1700	IntCal13	45175	41525.10	48824.90	El Castillo	OxA-2477	AMS
Homo sapiens	0.71	46.96	41200	1300	IntCal13	45034	42180.20	47887.80	Bordes-Fitte, Roches d'Abilly	OxA-22316	AMS
Homo sapiens	34.69	45.10	41200	0	IntCal13	44695.5	44649.43	44741.58	Kara-Bey	OxA-10884	AMS
Homo sapiens	-3.45	43.25	41280	1120	IntCal13	44979	42470.05	47487.95	El Miron, Burial area	GX-27112	AMS
Homo sapiens	13.52	42.02	41300	1000	IntCal13	44905	42648.75	47161.25	La Punta	OxA-16998	AMS
Homo sapiens	10.97	45.51	41350	750	IntCal13	44789.5	43030.58	46548.43	Fumane	LTL-377A	AMS
Homo sapiens	-1.22	53.28	41500	0	IntCal13	44947.5	44902.38	44992.63	Ash Tree Cave	OxA-7736	AMS
Homo sapiens	10.97	45.51	42000	750	IntCal13	45380	43474.30	47285.70	Fumane	LTL-378A	AMS

SDMs evaluation and response curves

SDMs reached excellent predictive performances for both Homo species, with AUC values > 0. 90 for each modeling algorithm and Boyce index values > 0.60, except for GAM and GBM for H. sapiens (Table 1).

Table S1. AUC and Boyce index values reached by the ensemble forecasting and by each modeling algorithm. Ranges of suitability values predicted over the study area are also reported

Species	Modeling algorithm	AUC	Boyce index
H. neanderthalensis	GLM	0.972 ± 0.031	0.737 ± 0.141
	GAM	0.974 ± 0.008	0.689 ± 0. 200
	GBM	0.966 ±0.014	0.631 ± 0.203
	MAXENT	0.974 ± 0.004	0.798 ± 0. 115
	ENSEMBLE	0.977 ± 0.004	0.823 ± 0.120
H. sapiens	GLM	0.940 ± 0.081	0.619 ± 0.206
	GAM	0.956 ± 0.015	0.390 ± 0.306
	GBM	0.931 ± 0.024	0.245 ± 0.326
	MAXENT	0.956 ± 0.010	0.857 ± 0.075
	ENSEMBLE	0.958 ± 0.010	0.656 ± 0.244

Specifically, ensemble forecasting for *H. neanderthalensis* reported AUC = 0.977 ± 0.004 and a Boyce index = 0.823 ± 0.120, and for *H. sapiens* AUC was 0.958 ± 0.010 and Boyce index = 0.656 ± 0.244 (Table S1). According to the MESS analysis results, negligible or no extrapolation effect emerged in SDMs predictions for each species and time interval (Fig. S2).

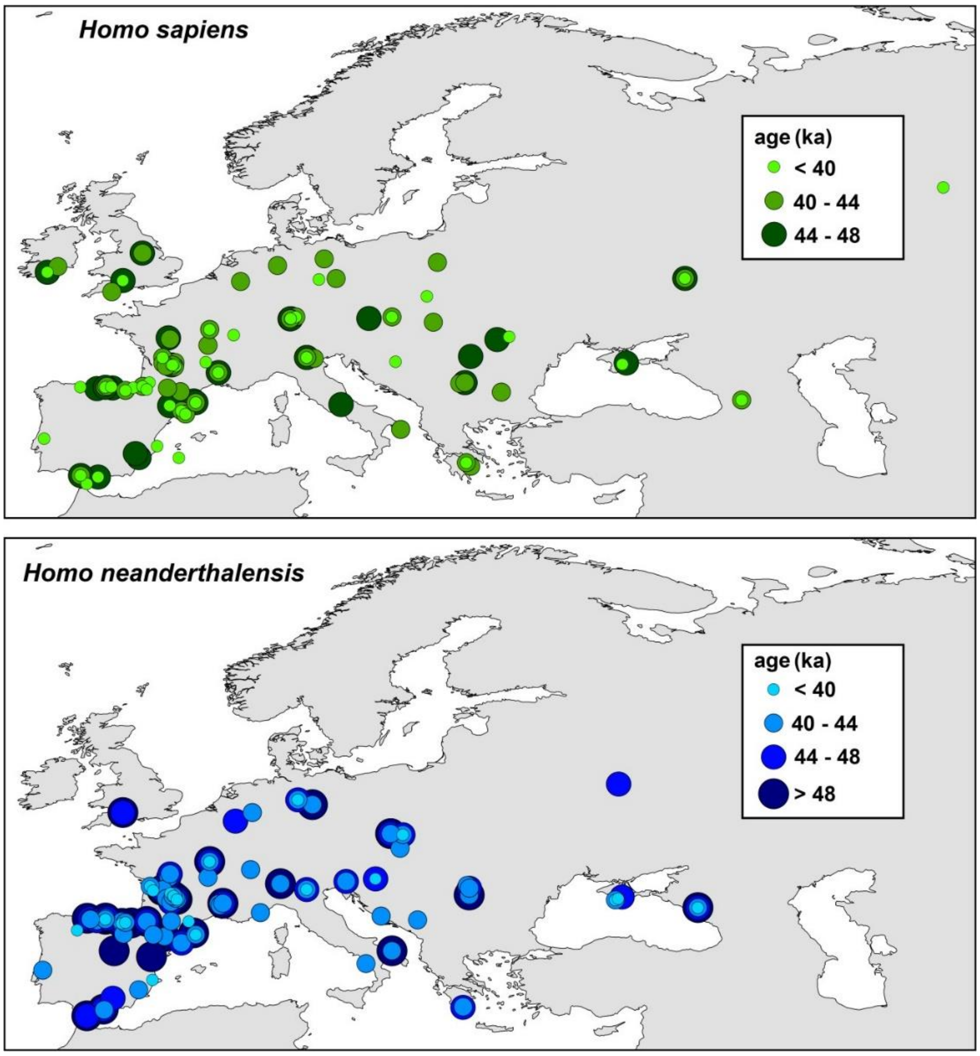


Figure S1. Fossil occurrence records for *H. sapiens* (green) and *H. neanderthalensis* (blue). Point size and color gradient refer to different ages.

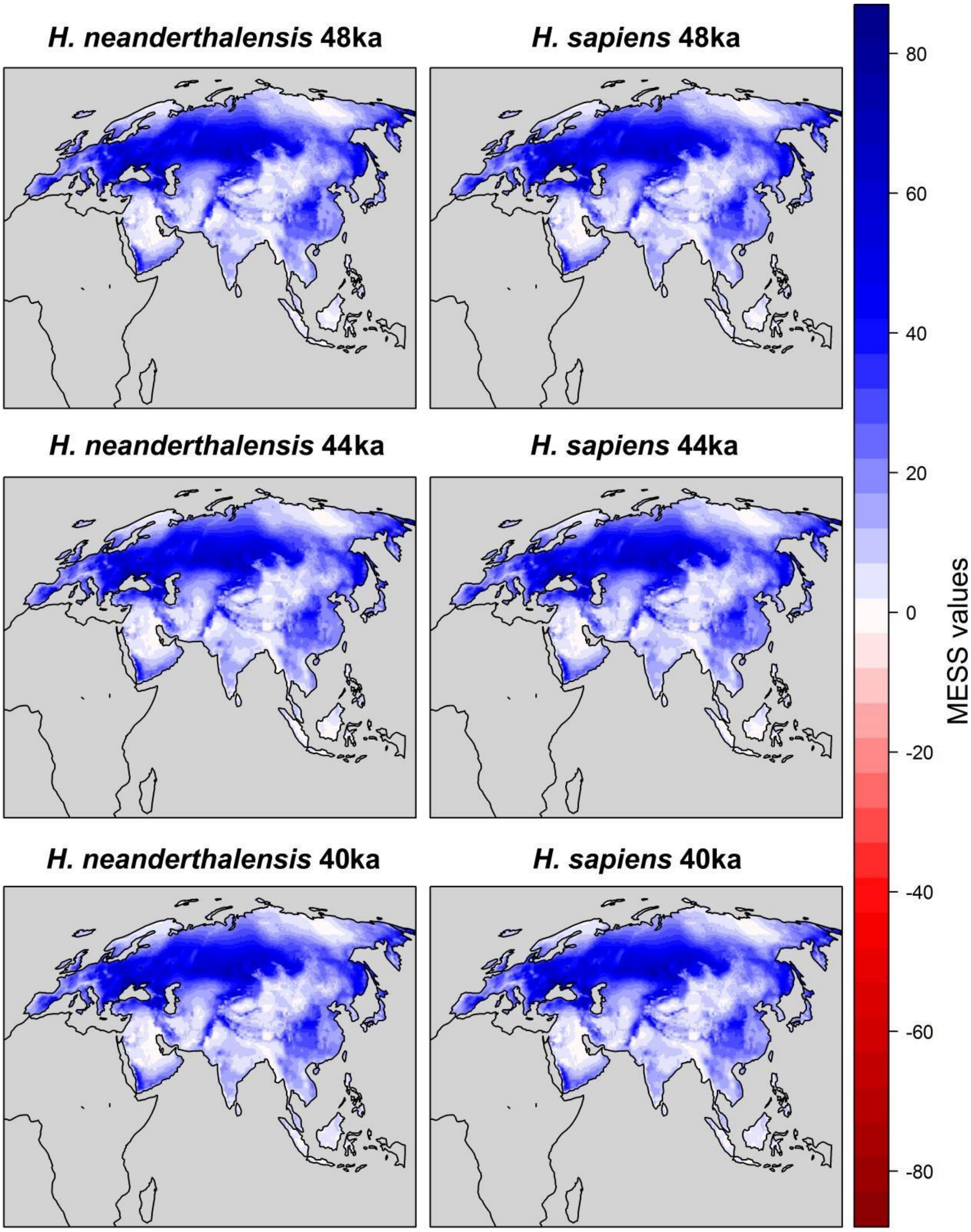


Figure S2. MESS analysis outputs. Maps were resampled at a spatial resolution of 10 km to improve figure readability. Maps were generated under the R package 'raster' available at https://CRAN.R-project.org/package=raster

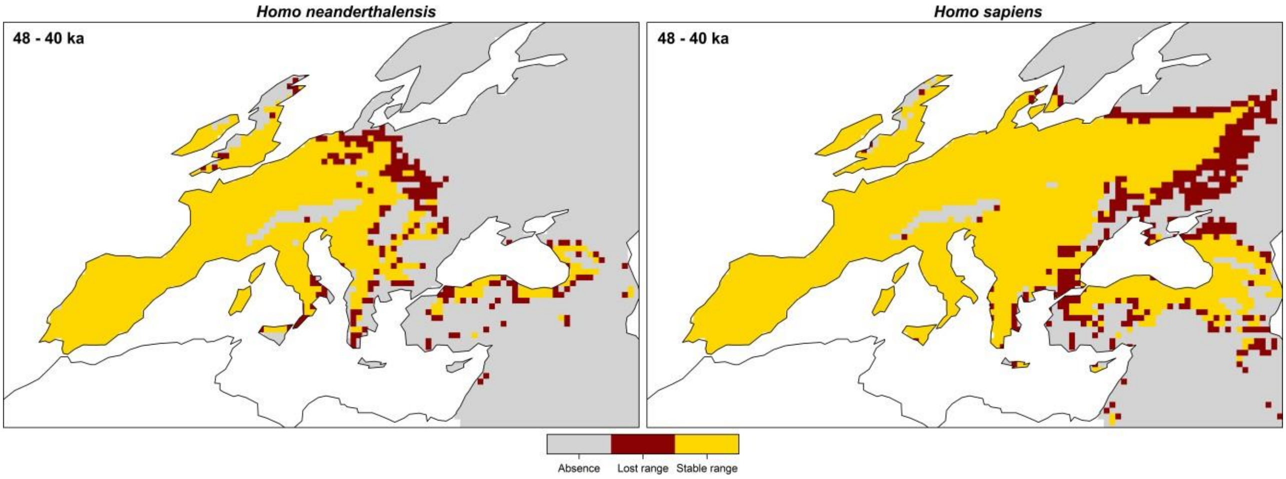


Figure S3. Cumulative species potential ranges along the three time moments. Gold pixels indicate potential range portions that remained stable in the 48-40 ka interval, while red pixels represent range portions that were lost during that time frame.

Maps were generated under the R packages 'raster' and 'rasterVis' available at https://CRAN.R-project.org/package=raster and at http://oscarperpinan.github.io/rastervis/

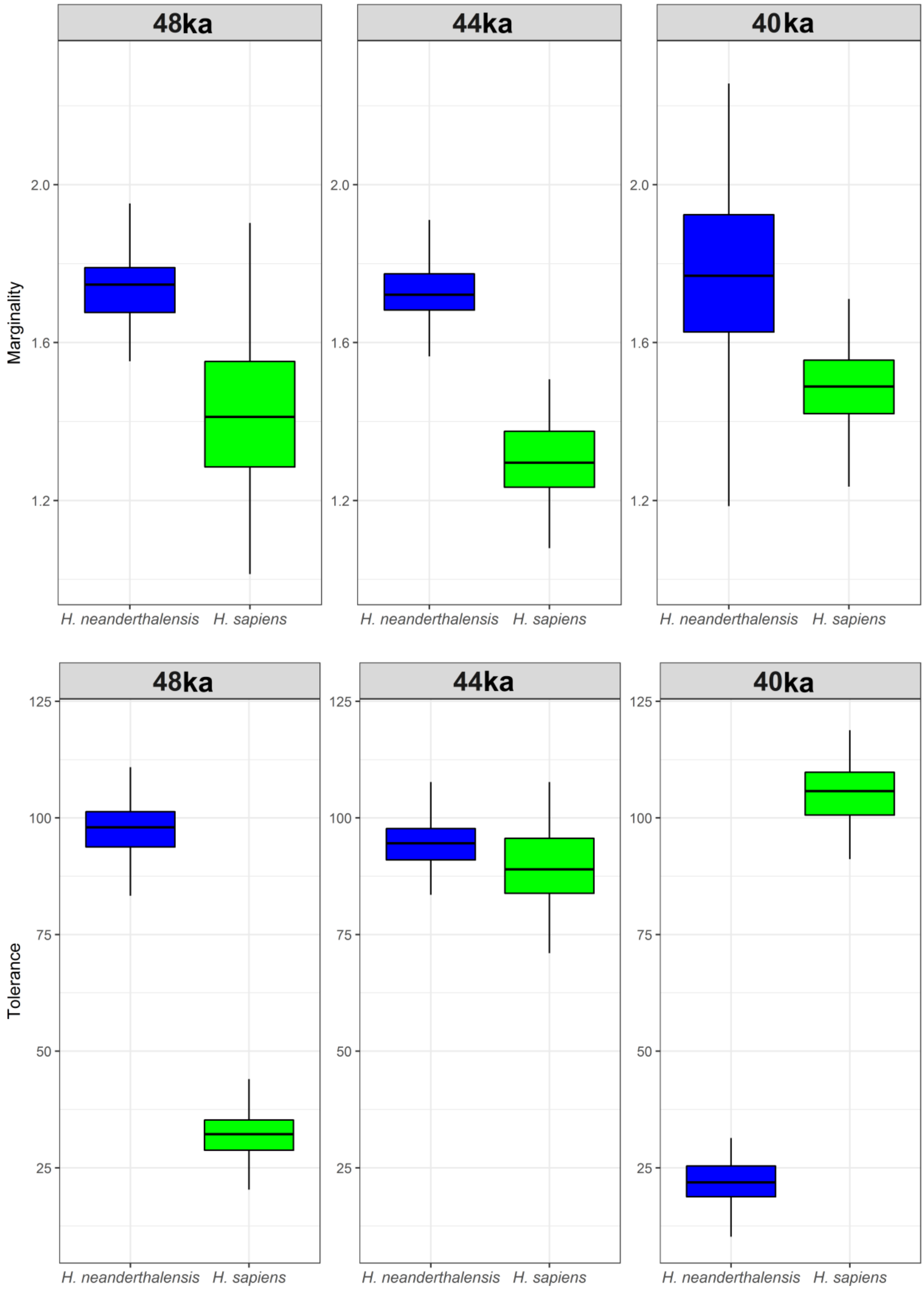


Figure S4. Niche marginality (first row) and tolerance (second row) values for *H. neanderthalensis* (blue) and *H. sapiens* (green) in the 48-40 ka time interval.

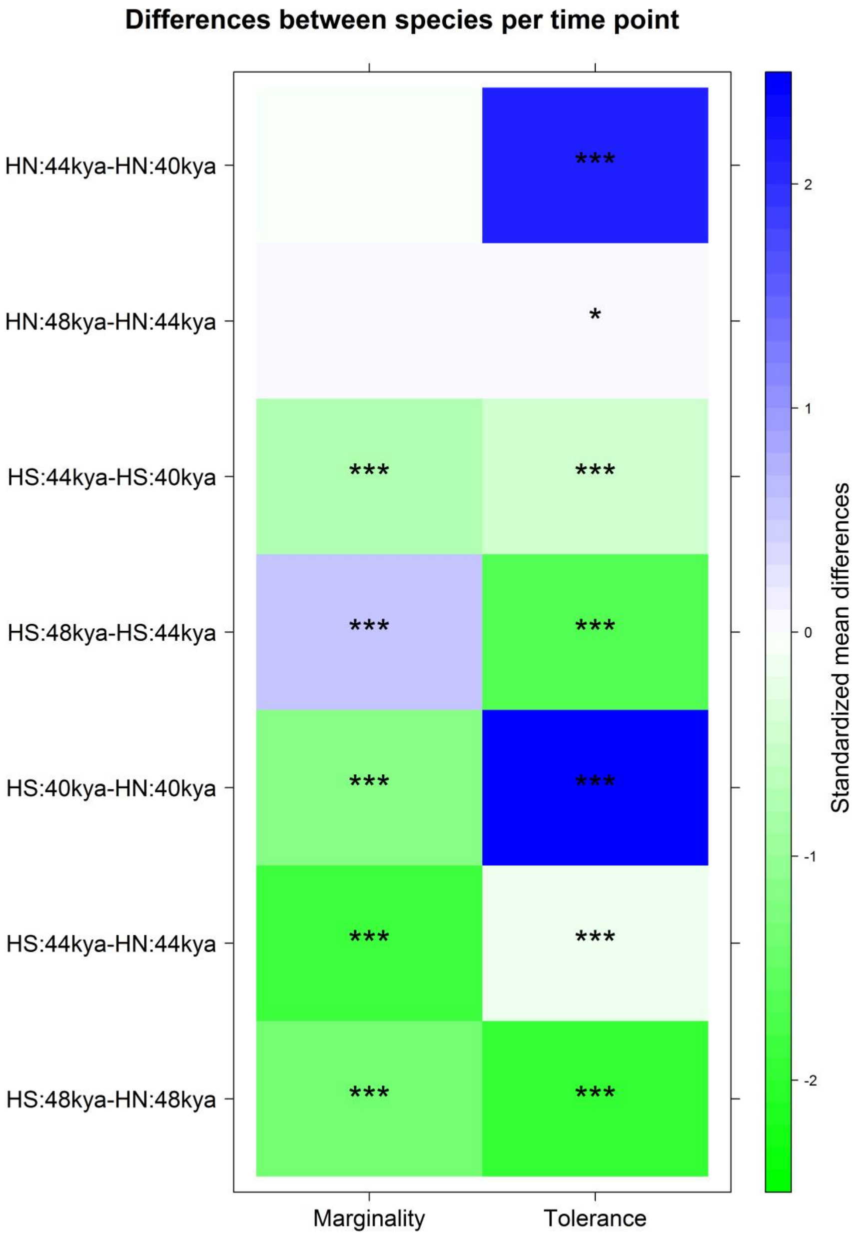


Figure S5. Standardized mean differences in niche marginality (first column) and tolerance (second column) between species per time point. Stars indicate statistical significance of the standardized differences according to the post-hoc Tukey HSD test ("*": $p < 0.05$; "**": $p < 0.01$; "***": $p < 0.001$).

Supplementary Information for: The well-behaved killer. Eurasian late Pleistocene Humans were significantly associated with living megafauna only

Table S1. Fossil occurrences data.

source	species	long	lat	age (years)	method	locality
PALEODB_EAST	*Acinonyx jubatus*	37.05	-1.47	68500.00	PALEODB	Lukenya HIll GvJm 62, 390-180cm
PALEODB_EAST	*Aepyceros melampus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, 170-0cm
PALEODB_EAST	*Aepyceros melampus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, Undated rockshelter
PALEODB_EAST	*Ailuropoda melanoleuca*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Ailuropoda melanoleuca*	106.00	22.05	68500.00	PALEODB	Keo Leng Cave
PALEODB_EAST	*Ailuropoda melanoleuca*	109.72	28.32	68500.00	PALEODB	Luosixuan cave, bed 1, Jishou county
PALEODB_EAST	*Ailuropoda melanoleuca*	109.72	28.32	68500.00	PALEODB	Luosixuan cave, bed 3, Jishou county
PALEODB_EAST	*Alcelaphus buselaphus*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Alcelaphus buselaphus*	22.40	-34.05	68500.00	PALEODB	Herolds Bay
PALEODB_EAST	*Alcelaphus buselaphus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
PALEODB_EAST	*Alcelaphus buselaphus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Alcelaphus buselaphus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 80-0cm
PALEODB_EAST	*Alcelaphus buselaphus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
PALEODB_EAST	*Alcelaphus buselaphus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, 170-0cm
PALEODB_EAST	*Alcelaphus buselaphus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, Undated rockshelter
PALEODB_EAST	*Alcelaphus buselaphus*	37.05	-1.47	68500.00	PALEODB	Lukenya HIll GvJm 62, 390-180cm
PALEODB_EAST	*Alcelaphus buselaphus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 62 180-70cm
NOW	*Alces alces*	92.82	55.97	10000.00	NOW	Badzhejskaja cave
NOW	*Alces alces*	30.50	50.40	10000.00	NOW	Kiev zemljanki
NOW	*Alces alces*	60.40	60.69	10000.00	NOW	Laksejskaja cave
NOW	*Alces alces*	92.79	56.01	10000.00	NOW	Ledopadnaja cave

NOW	*Alces alces*	46.00	42.30	10000.00	NOW	Lesgor I&II
NOW	*Alces alces*	60.04	59.28	10000.00	NOW	Lobvinskaja cave
NOW	*Alces alces*	92.80	56.01	10000.00	NOW	Lovushka cave (Belaja)
NOW	*Alces alces*	4.05	51.95	10000.00	NOW	Maasvlakte (Fauna III)
NOW	*Alces alces*	91.42	53.08	10000.00	NOW	Oznachennoe I
NOW	*Alces alces*	57.06	65.07	10000.00	NOW	Pechora, Unja caves
NOW	*Alces alces*	159.97	56.17	10000.00	NOW	Ushki I
NOW	*Alces alces*	100.33	58.30	10000.00	NOW	Ust'-Kova upper
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown “A” and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	14.50	45.32	16780.00	Radiometric	Zupanov Spodmol
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	27.21	48.19	17200.00	Radiometric	Cosauti
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	16.17	43.83	18388.00	Radiometric	Pecine u Brini East&West caves
NOW	*Alces alces*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Alces alces*	91.65	57.05	20000.00	NOW	Karaul'nyj Byk l. 3-9
NOW	*Alces alces*	39.92	43.56	20000.00	NOW	Navalishinskaja cave upper
NOW	*Alces alces*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Alces alces*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Alces alces*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Alces alces*	86.07	51.20	20000.00	NOW	Tytkesken' III l.7
NOW	*Alces alces*	104.28	52.37	20000.00	NOW	Verkholenskaja Gora 1 l.2
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	8.32	44.20	20470.00	Radiometric	Arene Candide
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	-4.84	43.42	21765.00	Radiometric	La Riera1
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	41.50	42.30	23000.00	Radiometric	Devis-Khvreli cave
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	36.20	50.00	23000.00	Radiometric	Kharkov
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	42.50	41.70	23000.00	Radiometric	Sakazhija

Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	40.17	43.50	24500.00	Radiometric	Akhshtyrskaja cave, Akhshatyr
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	16.16	46.26	28500.00	Radiometric	Vindija Cave
NOW	*Alces alces*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Alces alces*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Alces alces*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	-3.50	50.46	30185.00	Radiometric	Kent's Cavern
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	21.39	48.13	30677.00	Radiometric	Bodrogkeresztur [Henye Hill]
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
NOW	*Alces alces*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	11.49	45.42	40843.00	Radiometric	Gr. di Paina
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	57.57	59.85	51356.48	Fiedler	Kamen' Pisany
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	56.00	60.80	51356.48	Fiedler	Ushminskaya cave (stratum 1-2)
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	58.60	61.83	53456.57	Fiedler	Uninskaya
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	60.50	61.27	54769.12	Fiedler	Burmantovo1, 2
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	60.03	60.24	54800.00	Fiedler	Cheremukhovo 1 (1-4)
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	58.21	61.80	55294.14	Fiedler	Kaninskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	-0.21	53.64	55687.91	Fiedler	Stellmoor
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	8.37	47.50	58313.02	Fiedler	Niederleme

Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	5.23	45.07	61331.89	Fiedler	Abri de Campalou
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	10.95	45.61	61331.89	Fiedler	Grotte di Veja C
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	13.75	45.67	61856.91	Fiedler	Grotta Benussi
Raia et al. 2009; Carotenuto et al. 2010	*Alces alces*	15.87	45.84	62500.00	Radiometric	Veternica cave i
PALEODB_EAST	*Alces alces*	4.07	51.98	68500.00	PALEODB	Eurogeul
PALEODB_EAST	*Alces alces*	11.55	45.55	68500.00	PALEODB	Grotta Maggiore do S. Bernardino (Pleistocene), Colli Berici, Northern Italy
PALEODB_EAST	*Alces alces*	160.00	68.75	68500.00	PALEODB	Kolyma River, between the mouth of Omolon and Anjuj, Jedoma-Suite
NOW	*Alces alces*	100.00	74.00	70000.00	NOW	Tajmyr p-la LtPl
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	19.92	50.08	12000.00	Radiometric	Mamutowa Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	60.00	59.35	12800.00	Radiometric	Kakva-4
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown ''A'' and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	33.00	50.10	14365.00	Radiometric	Gontsy
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	32.00	52.40	14700.00	Radiometric	Chulatov (Chulatovo I)
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	31.50	49.65	15950.00	Radiometric	Mezherich

Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	19.80	50.06	15990.00	Radiometric	Zawalona cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown ''B'' loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	27.21	48.19	17200.00	Radiometric	Cosauti
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	19.92	50.05	18427.00	Radiometric	Spadzista St. A
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	15.53	48.14	19380.00	Radiometric	Grubgraben
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	38.88	54.77	20450.00	Radiometric	Zarajsk
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.67	49.25	23000.00	Radiometric	Adler cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	36.00	51.10	23000.00	Radiometric	Avdeevskaja
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.67	49.25	23000.00	Radiometric	Pekarna cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	31.00	52.50	23400.00	Radiometric	Berdyzhskaja stojanka
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	34.12	53.34	23660.00	Radiometric	Khotylevo II
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	40.48	56.13	25848.00	Radiometric	Sungir'

Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	3.99	50.47	26885.00	Radiometric	Maisieres-Canal
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	60.03	60.24	27350.00	Radiometric	Cheremukhovo 4 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	17.00	51.50	27450.00	Radiometric	Krems-Wachtberg
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	10.15	48.55	27876.00	Radiometric	Bockstein-Torle
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.16	46.26	28500.00	Radiometric	Vindija Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	1.33	44.77	28600.00	Radiometric	Roc de Combe7a
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	60.03	60.24	30140.00	Radiometric	Cheremukhovo 2, 3
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	10.17	48.55	34365.00	Radiometric	Hohlenstein-Stadel [IV]
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]

Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	6.80	50.70	36163.00	Radiometric	Lommersum
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-8.58	52.22	41631.00	Radiometric	Castlepook Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-2.87	51.32	43244.00	Radiometric	Banwell Bone Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	11.83	48.93	52012.76	Fiedler	Große Schulerloch E-F
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	58.60	61.83	53456.57	Fiedler	Uninskaya
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	60.50	61.27	54769.12	Fiedler	Burmantovo1, 2
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	11.40	50.62	55031.63	Fiedler	Teufelsbrücke 2-3a
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	11.40	50.62	55950.42	Fiedler	Teufelsbrücke 3
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	0.48	52.57	56212.93	Fiedler	Wretton
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	11.40	50.62	56737.95	Fiedler	Teufelsbrücke 2-3b
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	16.67	49.27	57394.23	Fiedler	Ztiny cave

Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	20.57	50.87	57400.00	Fiedler	Raj cave 6
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	6.65	50.23	59363.06	Fiedler	Buchenloch
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-2.88	51.29	59494.32	Fiedler	Picken's Hole, Layer 5
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	-7.63	52.10	60019.34	Fiedler	Shandon Cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Alopex lagopus*	19.77	50.22	70600.00	Radiometric	Jaskinia Nietoperzowa
PALEODB_EAST	*Antidorcas marsupialis*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
PALEODB_EAST	*Antidorcas marsupialis*	22.40	-34.05	68500.00	PALEODB	Herolds Bay
PALEODB_EAST	*Aonyx capensis*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
NOW	*Bison bonasus*	42.61	42.32	10000.00	NOW	Belaja cave Kolkhida Hol
NOW	*Bison bonasus*	43.50	42.50	10000.00	NOW	Kudaro 3 l.2 Hol
NOW	*Bison bonasus*	46.00	42.30	10000.00	NOW	Lesgor I&II
NOW	*Bison bonasus*	42.50	41.80	10000.00	NOW	Sagvardzhile
NOW	*Bison bonasus*	41.00	48.00	10000.00	NOW	Sarkel castle (Belaja Vezha)
NOW	*Bison bonasus*	43.00	42.45	10000.00	NOW	Shagat-Khokh-Leget
NOW	*Bison bonasus*	43.24	42.00	10000.00	NOW	Tsona cave Hol
NOW	*Bison bonasus*	42.50	42.00	20000.00	NOW	Gvardzhilas-Klde
NOW	*Bison bonasus*	75.00	51.50	20000.00	NOW	Irtysh left bank
NOW	*Bison priscus*	109.00	72.50	10000.00	NOW	Khatanga, Popugaj r. Hol
NOW	*Bison priscus*	105.82	54.03	10000.00	NOW	Makarovo II 3-4

NOW	*Bison priscus*	91.05	55.05	10000.00	NOW	Tarachikha loc. 1
NOW	*Bison priscus*	91.02	54.60	10000.00	NOW	Tashtyk I l.1-3, exc.2
NOW	*Bison priscus*	91.01	54.61	10000.00	NOW	Tashtyk II 1-2
NOW	*Bison priscus*	91.01	54.61	10000.00	NOW	Tashtyk IV 1-2
NOW	*Bison priscus*	26.90	48.00	10000.00	NOW	Trinka I l.1
NOW	*Bison priscus*	91.44	52.97	10000.00	NOW	Ui II, 2-7, exc. 1
NOW	*Bison priscus*	159.97	56.17	10000.00	NOW	Ushki I
NOW	*Bison priscus*	106.30	50.53	10000.00	NOW	Ust'-Kjakhta IV(1-2)
NOW	*Bison priscus*	100.33	58.30	10000.00	NOW	Ust'-Kova upper
NOW	*Bison priscus*	134.45	60.35	10000.00	NOW	Verkhne-Troitskaja
NOW	*Bison priscus*	104.28	52.37	10000.00	NOW	Verkholenskaja Gora 1 l.3
NOW	*Bison priscus*	80.25	54.65	10000.00	NOW	Volchja Griva
NOW	*Bison priscus*	37.00	51.80	10000.00	NOW	Yudinovo
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown ''A'' and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	33.00	50.10	14365.00	Radiometric	Gontsy
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	32.00	52.40	14700.00	Radiometric	Chulatov (Chulatovo I)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	31.50	49.65	15950.00	Radiometric	Mezherich
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown ''B'' loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	17.58	45.20	17500.00	Radiometric	Kamenika
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	17.88	45.42	17500.00	Radiometric	Zarilac
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
NOW	*Bison priscus*	57.00	57.50	20000.00	NOW	Bolshoj Glukhoj grot l.V-IX
NOW	*Bison priscus*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Bison priscus*	41.26	43.02	20000.00	NOW	Kholodnyj Grot/ Kej Bogaz

NOW	*Bison priscus*	89.45	54.42	20000.00	NOW	Malaja Syja l. 1-2
NOW	*Bison priscus*	103.53	52.83	20000.00	NOW	Mal'ta main 8
NOW	*Bison priscus*	42.10	42.10	20000.00	NOW	Mgvimevi
NOW	*Bison priscus*	83.55	57.73	20000.00	NOW	Mogochino I, exc. 1-3
NOW	*Bison priscus*	4.50	52.50	20000.00	NOW	North Sea Reindeer culture
NOW	*Bison priscus*	90.95	54.97	20000.00	NOW	Novoselovo XI
NOW	*Bison priscus*	90.95	54.97	20000.00	NOW	Novoselovo XII
NOW	*Bison priscus*	90.95	54.97	20000.00	NOW	Novoselovo XIII 1-2
NOW	*Bison priscus*	108.55	50.18	20000.00	NOW	Priiskovaja
NOW	*Bison priscus*	91.07	54.58	20000.00	NOW	Sabanikha
NOW	*Bison priscus*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Bison priscus*	102.46	52.61	20000.00	NOW	Shamotnyj Zavod 1-2
NOW	*Bison priscus*	87.95	55.90	20000.00	NOW	Shestakovo
NOW	*Bison priscus*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Bison priscus*	113.43	52.02	20000.00	NOW	Sokhatino II
NOW	*Bison priscus*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Bison priscus*	103.43	52.87	20000.00	NOW	Sosnovyj Bor l. 5
NOW	*Bison priscus*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Bison priscus*	26.90	48.00	20000.00	NOW	Trinka I l.2
NOW	*Bison priscus*	116.00	52.00	20000.00	NOW	Tsagan Ola
NOW	*Bison priscus*	86.07	51.20	20000.00	NOW	Tytkesken' III l.7
NOW	*Bison priscus*	91.43	52.97	20000.00	NOW	Ui I, 2-2/3
NOW	*Bison priscus*	86.70	52.50	20000.00	NOW	Ushlep VI, l.3
NOW	*Bison priscus*	84.68	51.38	20000.00	NOW	Ust-Karakol l. 2
NOW	*Bison priscus*	87.00	51.70	20000.00	NOW	Ust'-Kujum
NOW	*Bison priscus*	133.12	59.65	20000.00	NOW	Ust'-Mil' II A-C
NOW	*Bison priscus*	77.00	56.00	20000.00	NOW	Vengerovo V
NOW	*Bison priscus*	104.28	52.37	20000.00	NOW	Verkholenskaja Gora 1 l.2
NOW	*Bison priscus*	15.87	45.84	20000.00	NOW	Veternica cave st. d
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	38.88	54.77	20450.00	Radiometric	Zarajsk
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	5.43	46.38	21379.00	Radiometric	La Balme d'Epy [Jura]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-0.60	43.11	22166.00	Radiometric	Gr. des Bisons [Lurbe-St-Christau]

Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	28.50	47.50	22600.00	Radiometric	Climauti II S
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	27.90	50.05	23000.00	Radiometric	Dovginichi
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	35.50	48.50	23000.00	Radiometric	Jamburg
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	36.20	50.00	23000.00	Radiometric	Kharkov
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	34.12	53.34	23660.00	Radiometric	Khotylevo II
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	60.03	60.24	27350.00	Radiometric	Cheremukhovo 4 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-2.04	52.02	27650.00	Radiometric	Beckford
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-0.16	43.11	27931.00	Radiometric	Trou du Rhinoceros [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	16.16	46.26	28500.00	Radiometric	Vindija Cave
NOW	*Bison priscus*	129.35	71.81	30000.00	NOW	Holocene shore, Bykovskij p, L
NOW	*Bison priscus*	1.50	45.05	30000.00	NOW	Jaurens
NOW	*Bison priscus*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Bison priscus*	97.00	73.30	30000.00	NOW	Logata r, Tajmyr
NOW	*Bison priscus*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Bison priscus*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	60.03	60.24	30140.00	Radiometric	Cheremukhovo 2, 3
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	21.39	48.13	30677.00	Radiometric	Bodrogkeresztur [Henye Hill]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]

Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	1.47	45.00	33800.00	Radiometric	Sirejol [Gignac]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	15.24	40.50	34540.00	Radiometric	Castelcivitagic
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	10.90	45.57	34939.00	Radiometric	Abri Fumane
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	0.30	45.50	36543.00	Radiometric	La Quina Y-Z [Villebois la Valette]3
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	17.93	48.55	38400.00	Radiometric	Certova Pec (Radosina)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
NOW	*Bison priscus*	4.00	44.00	40000.00	NOW	Baume NÃ©ron
NOW	*Bison priscus*	141.33	73.36	40000.00	NOW	Bolshoj Lyakhovskij isl, 1TC
NOW	*Bison priscus*	129.40	71.79	40000.00	NOW	Lena delta, Bykovskij,MKh main
NOW	*Bison priscus*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	1.22	44.81	41900.00	Radiometric	Combe Grenal [Domme, Dordogne]1
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-2.87	51.32	43244.00	Radiometric	Banwell Bone Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-3.02	51.32	43730.00	Radiometric	Brean Down

Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	18.50	42.78	43730.00	Radiometric	Crvena Stijena
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	13.33	52.30	45000.00	Radiometric	Niederweningen
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
NOW	*Bison priscus*	129.38	71.78	50000.00	NOW	Lena delta, MKh, shore&bar ear
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	41.90	49.60	52669.04	Fiedler	Lebiazhenskoe
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-2.10	52.31	54244.10	Fiedler	Upton Warren gravels
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	12.65	43.92	54375.36	Fiedler	Torrente Conca (Morciano di Romagna)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	28.50	47.50	55031.63	Fiedler	Climauti II i
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	0.48	52.57	56212.93	Fiedler	Wretton
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	0.61	45.34	56400.00	Radiometric	Fonseigner [Bourdeilles]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	19.05	47.75	57656.74	Fiedler	Remete cave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	39.00	45.00	58181.76	Fiedler	Mezmaiskaya Cave 2

Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	10.45	48.82	58313.02	Fiedler	Große Ofnethöhle V
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	5.43	45.09	58444.27	Fiedler	Gr. de Preletang [Presles]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	9.16	48.58	59888.08	Fiedler	Steinheim upper level
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	40.00	44.90	60000.00	Radiometric	Dakhovskaja cave
NOW	*Bison priscus*	9.76	48.40	60000.00	NOW	Sirgenstein cave
NOW	*Bison priscus*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	44.30	48.40	60000.00	Radiometric	Sukhaja Mechetka l.4
NOW	*Bison priscus*	91.65	55.22	60000.00	NOW	Ust'-Izhul
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	0.18	51.26	60150.59	Fiedler	Bacon hole
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	20.65	48.12	60413.10	Fiedler	Budospest
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	11.00	45.27	61331.89	Fiedler	Quinzano

Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	84.50	57.09	61594.40	Fiedler	Krasny Jar 2
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	11.25	45.42	61725.66	Fiedler	Soave
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	39.00	45.00	61988.17	Fiedler	Mezmaiskaya Cave 2A
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	0.37	43.11	61988.17	Fiedler	Montousse I (Haute Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	39.00	45.00	62513.19	Fiedler	Mezmaiskaya Cave 1–2
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	39.00	45.00	64088.25	Fiedler	Mezmaiskaya Cave 2B
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	0.67	52.50	65500.00	Radiometric	Lynford
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	9.16	48.58	65925.83	Fiedler	Steinheim lower level
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
NOW	*Bison priscus*	100.00	74.00	70000.00	NOW	Tajmyr p-la LtPl

Raia et al. 2009; Carotenuto et al. 2010	*Bison priscus*	19.77	50.22	70600.00	Radiometric	Jaskinia Nietoperzowa
NOW	*Bison schoetensacki*	1.50	45.05	30000.00	NOW	Jaurens
Raia et al. 2009; Carotenuto et al. 2010	*Bison schoetensacki*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Bison schoetensacki*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
NOW	*Bos javanicus*	110.26	-7.37	10000.00	NOW	Holocene caves
NOW	*Bos javanicus*	118.00	4.00	10000.00	NOW	Madai
NOW	*Bos primigenius*	60.00	43.00	10000.00	NOW	Khoresm, Uchashchi st.
NOW	*Bos primigenius*	60.40	60.69	10000.00	NOW	Laksejskaja cave
NOW	*Bos primigenius*	4.05	51.95	10000.00	NOW	Maasvlakte (Fauna III)
NOW	*Bos primigenius*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	16.90	43.60	12392.50	Radiometric	Kopacina
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	17.88	45.42	17500.00	Radiometric	Zarilac
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.66	44.62	18388.00	Radiometric	Gr. Pegourie [Caniac du Causse]
NOW	*Bos primigenius*	42.61	42.32	20000.00	NOW	Belaja cave Kolkhida LtPal
NOW	*Bos primigenius*	20.00	40.36	20000.00	NOW	Cardamone
NOW	*Bos primigenius*	91.77	57.01	20000.00	NOW	Pereselencheskij Punkt
NOW	*Bos primigenius*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Bos primigenius*	93.00	54.00	20000.00	NOW	Ulazy
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	8.32	44.20	20470.00	Radiometric	Arene Candide
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	20.50	39.42	20800.00	Radiometric	Kastritsa
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-4.84	43.42	21765.00	Radiometric	La Riera1
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-0.49	45.04	22200.00	Radiometric	Roc de la Melca
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	16.75	49.41	22603.00	Radiometric	Kulna Cave6a
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	31.28	49.45	23000.00	Radiometric	Kanev
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	16.75	49.33	23000.00	Radiometric	Ochoz cave

Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	16.67	49.25	23000.00	Radiometric	Pekarna cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	17.96	40.15	23151.00	Radiometric	Cavallo
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	2.34	43.31	24025.00	Radiometric	Canecaude I [Villardonel]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	0.86	46.70	26728.00	Radiometric	Fontenioux [St Pierre de Maille]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.85	44.72	28400.00	Radiometric	A. du Mas Viel [St-Simon]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.06	44.98	29500.00	Radiometric	Abri du Facteur
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-5.30	36.13	29544.00	Radiometric	Gorham's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Bos primigenius*	1.50	45.05	30000.00	NOW	Jaurens
NOW	*Bos primigenius*	105.80	54.02	30000.00	NOW	Makarovo III
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-4.13	36.95	31300.00	Radiometric	Zafarraya Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-4.24	51.55	31717.00	Radiometric	Paviland Cave [Goat's Hole]

Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	4.33	43.93	36448.00	Radiometric	Esquicho-Grapaou
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	0.30	45.50	36543.00	Radiometric	La Quina Y-Z [Villebois la Valette]3
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	17.93	48.55	38400.00	Radiometric	Certova Pec (Radosina)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.22	44.81	41900.00	Radiometric	Combe Grenal [Domme, Dordogne]1
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	11.57	45.47	42224.00	Radiometric	Gr. del Broion
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-2.66	51.84	51618.99	Fiedler	King Arthur's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.10	41.23	54200.00	Radiometric	Gr. Guattari
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.05	41.23	56344.19	Fiedler	Gr. Breuil

Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	3.90	43.94	57200.00	Radiometric	La Roquette II [Conquerac]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.51	41.22	59100.55	Fiedler	Gr. di Sant'Agostino
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-2.88	51.29	59494.32	Fiedler	Picken's Hole, Layer 5
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
NOW	*Bos primigenius*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.70	45.72	60544.36	Fiedler	GabrovizzaII
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	10.33	43.93	60938.12	Fiedler	Buca della Iena
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-3.01	41.01	61100.00	Fiedler	Las Figuras (Alcorlo)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	9.16	48.58	61200.64	Fiedler	Steinheim middle level

Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	10.95	45.61	61331.89	Fiedler	Grotte di Veja C
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	0.50	44.01	61700.00	Fiedler	Gr. de la Nauterie I [La Romieu]
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.50	41.93	61856.91	Fiedler	Monte Delle Gioie
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	0.15	45.63	61988.17	Fiedler	Artenac 10
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.03	49.30	62250.68	Fiedler	Cleon
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-3.33	40.87	62250.68	Fiedler	Cueva del Congosto, Guadalajara
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	11.36	45.28	62250.68	Fiedler	Grotta Perin
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.40	41.78	62250.68	Fiedler	Vitinia (Upper Beds) (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	15.87	45.84	62500.00	Radiometric	Veternica cave i

Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.50	41.92	62513.19	Fiedler	Prati Fiscali
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-2.50	41.15	62906.95	Fiedler	Ambrona
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.73	42.22	62906.95	Fiedler	Fara Sabina
PALEODB_EAST	*Bos primigenius*	3.00	55.00	63000.00	PALEODB	Dogger Bank
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.10	41.98	63038.21	Fiedler	Cerveteri (Rome)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-5.50	36.22	63038.21	Fiedler	Devil's Tower
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.25	41.90	63825.74	Fiedler	La Polledrara di Cecanibbio
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
PALEODB_EAST	*Bos primigenius*	11.55	45.55	68500.00	PALEODB	Grotta Maggiore do S. Bernardino (Pleistocene), Colli Berici, Northern Italy
PALEODB_EAST	*Bos primigenius*	4.05	51.96	68500.00	PALEODB	Maasvlakte, Fauna II
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Bos primigenius*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli
Raia et al. 2009; Carotenuto et al. 2010	*Bubalus murrensis*	9.16	48.58	61200.64	Fiedler	Steinheim middle level
Raia et al. 2009; Carotenuto et al. 2010	*Camelus knoblochi*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Canis arnensis*	15.65	41.77	40000.00	Radiometric	Ingarano c
Raia et al. 2009; Carotenuto et al. 2010	*Canis arnensis*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Canis arnensis*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli

NOW	*Canis aureus*	42.00	42.00	10000.00	NOW	Anaklia
NOW	*Canis aureus*	44.40	40.30	10000.00	NOW	Sarajbulakhskij, Urtskij khreb
NOW	*Canis aureus*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
NOW	*Canis lupus*	40.16	43.50	10000.00	NOW	Akhshtyrskaja cave Hol
NOW	*Canis lupus*	92.82	55.97	10000.00	NOW	Badzhejskaja cave
NOW	*Canis lupus*	49.80	40.40	10000.00	NOW	Baku
NOW	*Canis lupus*	143.95	70.43	10000.00	NOW	Berelekh ""kitchen""
NOW	*Canis lupus*	92.80	56.01	10000.00	NOW	Bezdonnaja Yama cave
NOW	*Canis lupus*	92.82	55.97	10000.00	NOW	Bolshaja Oreshnaja cave Hol
NOW	*Canis lupus*	9.13	48.07	10000.00	NOW	BurghÃ¶hle Dietfurt Hol
NOW	*Canis lupus*	37.00	52.00	10000.00	NOW	Eliseevichi
NOW	*Canis lupus*	92.80	56.01	10000.00	NOW	Gnilaja Yama cave
NOW	*Canis lupus*	43.50	42.50	10000.00	NOW	Kudaro 3 l.2 Hol
NOW	*Canis lupus*	60.40	60.69	10000.00	NOW	Laksejskaja cave
NOW	*Canis lupus*	92.80	56.01	10000.00	NOW	Ledjanaja cave
NOW	*Canis lupus*	92.79	56.01	10000.00	NOW	Ledopadnaja cave
NOW	*Canis lupus*	92.80	56.01	10000.00	NOW	Lovushka cave (Belaja)
NOW	*Canis lupus*	92.82	55.98	10000.00	NOW	Majachnaja cave Hol
NOW	*Canis lupus*	105.82	54.03	10000.00	NOW	Makarovo II 3-4
NOW	*Canis lupus*	92.79	56.01	10000.00	NOW	Nizhnesliznevskaja cave
NOW	*Canis lupus*	44.40	40.30	10000.00	NOW	Sarajbulakhskij, Urtskij khreb
NOW	*Canis lupus*	43.00	42.45	10000.00	NOW	Shagat-Khokh-Leget
NOW	*Canis lupus*	66.37	56.32	10000.00	NOW	Shikaevka
NOW	*Canis lupus*	103.43	52.87	10000.00	NOW	Sosnovyj Bor l. 3-4
NOW	*Canis lupus*	91.02	54.60	10000.00	NOW	Tashtyk I l.1-3, exc.2
NOW	*Canis lupus*	43.24	42.00	10000.00	NOW	Tsona cave Hol
NOW	*Canis lupus*	108.62	50.21	10000.00	NOW	Ust'-Menza II
NOW	*Canis lupus*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
NOW	*Canis lupus*	134.45	60.35	10000.00	NOW	Verkhne-Troitskaja
NOW	*Canis lupus*	80.25	54.65	10000.00	NOW	Volchja Griva
NOW	*Canis lupus*	23.50	38.00	10000.00	NOW	Vraona cave
NOW	*Canis lupus*	37.00	51.80	10000.00	NOW	Yudinovo
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	60.00	59.35	12800.00	Radiometric	Kakva-4
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown "A" and grey loamy soil)

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	33.00	50.10	14365.00	Radiometric	Gontsy
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	32.00	52.40	14700.00	Radiometric	Chulatov (Chulatovo I)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.10	40.17	15000.00	Radiometric	Klithi
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	31.50	49.65	15950.00	Radiometric	Mezherich
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	19.80	50.06	15990.00	Radiometric	Zawalona cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown ‘‘B’’ loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	23.90	37.92	16932.50	Radiometric	Vraona cave (Attiki)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	17.58	45.20	17500.00	Radiometric	Kamenika
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	14.50	45.33	17500.00	Radiometric	Pecina na Gradini
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	39.00	44.10	18040.00	Radiometric	Anetovka II
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.66	44.62	18388.00	Radiometric	Gr. Pegourie [Caniac du Causse]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	19.92	50.05	18427.00	Radiometric	Spadzista St. A
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
NOW	*Canis lupus*	57.00	57.50	20000.00	NOW	Bolshoj Glukhoj grot l.V-IX
NOW	*Canis lupus*	9.13	48.07	20000.00	NOW	BurghÃ¶hle Dietfurt
NOW	*Canis lupus*	20.00	40.36	20000.00	NOW	Cardamone
NOW	*Canis lupus*	-7.50	54.00	20000.00	NOW	Castlepook cave LGM
NOW	*Canis lupus*	68.51	60.90	20000.00	NOW	Lugovskoe
NOW	*Canis lupus*	85.05	51.00	20000.00	NOW	Maloialomanskaja l.2
NOW	*Canis lupus*	103.53	52.83	20000.00	NOW	Mal'ta main 8
NOW	*Canis lupus*	42.10	42.10	20000.00	NOW	Mgvimevi
NOW	*Canis lupus*	90.95	54.97	20000.00	NOW	Novoselovo XI

NOW	*Canis lupus*	90.95	54.97	20000.00	NOW	Novoselovo XII
NOW	*Canis lupus*	91.77	57.01	20000.00	NOW	Pereselencheskij Punkt
NOW	*Canis lupus*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XIV-XV
NOW	*Canis lupus*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XVI-XVII
NOW	*Canis lupus*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Canis lupus*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Canis lupus*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Canis lupus*	26.90	48.00	20000.00	NOW	Trinka I l.2
NOW	*Canis lupus*	93.00	54.00	20000.00	NOW	Ulazy
NOW	*Canis lupus*	15.87	45.84	20000.00	NOW	Veternica cave st. d
NOW	*Canis lupus*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	38.88	54.77	20450.00	Radiometric	Zarajsk
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.95	44.97	21466.00	Radiometric	Laugerie-Haute Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	25.48	45.54	22000.00	Radiometric	Gura Cheii-Rasnov
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-4.84	43.42	22280.00	Radiometric	La Riera23
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.01	45.21	22383.00	Radiometric	Gr. des Cottier[s] [Retournac]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	28.50	47.50	22600.00	Radiometric	Climauti II S
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.75	49.41	22603.00	Radiometric	Kulna Cave6a
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	17.89	48.61	22630.00	Radiometric	Moravany-Lopata II
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.72	46.40	22696.00	Radiometric	Gr. de Laraux
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.67	49.25	23000.00	Radiometric	Adler cave

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	36.00	51.10	23000.00	Radiometric	Avdeevskaja
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	41.50	42.30	23000.00	Radiometric	Devis-Khvreli cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	27.90	50.05	23000.00	Radiometric	Dovginichi
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	42.50	42.00	23000.00	Radiometric	Gvardzhilas-Klde
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.87	45.84	23000.00	Radiometric	Veternica cave e
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.87	45.84	23000.00	Radiometric	Veternica cave f
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	32.50	50.50	23000.00	Radiometric	Zhuravka
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	17.96	40.15	23151.00	Radiometric	Cavallo
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	8.13	50.42	23300.00	Radiometric	Wildenscheuer cave st. III
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	31.00	52.50	23400.00	Radiometric	Berdyzhskaja stojanka
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	34.12	53.34	23660.00	Radiometric	Khotylevo II
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.73	46.30	24400.00	Radiometric	Solutre [O/A]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.08	44.85	25752.00	Radiometric	Le Flageolet I [Bezenac]VI
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	40.48	56.13	25848.00	Radiometric	Sungir'

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	14.97	48.84	26235.00	Radiometric	Herdengelhoehle s.6
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]K
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	60.03	60.24	27350.00	Radiometric	Cheremukhovo 4 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	17.00	51.50	27450.00	Radiometric	Krems-Wachtberg
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.72	46.38	28313.00	Radiometric	L'Ermitage [Lussac-les-Chateaux]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.33	44.77	28600.00	Radiometric	Roc de Combe7a
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-3.66	50.49	29176.00	Radiometric	Tornewton Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-5.30	36.13	29544.00	Radiometric	Gorham's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Canis lupus*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Canis lupus*	105.80	54.02	30000.00	NOW	Makarovo III
NOW	*Canis lupus*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Canis lupus*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-9.22	38.90	30100.00	Radiometric	Pego do Diabo
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-3.50	50.46	30185.00	Radiometric	Kent's Cavern
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.73	48.84	30939.00	Radiometric	Milovice I
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-4.13	36.95	31300.00	Radiometric	Zafarraya Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-4.24	51.55	31717.00	Radiometric	Paviland Cave [Goat's Hole]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.89	46.18	32461.00	Radiometric	Krapina
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.30	45.50	32659.00	Radiometric	La Quina Y-Z [Villebois la Valette]1
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	3.87	45.06	32903.00	Radiometric	Les Rivaux, Loc. 1 [Espaly-St-Marcel]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.85	47.70	32979.00	Radiometric	Les Cottes [St. Pierre de Maille]E3
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.04	46.29	33850.00	Radiometric	Velica Pecina j
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.33	44.77	34500.00	Radiometric	Roc de Combe4
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.24	40.50	34540.00	Radiometric	Castelcivitagic
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	6.80	50.70	36163.00	Radiometric	Lommersum
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.77	48.40	36169.00	Radiometric	Das GeissenklosterleI
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.75	42.16	36260.00	Radiometric	Mollet Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.33	43.93	36448.00	Radiometric	Esquicho-Grapaou
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.30	45.50	36543.00	Radiometric	La Quina Y-Z [Villebois la Valette]3
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-7.31	43.48	36700.00	Radiometric	Valina
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.37	43.53	38000.00	Radiometric	Smolucka Pecina
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	17.93	48.55	38400.00	Radiometric	Certova Pec (Radosina)

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
NOW	*Canis lupus*	4.00	44.00	40000.00	NOW	Baume NÃ©ron
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.65	41.77	40000.00	Radiometric	Ingarano c
NOW	*Canis lupus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Canis lupus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
NOW	*Canis lupus*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-8.58	52.22	41631.00	Radiometric	Castlepook Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.87	51.32	43244.00	Radiometric	Banwell Bone Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-3.02	51.32	43730.00	Radiometric	Brean Down
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.33	52.30	45000.00	Radiometric	Niederweningen
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.32	52.17	51000.00	Radiometric	Salzgitter
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	58.60	61.83	53456.57	Fiedler	Uninskaya
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.10	41.23	54200.00	Radiometric	Gr. Guattari
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	60.50	61.27	54769.12	Fiedler	Burmantovo1, 2
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	60.03	60.24	54800.00	Fiedler	Cheremukhovo 1 (1-4)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	28.50	47.50	55031.63	Fiedler	Climauti II i
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	22.54	46.91	55031.63	Fiedler	Valea Sesii
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	58.21	61.80	55294.14	Fiedler	Kaninskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.84	44.88	55400.00	Fiedler	Baume Moula-Guercy V-VII ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-0.21	53.64	55687.91	Fiedler	Stellmoor
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.48	52.57	56212.93	Fiedler	Wretton
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.05	41.23	56344.19	Fiedler	Gr. Breuil
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	22.26	44.59	56344.19	Fiedler	Pestera Climente
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.67	45.37	56344.19	Fiedler	Romualdo Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-0.03	51.46	56475.44	Fiedler	Willments gravels
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.40	50.62	56737.95	Fiedler	Teufelsbrücke 2-3b
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.57	50.87	57400.00	Fiedler	Raj cave 6

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.02	44.97	57656.74	Fiedler	Abri de la Madeleine
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.77	48.41	58181.76	Fiedler	Brillenhohle8
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.45	48.82	58313.02	Fiedler	Große Ofnethöhle V
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.10	51.04	58706.78	Fiedler	Dendermonde
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.51	41.22	59100.55	Fiedler	Gr. di Sant'Agostino
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.15	45.63	59363.06	Fiedler	Artenac 6
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	6.65	50.23	59363.06	Fiedler	Buchenloch
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.25	45.07	59400.00	Fiedler	Grotte du Tai C''
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.88	51.29	59494.32	Fiedler	Picken's Hole, Layer 5
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.16	48.58	59888.08	Fiedler	Steinheim upper level
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
NOW	*Canis lupus*	40.00	44.90	60000.00	NOW	Dakhovskaja cave
NOW	*Canis lupus*	5.01	50.43	60000.00	NOW	Goyet Cave st.4
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	22.37	47.20	60000.00	Radiometric	Igrita cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	33.87	45.25	60000.00	Radiometric	Mamat-Koba

NOW	*Canis lupus*	39.92	43.56	60000.00	NOW	Navalishinskaja cave lower
NOW	*Canis lupus*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	44.30	48.40	60000.00	Radiometric	Sukhaja Mechetka l.4
NOW	*Canis lupus*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-7.63	52.10	60019.34	Fiedler	Shandon Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.72	44.08	60150.59	Fiedler	Abri des Battus 3
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.15	45.63	60150.59	Fiedler	Artenac 8
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.65	48.12	60413.10	Fiedler	Budospest
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.84	44.88	60500.00	Fiedler	Baume Moula-Guercy IV ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.70	45.72	60544.36	Fiedler	GabrovizzaII
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.18	44.82	60544.36	Fiedler	Grotte Maldidier
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	24.71	44.42	60675.61	Fiedler	Icoana
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.42	50.64	60675.61	Fiedler	Roter Berg

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.33	43.93	60938.12	Fiedler	Buca della Iena
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	5.23	45.07	61331.89	Fiedler	Abri de Campalou
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.72	44.08	61331.89	Fiedler	Abri des Battus 5
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.95	45.61	61331.89	Fiedler	Grotte di Veja C
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	20.30	48.50	61331.89	Fiedler	Horvolgy
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.50	45.03	61331.89	Fiedler	La Grotte des Fees
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-3.95	43.28	61594.40	Fiedler	Castillo22

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.16	46.20	61594.40	Fiedler	Riparo Predastel
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.25	45.42	61725.66	Fiedler	Soave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.09	44.82	61856.91	Fiedler	Abri du Morin B1
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.70	45.90	61856.91	Fiedler	Grotta Azzurra
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.75	45.67	61856.91	Fiedler	Grotta Benussi
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.15	45.63	61988.17	Fiedler	Artenac 10
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.37	43.11	61988.17	Fiedler	Montousse I (Haute Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.87	46.71	62250.68	Fiedler	A. Rousseau [Dousse]
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.09	44.82	62250.68	Fiedler	Abri du Morin A4
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.83	42.00	62250.68	Fiedler	Grotta Cola
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.36	45.28	62250.68	Fiedler	Grotta Perin
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	12.40	41.78	62250.68	Fiedler	Vitinia (Upper Beds) (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.67	49.40	62500.00	Radiometric	Barova cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	16.90	50.23	62500.00	Radiometric	Jaskinia Niedwiedzia
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	8.13	50.42	62500.00	Radiometric	Wildenscheuer cave st. I-II
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.25	42.45	62644.44	Fiedler	Brecce di Soave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-0.71	40.90	62644.44	Fiedler	Cueva de los Huesos
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.50	41.15	62906.95	Fiedler	Ambrona
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
PALEODB_EAST	*Canis lupus*	3.00	55.00	63000.00	PALEODB	Dogger Bank
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-5.50	36.22	63038.21	Fiedler	Devil's Tower
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	12.25	41.90	63825.74	Fiedler	La Polledrara di Cecanibbio
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	39.00	45.00	64088.25	Fiedler	Mezmaiskaya Cave 2B
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.63	43.21	64088.25	Fiedler	Montmaurin
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II

Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	12.57	41.92	64482.02	Fiedler	Casal De' Pazzi (Rebibbia)
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	14.97	48.84	64800.00	Radiometric	Herdengelhoehle
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	0.67	52.50	65500.00	Radiometric	Lynford
PALEODB_EAST	*Canis lupus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 10', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Canis lupus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 5', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Canis lupus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 6 composite list', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Canis lupus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 7', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Canis lupus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 8', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Canis lupus*	4.07	51.98	68500.00	PALEODB	Eurogeul
PALEODB_EAST	*Canis lupus*	11.55	45.55	68500.00	PALEODB	Grotta Maggiore do S. Bernardino (Pleistocene), Colli Berici, Northern Italy
PALEODB_EAST	*Canis lupus*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Canis lupus*	160.00	68.75	68500.00	PALEODB	Kolyma River, between the mouth of Omolon and Anjuj, Jedoma-Suite
PALEODB_EAST	*Canis lupus*	141.43	41.41	68500.00	PALEODB	Shiriya, Locality 2
PALEODB_EAST	*Canis lupus*	141.43	41.40	68500.00	PALEODB	Shiriya, Locality 3-1
PALEODB_EAST	*Canis lupus*	141.43	41.40	68500.00	PALEODB	Shiriya, Locality 3-2
PALEODB_EAST	*Canis lupus*	84.75	50.95	68500.00	PALEODB	Ust'-Kanskaia Cave
PALEODB_EAST	*Canis lupus*	-5.34	36.13	68500.00	PALEODB	Vangaurd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
NOW	*Canis lupus*	68.66	38.66	70000.00	NOW	Khudji
NOW	*Canis lupus*	27.36	47.86	70000.00	NOW	Starye Duruitory l. 3-4
NOW	*Canis lupus*	100.00	74.00	70000.00	NOW	Tajmyr p-la LtPl
NOW	*Canis lupus*	4.39	50.98	70000.00	NOW	Zemst IIIC
Raia et al. 2009; Carotenuto et al. 2010	*Canis lupus*	19.77	50.22	70600.00	Radiometric	Jaskinia Nietoperzowa
PALEODB_EAST	*Canis mesomelas*	21.22	-34.42	68500.00	PALEODB	Blombos Cave

PALEODB_EAST	*Canis mesomelas*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
PALEODB_EAST	*Canis mesomelas*	23.40	-34.10	68500.00	PALEODB	Nelson Bay Cave, Pleistocene
NOW	*Capra caucasica*	42.61	42.32	10000.00	NOW	Belaja cave Kolkhida Hol
NOW	*Capra caucasica*	43.50	42.50	10000.00	NOW	Kudaro 1 Hol
NOW	*Capra caucasica*	43.50	42.50	10000.00	NOW	Kudaro 3 l.2 Hol
NOW	*Capra caucasica*	43.00	42.45	10000.00	NOW	Shagat-Khokh-Leget
NOW	*Capra caucasica*	41.20	44.00	10000.00	NOW	Treugol'naja cave 1-2
NOW	*Capra caucasica*	43.24	42.00	10000.00	NOW	Tsona cave Hol
NOW	*Capra caucasica*	41.50	42.30	20000.00	NOW	Devis-Khvreli cave
NOW	*Capra caucasica*	42.50	42.00	20000.00	NOW	Gvardzhilas-Klde
NOW	*Capra caucasica*	41.26	43.02	20000.00	NOW	Kholodnyj Grot/ Kej Bogaz
NOW	*Capra caucasica*	42.10	42.10	20000.00	NOW	Mgvimevi
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	40.17	43.50	24500.00	Radiometric	Akhshtyrskaja cave, Akhshatyr
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	39.00	45.00	58181.76	Fiedler	Mezmaiskaya Cave 2
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
NOW	*Capra caucasica*	40.00	44.90	60000.00	NOW	Dakhovskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	39.00	45.00	61988.17	Fiedler	Mezmaiskaya Cave 2A
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	39.00	45.00	62513.19	Fiedler	Mezmaiskaya Cave 1–2
Raia et al. 2009; Carotenuto et al. 2010	*Capra caucasica*	39.00	45.00	64088.25	Fiedler	Mezmaiskaya Cave 2B
NOW	*Capra cylindricornis*	46.00	42.20	10000.00	NOW	Dzivgis
NOW	*Capra cylindricornis*	46.00	42.30	10000.00	NOW	Lesgor I&II
NOW	*Capra ibex*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.08	43.91	12000.00	Radiometric	Chinchon I

Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	16.90	43.60	12392.50	Radiometric	Kopacina
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	20.10	40.17	15000.00	Radiometric	Klithi
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.66	44.62	18388.00	Radiometric	Gr. Pegourie [Caniac du Causse]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
NOW	*Capra ibex*	22.37	47.20	20000.00	NOW	Igrita cave
NOW	*Capra ibex*	17.00	51.50	20000.00	NOW	Krems-Wachtberg
NOW	*Capra ibex*	27.08	48.55	20000.00	NOW	Molodova I l.1-3 LtPal
NOW	*Capra ibex*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XIV-XV
NOW	*Capra ibex*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XVI-XVII
NOW	*Capra ibex*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Capra ibex*	15.87	45.84	20000.00	NOW	Veternica cave st. d
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	0.95	44.97	21466.00	Radiometric	Laugerie-Haute Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.47	44.35	21500.00	Radiometric	Gr. de La Baume d'Oullins (a.k.a. d'Oulen\) [Labastide-de-Virac]"
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-4.84	43.42	21765.00	Radiometric	La Riera1
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	25.48	45.54	22000.00	Radiometric	Gura Cheii-Rasnov
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-0.49	45.04	22200.00	Radiometric	Roc de la Melca
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	0.95	44.97	22207.00	Radiometric	Laugerie-Haute Est
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-4.84	43.42	22280.00	Radiometric	La Riera23
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.01	45.21	22383.00	Radiometric	Gr. des Cottier[s] [Retournac]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	15.87	45.84	23000.00	Radiometric	Veternica cave e
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	0.94	44.96	23662.00	Radiometric	La FerrassieD2

Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	2.34	43.31	24025.00	Radiometric	Canecaude I [Villardonel]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.54	44.33	24200.00	Radiometric	Gr. St-Marcel [d'Ardeche] [Bidon]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.97	50.48	24700.00	Radiometric	Gr. de la Princesse [Marche-les-Dames]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-1.90	43.27	25500.00	Radiometric	Aitzbitarte III
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.08	44.85	25752.00	Radiometric	Le Flageolet I [Bezenac]VI
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.33	44.77	26800.00	Radiometric	Roc de Combe6
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]K
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.08	44.85	27870.00	Radiometric	Le Flageolet I [Bezenac]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-0.16	43.11	27931.00	Radiometric	Trou du Rhinoceros [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-4.84	43.42	28147.00	Radiometric	Cueto de la Mina
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	16.16	46.26	28500.00	Radiometric	Vindija Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.33	44.77	28600.00	Radiometric	Roc de Combe7a
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.06	44.98	29500.00	Radiometric	Abri du Facteur

Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Capra ibex*	20.36	43.53	30000.00	NOW	Smolucka Pecina
NOW	*Capra ibex*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-0.16	43.11	30778.00	Radiometric	Grotte de Courau (Grotte Saucet) [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.33	44.77	31300.00	Radiometric	Roc de Combe1c
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-4.13	36.95	31300.00	Radiometric	Zafarraya Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	0.85	47.70	32979.00	Radiometric	Les Cottes [St. Pierre de Maille]E3
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.33	44.77	34500.00	Radiometric	Roc de Combe4
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	15.24	40.50	34540.00	Radiometric	Castelcivitagic
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	10.90	45.57	34939.00	Radiometric	Abri Fumane
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	9.77	48.40	36169.00	Radiometric	Das GeissenklosterleI
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.33	43.93	36448.00	Radiometric	Esquicho-Grapaou

Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	2.06	42.85	37905.00	Radiometric	Caune de Belvis [Belvis]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
NOW	*Capra ibex*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Capra ibex*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	11.49	45.42	40843.00	Radiometric	Gr. di Paina
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	18.50	42.78	43730.00	Radiometric	Crvena Stijena
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.97	50.21	43760.00	Radiometric	Trou MagriteM3
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	9.80	48.41	52012.76	Fiedler	Rusenschloss
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.56	44.84	52931.55	Fiedler	Abri de Combe-Cullier
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]

Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	22.54	46.91	55031.63	Fiedler	Valea Sesii
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	13.05	41.23	56344.19	Fiedler	Gr. Breuil
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	22.26	44.59	56344.19	Fiedler	Pestera Climente
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	13.67	45.37	56344.19	Fiedler	Romualdo Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	-7.64	39.66	56475.44	Fiedler	Foz do Enxarrique
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.02	44.97	57656.74	Fiedler	Abri de la Madeleine
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.43	45.09	58444.27	Fiedler	Gr. de Preletang [Presles]
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.03	50.50	58444.27	Fiedler	Princesse Pauline
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.59	42.86	58838.04	Fiedler	Abri du Flageolet II
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	13.51	41.22	59100.55	Fiedler	Gr. di Sant'Agostino
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.08	44.84	59363.06	Fiedler	Abri du Flageolet I
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	12.44	43.19	59363.06	Fiedler	Monte Cucco
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.25	45.07	59400.00	Fiedler	Grotte du Tai C''
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.87	44.60	59494.32	Fiedler	Saint Eulaile
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
NOW	*Capra ibex*	16.66	49.40	60000.00	NOW	Barova cave
NOW	*Capra ibex*	5.01	50.43	60000.00	NOW	Goyet Cave st.4
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	6.24	43.44	60019.34	Fiedler	Trou du Renard

Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.72	44.08	60150.59	Fiedler	Abri des Battus 3
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.18	44.82	60544.36	Fiedler	Grotte Maldidier
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	15.24	40.50	60675.61	Fiedler	Castelcivita
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	5.23	45.07	61331.89	Fiedler	Abri de Campalou
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	1.72	44.08	61331.89	Fiedler	Abri des Battus 5
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	10.95	45.61	61331.89	Fiedler	Grotte di Veja C
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	11.16	46.20	61594.40	Fiedler	Riparo Predastel
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	13.70	45.90	61856.91	Fiedler	Grotta Azzurra
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	22.58	37.00	63038.21	Fiedler	Apidima Cave B
Raia et al. 2009; Carotenuto et al. 2010	*Capra ibex*	22.58	37.00	63038.21	Fiedler	Apidima Cave C

PALEODB_EAST	*Capra ibex*	11.55	45.55	68500.00	PALEODB	Grotta Maggiore do S. Bernardino (Pleistocene), Colli Berici, Northern Italy
PALEODB_EAST	*Capra ibex*	-5.34	36.13	68500.00	PALEODB	Vangaurd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-3.84	43.36	21500.00	Radiometric	Cueva Morin
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-9.22	38.90	30100.00	Radiometric	Pego do Diabo
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-2.75	42.16	36260.00	Radiometric	Mollet Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-3.01	41.01	61100.00	Fiedler	Las Figuras (Alcorlo)
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-3.47	42.05	61331.89	Fiedler	Cueva Millan 1a
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-5.50	36.22	63038.21	Fiedler	Devil's Tower
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Capra pyrenaica*	-8.59	39.53	70000.00	Radiometric	Oliveira Cave
NOW	*Capra sibirica*	91.65	57.05	20000.00	NOW	Karaul'nyj Byk l. 3-9
NOW	*Capra sibirica*	85.05	51.00	20000.00	NOW	Maloialomanskaja l.2
NOW	*Capra sibirica*	91.77	57.01	20000.00	NOW	Pereselencheskij Punkt
NOW	*Capra sibirica*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Capra sibirica*	91.43	52.97	20000.00	NOW	Ui I, 2-2/3
NOW	*Capra sibirica*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
NOW	*Capra sibirica*	84.33	51.67	40000.00	NOW	Okladnikov cave
NOW	*Capra sibirica*	89.47	54.45	40000.00	NOW	Proskurjakov cave
NOW	*Capra sibirica*	92.81	55.97	60000.00	NOW	Devjatka cave early
NOW	*Capreolus capreolus*	40.16	43.50	10000.00	NOW	Akhshtyrskaja cave Hol
NOW	*Capreolus capreolus*	42.00	42.00	10000.00	NOW	Anaklia
NOW	*Capreolus capreolus*	92.82	55.97	10000.00	NOW	Badzhejskaja cave

NOW	*Capreolus capreolus*	92.80	56.01	10000.00	NOW	Bezdonnaja Yama cave
NOW	*Capreolus capreolus*	92.82	55.97	10000.00	NOW	Bolshaja Oreshnaja cave Hol
NOW	*Capreolus capreolus*	9.13	48.07	10000.00	NOW	BurghÃ¶hle Dietfurt Hol
NOW	*Capreolus capreolus*	92.81	55.97	10000.00	NOW	Devjatka cave
NOW	*Capreolus capreolus*	46.00	42.20	10000.00	NOW	Dzivgis
NOW	*Capreolus capreolus*	92.80	56.01	10000.00	NOW	Gnilaja Yama cave
NOW	*Capreolus capreolus*	92.80	56.01	10000.00	NOW	Khitryj Kljuch grot
NOW	*Capreolus capreolus*	92.80	56.01	10000.00	NOW	Ledjanaja cave
NOW	*Capreolus capreolus*	92.79	56.01	10000.00	NOW	Ledopadnaja cave
NOW	*Capreolus capreolus*	46.00	42.30	10000.00	NOW	Lesgor I&II
NOW	*Capreolus capreolus*	60.04	59.28	10000.00	NOW	Lobvinskaja cave
NOW	*Capreolus capreolus*	4.05	51.95	10000.00	NOW	Maasvlakte (Fauna III)
NOW	*Capreolus capreolus*	27.28	48.27	10000.00	NOW	Molodova V [Kosoutsy]
NOW	*Capreolus capreolus*	40.85	44.20	10000.00	NOW	Monasheskaja l.1/Barakaevskaja
NOW	*Capreolus capreolus*	92.79	56.01	10000.00	NOW	Nizhnesliznevskaja cave
NOW	*Capreolus capreolus*	57.06	65.07	10000.00	NOW	Pechora, Unja caves
NOW	*Capreolus capreolus*	23.02	43.13	10000.00	NOW	Pestera Cioarei st. XVIII
NOW	*Capreolus capreolus*	92.79	56.01	10000.00	NOW	Roevskaja cave
NOW	*Capreolus capreolus*	103.43	52.87	10000.00	NOW	Sosnovyj Bor l. 3-4
NOW	*Capreolus capreolus*	95.92	56.18	10000.00	NOW	Strizhova Gora l.4, 8-16,17
NOW	*Capreolus capreolus*	132.00	43.50	10000.00	NOW	Suchan caves
NOW	*Capreolus capreolus*	108.62	50.21	10000.00	NOW	Ust'-Menza II
NOW	*Capreolus capreolus*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
NOW	*Capreolus capreolus*	104.28	52.37	10000.00	NOW	Verkholenskaja Gora 1 l.3
NOW	*Capreolus capreolus*	23.50	38.00	10000.00	NOW	Vraona cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	16.90	43.60	12392.50	Radiometric	Kopacina
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.05	43.11	16270.00	Radiometric	Cueva de Eralla
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.10	43.18	17050.00	Radiometric	Cueva de Urtiaga

Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	27.21	48.19	17200.00	Radiometric	Cosauti
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.10	43.18	17950.00	Radiometric	Cueva de Aitzbitarte
NOW	*Capreolus capreolus*	75.00	51.50	20000.00	NOW	Irtysh left bank
NOW	*Capreolus capreolus*	27.08	48.55	20000.00	NOW	Molodova I l.1-3 LtPal
NOW	*Capreolus capreolus*	108.00	59.90	20000.00	NOW	Nepa
NOW	*Capreolus capreolus*	91.77	57.01	20000.00	NOW	Pereselencheskij Punkt
NOW	*Capreolus capreolus*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Capreolus capreolus*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Capreolus capreolus*	86.07	51.20	20000.00	NOW	Tytkesken' III l.7
NOW	*Capreolus capreolus*	93.00	54.00	20000.00	NOW	Ulazy
NOW	*Capreolus capreolus*	103.50	52.60	20000.00	NOW	Ust'-Belaja 14-16
NOW	*Capreolus capreolus*	104.28	52.37	20000.00	NOW	Verkholenskaja Gora 1 l.2
NOW	*Capreolus capreolus*	15.87	45.84	20000.00	NOW	Veternica cave st. d
NOW	*Capreolus capreolus*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
NOW	*Capreolus capreolus*	104.32	52.30	20000.00	NOW	Voennyj Gospital'
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	8.32	44.20	20470.00	Radiometric	Arene Candide
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	20.50	39.42	20800.00	Radiometric	Kastritsa
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-3.84	43.36	21500.00	Radiometric	Cueva Morin
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-4.84	43.42	21765.00	Radiometric	La Riera1
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.26	43.16	22220.00	Radiometric	Ekain Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-4.84	43.42	22280.00	Radiometric	La Riera23
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	41.50	42.30	23000.00	Radiometric	Devis-Khvreli cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	42.50	42.00	23000.00	Radiometric	Gvardzhilas-Klde
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	31.28	49.45	23000.00	Radiometric	Kanev

Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	15.87	45.84	23000.00	Radiometric	Veternica cave e
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	4.54	44.33	24200.00	Radiometric	Gr. St-Marcel [d'Ardeche] [Bidon]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	40.17	43.50	24500.00	Radiometric	Akhshtyrskaja cave, Akhshatyr
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-1.90	43.27	25500.00	Radiometric	Aitzbitarte III
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.08	44.85	25752.00	Radiometric	Le Flageolet I [Bezenac]VI
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.33	44.77	26800.00	Radiometric	Roc de Combe6
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.08	44.85	27870.00	Radiometric	Le Flageolet I [Bezenac]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-4.84	43.42	28147.00	Radiometric	Cueto de la Mina
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.08	44.85	28595.00	Radiometric	Le Flageolet I [Bezenac]IX
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Capreolus capreolus*	1.50	45.05	30000.00	NOW	Jaurens
NOW	*Capreolus capreolus*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-0.16	43.11	30778.00	Radiometric	Grotte de Courau (Grotte Saucet) [St-Pe-de-Bigorre]

Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.33	44.77	31300.00	Radiometric	Roc de Combe1c
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-4.13	36.95	31300.00	Radiometric	Zafarraya Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	15.89	46.18	32461.00	Radiometric	Krapina
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	5.00	52.00	32500.00	Radiometric	Raalte
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.33	44.77	34500.00	Radiometric	Roc de Combe4
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	15.24	40.50	34540.00	Radiometric	Castelcivitagic
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	10.90	45.57	34939.00	Radiometric	Abri Fumane
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-7.31	43.48	36700.00	Radiometric	Valina
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	2.06	42.85	37905.00	Radiometric	Caune de Belvis [Belvis]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	17.93	48.55	38400.00	Radiometric	Certova Pec (Radosina)
NOW	*Capreolus capreolus*	84.33	51.67	40000.00	NOW	Okladnikov cave
NOW	*Capreolus capreolus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Capreolus capreolus*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.49	45.42	40843.00	Radiometric	Gr. di Paina
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.75	42.16	43047.00	Radiometric	Reclau Viver

Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.17	45.06	53978.00	Radiometric	Regourdou [Montignac]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.40	50.62	55950.42	Fiedler	Teufelsbrücke 3
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.05	41.23	56344.19	Fiedler	Gr. Breuil
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.02	44.97	57656.74	Fiedler	Abri de la Madeleine
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.51	41.22	59100.55	Fiedler	Gr. di Sant'Agostino
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.08	44.84	59363.06	Fiedler	Abri du Flageolet I
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.15	45.63	59363.06	Fiedler	Artenac 6
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-4.10	43.40	59363.06	Fiedler	Cueva de Altamira Sol
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
NOW	*Capreolus capreolus*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.15	45.63	60150.59	Fiedler	Artenac 8
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.18	51.26	60150.59	Fiedler	Bacon hole
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	5.68	50.83	60281.85	Fiedler	Maastricht-Belvedere 4
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.70	45.72	60544.36	Fiedler	GabrovizzaII

Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	15.24	40.50	60675.61	Fiedler	Castelcivita
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	24.71	44.42	60675.61	Fiedler	Icoana
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.10	43.18	60806.87	Fiedler	Cueva de Ermittia
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	10.33	43.93	60938.12	Fiedler	Buca della Iena
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-3.01	41.01	61100.00	Fiedler	Las Figuras (Alcorlo)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	9.16	48.58	61200.64	Fiedler	Steinheim middle level
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-3.47	42.05	61331.89	Fiedler	Cueva Millan 1a
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	20.30	48.50	61331.89	Fiedler	Horvolgy
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)

Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	10.02	51.47	61594.40	Fiedler	Bettenroder Berg 14
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.16	46.20	61594.40	Fiedler	Riparo Predastel
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.25	45.42	61725.66	Fiedler	Soave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.70	45.90	61856.91	Fiedler	Grotta Azzurra
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.75	45.67	61856.91	Fiedler	Grotta Benussi
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	39.00	45.00	61988.17	Fiedler	Mezmaiskaya Cave 2A
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.37	43.11	61988.17	Fiedler	Montousse I (Haute Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.87	46.71	62250.68	Fiedler	A. Rousseau [Dousse]
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.27	44.85	62250.68	Fiedler	Abri Caminade-Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.09	44.82	62250.68	Fiedler	Abri du Morin A4
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-3.33	40.87	62250.68	Fiedler	Cueva del Congosto, Guadalajara
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.83	42.00	62250.68	Fiedler	Grotta Cola
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.36	45.28	62250.68	Fiedler	Grotta Perin
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)

Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	16.90	50.23	62500.00	Radiometric	Jaskinia Niedwiedzia
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.25	42.45	62644.44	Fiedler	Brecce di Soave
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	0.30	51.43	62644.44	Fiedler	Purfleet gravels
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	47.00	43.30	63038.21	Fiedler	Alkhast
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	12.57	41.92	64482.02	Fiedler	Casal De' Pazzi (Rebibbia)
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
PALEODB_EAST	*Capreolus capreolus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 6 composite list', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Capreolus capreolus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 8', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Capreolus capreolus*	11.55	45.55	68500.00	PALEODB	Grotta Maggiore do S. Bernardino (Pleistocene), Colli Berici, Northern Italy
PALEODB_EAST	*Capreolus capreolus*	35.05	32.72	68500.00	PALEODB	Tabun Cave Level C & D
Raia et al. 2009; Carotenuto et al. 2010	*Capreolus capreolus*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli
NOW	*Cervus elaphus*	40.16	43.50	10000.00	NOW	Akhshtyrskaja cave Hol

NOW	*Cervus elaphus*	42.00	42.00	10000.00	NOW	Anaklia
NOW	*Cervus elaphus*	92.82	55.97	10000.00	NOW	Badzhejskaja cave
NOW	*Cervus elaphus*	18.91	47.63	10000.00	NOW	Bivak cave Hol
NOW	*Cervus elaphus*	92.82	55.97	10000.00	NOW	Bolshaja Oreshnaja cave Hol
NOW	*Cervus elaphus*	9.13	48.07	10000.00	NOW	BurghÃ¶hle Dietfurt Hol
NOW	*Cervus elaphus*	46.00	42.20	10000.00	NOW	Dzivgis
NOW	*Cervus elaphus*	37.00	52.00	10000.00	NOW	Eliseevichi
NOW	*Cervus elaphus*	92.80	56.01	10000.00	NOW	Gnilaja Yama cave
NOW	*Cervus elaphus*	44.50	40.20	10000.00	NOW	Karmir Blur (Tejshebaini) cast
NOW	*Cervus elaphus*	35.40	48.40	10000.00	NOW	Kichkas
NOW	*Cervus elaphus*	30.50	50.40	10000.00	NOW	Kiev zemljanki
NOW	*Cervus elaphus*	34.54	38.55	10000.00	NOW	KratergÃ¶lu
NOW	*Cervus elaphus*	43.50	42.50	10000.00	NOW	Kudaro 1 Hol
NOW	*Cervus elaphus*	43.50	42.50	10000.00	NOW	Kudaro 3 l.2 Hol
NOW	*Cervus elaphus*	46.00	42.30	10000.00	NOW	Lesgor I&II
NOW	*Cervus elaphus*	4.05	51.95	10000.00	NOW	Maasvlakte (Fauna III)
NOW	*Cervus elaphus*	105.82	54.03	10000.00	NOW	Makarovo II 3-4
NOW	*Cervus elaphus*	40.85	44.20	10000.00	NOW	Monasheskaja l.1/Barakaevskaja
NOW	*Cervus elaphus*	23.02	43.13	10000.00	NOW	Pestera Cioarei st. XVIII
NOW	*Cervus elaphus*	44.40	40.30	10000.00	NOW	Sarajbulakhskij, Urtskij khreb
NOW	*Cervus elaphus*	43.00	42.45	10000.00	NOW	Shagat-Khokh-Leget
NOW	*Cervus elaphus*	103.43	52.87	10000.00	NOW	Sosnovyj Bor l. 3-4
NOW	*Cervus elaphus*	95.92	56.18	10000.00	NOW	Strizhova Gora l.4, 8-16,17
NOW	*Cervus elaphus*	108.50	50.17	10000.00	NOW	Studenoe l. 14-19
NOW	*Cervus elaphus*	132.00	43.50	10000.00	NOW	Suchan caves
NOW	*Cervus elaphus*	91.02	54.60	10000.00	NOW	Tashtyk I l.1-3, exc.2
NOW	*Cervus elaphus*	41.20	44.00	10000.00	NOW	Treugol'naja cave 1-2
NOW	*Cervus elaphus*	43.24	42.00	10000.00	NOW	Tsona cave Hol
NOW	*Cervus elaphus*	91.44	52.97	10000.00	NOW	Ui II, 2-7, exc. 1
NOW	*Cervus elaphus*	108.62	50.21	10000.00	NOW	Ust'-Menza II
NOW	*Cervus elaphus*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
NOW	*Cervus elaphus*	104.28	52.37	10000.00	NOW	Verkholenskaja Gora 1 l.3
NOW	*Cervus elaphus*	23.50	38.00	10000.00	NOW	Vraona cave
NOW	*Cervus elaphus*	37.00	51.80	10000.00	NOW	Yudinovo

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	19.92	50.08	12000.00	Radiometric	Mamutowa Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	16.90	43.60	12392.50	Radiometric	Kopacina
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.10	40.17	15000.00	Radiometric	Klithi
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.05	43.11	16270.00	Radiometric	Cueva de Eralla
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	14.50	45.32	16780.00	Radiometric	Zupanov Spodmol
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	23.90	37.92	16932.50	Radiometric	Vraona cave (Attiki)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.10	43.18	17050.00	Radiometric	Cueva de Urtiaga
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	27.21	48.19	17200.00	Radiometric	Cosauti
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	17.58	45.20	17500.00	Radiometric	Kamenika
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	14.50	45.33	17500.00	Radiometric	Pecina na Gradini
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	17.88	45.42	17500.00	Radiometric	Zarilac
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.10	43.18	17950.00	Radiometric	Cueva de Aitzbitarte
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	39.00	44.10	18040.00	Radiometric	Anetovka II
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	16.17	43.83	18388.00	Radiometric	Pecine u Brini East&West caves
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	19.50	50.53	19250.00	Radiometric	Deszczowa Cave
NOW	*Cervus elaphus*	20.00	40.36	20000.00	NOW	Cardamone
NOW	*Cervus elaphus*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Cervus elaphus*	75.00	51.50	20000.00	NOW	Irtysh left bank
NOW	*Cervus elaphus*	41.26	43.02	20000.00	NOW	Kholodnyj Grot/ Kej Bogaz
NOW	*Cervus elaphus*	89.45	54.42	20000.00	NOW	Malaja Syja l. 1-2
NOW	*Cervus elaphus*	27.08	48.55	20000.00	NOW	Molodova I l.1-3 LtPal

NOW	*Cervus elaphus*	90.95	54.97	20000.00	NOW	Novoselovo XI
NOW	*Cervus elaphus*	91.77	57.01	20000.00	NOW	Pereselencheskij Punkt
NOW	*Cervus elaphus*	91.07	54.58	20000.00	NOW	Sabanikha
NOW	*Cervus elaphus*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Cervus elaphus*	91.60	57.10	20000.00	NOW	Shalunin Byk
NOW	*Cervus elaphus*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Cervus elaphus*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Cervus elaphus*	103.43	52.87	20000.00	NOW	Sosnovyj Bor l. 5
NOW	*Cervus elaphus*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Cervus elaphus*	91.43	52.97	20000.00	NOW	Ui I, 2-2/3
NOW	*Cervus elaphus*	93.00	54.00	20000.00	NOW	Ulazy
NOW	*Cervus elaphus*	103.50	52.60	20000.00	NOW	Ust'-Belaja 14-16
NOW	*Cervus elaphus*	84.68	51.38	20000.00	NOW	Ust-Karakol l. 2
NOW	*Cervus elaphus*	87.00	51.70	20000.00	NOW	Ust'-Kujum
NOW	*Cervus elaphus*	104.28	52.37	20000.00	NOW	Verkholenskaja Gora 1 l.2
NOW	*Cervus elaphus*	15.87	45.84	20000.00	NOW	Veternica cave st. d
NOW	*Cervus elaphus*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
NOW	*Cervus elaphus*	104.32	52.30	20000.00	NOW	Voennyj Gospital'
NOW	*Cervus elaphus*	16.66	42.26	20000.00	NOW	Zitny cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	8.32	44.20	20470.00	Radiometric	Arene Candide
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.50	39.42	20800.00	Radiometric	Kastritsa
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.95	44.97	21466.00	Radiometric	Laugerie-Haute Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.84	43.36	21500.00	Radiometric	Cueva Morin
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.47	44.35	21500.00	Radiometric	Gr. de La Baume d'Oullins (a.k.a. d'Oulen\) [Labastide-de-Virac]"
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-4.84	43.42	21765.00	Radiometric	La Riera1
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	25.48	45.54	22000.00	Radiometric	Gura Cheii-Rasnov
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	27.04	48.24	22100.00	Radiometric	Ciuntu

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-0.49	45.04	22200.00	Radiometric	Roc de la Melca
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.95	44.97	22207.00	Radiometric	Laugerie-Haute Est
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.26	43.16	22220.00	Radiometric	Ekain Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-4.84	43.42	22280.00	Radiometric	La Riera23
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	28.50	47.50	22600.00	Radiometric	Climauti II S
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.72	46.40	22696.00	Radiometric	Gr. de Laraux
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	41.50	42.30	23000.00	Radiometric	Devis-Khvreli cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	42.50	42.00	23000.00	Radiometric	Gvardzhilas-Klde
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	31.28	49.45	23000.00	Radiometric	Kanev
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	16.67	49.25	23000.00	Radiometric	Pekarna cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.87	45.84	23000.00	Radiometric	Veternica cave e
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.87	45.84	23000.00	Radiometric	Veternica cave f
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	32.50	50.50	23000.00	Radiometric	Zhuravka
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	17.96	40.15	23151.00	Radiometric	Cavallo
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.54	44.33	24200.00	Radiometric	Gr. St-Marcel [d'Ardeche] [Bidon]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	40.17	43.50	24500.00	Radiometric	Akhshtyrskaja cave, Akhshatyr
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.97	50.48	24700.00	Radiometric	Gr. de la Princesse [Marche-les-Dames]

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-1.90	43.27	25500.00	Radiometric	Aitzbitarte III
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	6.14	47.61	25677.00	Radiometric	Gr. d'Echenoz-la-Meline [La Baume]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.08	44.85	25752.00	Radiometric	Le Flageolet I [Bezenac]VI
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	14.97	48.84	26235.00	Radiometric	Herdengelhoehle s.6
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.86	46.70	26728.00	Radiometric	Fontenioux [St Pierre de Maille]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.33	44.77	26800.00	Radiometric	Roc de Combe6
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	3.99	50.47	26885.00	Radiometric	Maisieres-Canal
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]K
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	17.00	51.50	27450.00	Radiometric	Krems-Wachtberg
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.08	44.85	27870.00	Radiometric	Le Flageolet I [Bezenac]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-0.16	43.11	27931.00	Radiometric	Trou du Rhinoceros [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-4.84	43.42	28147.00	Radiometric	Cueto de la Mina
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.28	47.53	28240.00	Radiometric	Montagne de Girault [Genay]1
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.72	46.38	28313.00	Radiometric	L'Ermitage [Lussac-les-Chateaux]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.85	44.72	28400.00	Radiometric	A. du Mas Viel [St-Simon]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.08	44.85	28595.00	Radiometric	Le Flageolet I [Bezenac]IX
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.33	44.77	28600.00	Radiometric	Roc de Combe7a
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.06	44.98	29500.00	Radiometric	Abri du Facteur
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-5.30	36.13	29544.00	Radiometric	Gorham's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Cervus elaphus*	1.50	45.05	30000.00	NOW	Jaurens
NOW	*Cervus elaphus*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Cervus elaphus*	105.80	54.02	30000.00	NOW	Makarovo III
NOW	*Cervus elaphus*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
NOW	*Cervus elaphus*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-9.22	38.90	30100.00	Radiometric	Pego do Diabo
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.50	50.46	30185.00	Radiometric	Kent's Cavern
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-0.16	43.11	30778.00	Radiometric	Grotte de Courau (Grotte Saucet) [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.94	44.96	30782.00	Radiometric	La FerrassieI1

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.33	44.77	31300.00	Radiometric	Roc de Combe1c
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-4.13	36.95	31300.00	Radiometric	Zafarraya Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.89	46.18	32461.00	Radiometric	Krapina
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	3.87	45.06	32903.00	Radiometric	Les Rivaux, Loc. 1 [Espaly-St-Marcel]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.85	47.70	32979.00	Radiometric	Les Cottes [St. Pierre de Maille]E3
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.47	45.00	33800.00	Radiometric	Sirejol [Gignac]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.33	44.77	34500.00	Radiometric	Roc de Combe4
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.24	40.50	34540.00	Radiometric	Castelcivitagic
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.90	45.57	34939.00	Radiometric	Abri Fumane
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.63	48.12	35127.00	Radiometric	Szeleta Cave

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.75	42.16	36260.00	Radiometric	Mollet Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.26	44.88	36366.00	Radiometric	Abri Caminade [Caneda]D21
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.33	43.93	36448.00	Radiometric	Esquicho-Grapaou
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-7.31	43.48	36700.00	Radiometric	Valina
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.26	44.88	37894.00	Radiometric	Abri Caminade [Caneda]F
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	2.06	42.85	37905.00	Radiometric	Caune de Belvis [Belvis]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.37	43.53	38000.00	Radiometric	Smolucka Pecina
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	17.93	48.55	38400.00	Radiometric	Certova Pec (Radosina)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
NOW	*Cervus elaphus*	4.00	44.00	40000.00	NOW	Baume NÃ©ron
NOW	*Cervus elaphus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Cervus elaphus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
NOW	*Cervus elaphus*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.49	45.42	40843.00	Radiometric	Gr. di Paina

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.22	44.81	41900.00	Radiometric	Combe Grenal [Domme, Dordogne]1
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.57	45.47	42224.00	Radiometric	Gr. del Broion
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	18.50	42.78	43730.00	Radiometric	Crvena Stijena
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.17	45.06	53978.00	Radiometric	Regourdou [Montignac]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	3.90	43.94	57200.00	Radiometric	La Roquette II [Conquerac]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	16.67	49.27	57394.23	Fiedler	Ztiny cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	19.05	47.75	57656.74	Fiedler	Remete cave

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.43	45.09	58444.27	Fiedler	Gr. de Preletang [Presles]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.03	50.50	58444.27	Fiedler	Princesse Pauline
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.10	51.04	58706.78	Fiedler	Dendermonde
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.59	42.86	58838.04	Fiedler	Abri du Flageolet II
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.08	44.84	59363.06	Fiedler	Abri du Flageolet I
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	6.65	50.23	59363.06	Fiedler	Buchenloch
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-4.10	43.40	59363.06	Fiedler	Cueva de Altamira Sol
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.44	43.19	59363.06	Fiedler	Monte Cucco
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.25	45.07	59400.00	Fiedler	Grotte du Tai C''
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.88	51.29	59494.32	Fiedler	Picken's Hole, Layer 5
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.87	44.60	59494.32	Fiedler	Saint Eulaile
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	9.72	48.37	59756.83	Fiedler	Kogelstein

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	9.16	48.58	59888.08	Fiedler	Steinheim upper level
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	40.00	44.90	60000.00	Radiometric	Dakhovskaja cave
NOW	*Cervus elaphus*	5.01	50.43	60000.00	NOW	Goyet Cave st.4
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
NOW	*Cervus elaphus*	9.76	48.40	60000.00	NOW	Sirgenstein cave
NOW	*Cervus elaphus*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	44.30	48.40	60000.00	Radiometric	Sukhaja Mechetka l.4
NOW	*Cervus elaphus*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-7.63	52.10	60019.34	Fiedler	Shandon Cave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	6.24	43.44	60019.34	Fiedler	Trou du Renard
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.72	44.08	60150.59	Fiedler	Abri des Battus 3
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.18	51.26	60150.59	Fiedler	Bacon hole
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	7.30	50.53	60281.85	Fiedler	Ariendorf
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.68	50.83	60281.85	Fiedler	Maastricht-Belvedere 4
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.65	48.12	60413.10	Fiedler	Budospest
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-1.34	43.08	60413.10	Fiedler	Cueva de Abauntz
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.84	44.88	60500.00	Fiedler	Baume Moula-Guercy IV ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.18	44.82	60544.36	Fiedler	Grotte Maldidier
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.24	40.50	60675.61	Fiedler	Castelcivita
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	24.71	44.42	60675.61	Fiedler	Icoana
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.10	43.18	60806.87	Fiedler	Cueva de Ermittia
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.01	41.01	61100.00	Fiedler	Las Figuras (Alcorlo)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	9.16	48.58	61200.64	Fiedler	Steinheim middle level
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	5.23	45.07	61331.89	Fiedler	Abri de Campalou
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.72	44.08	61331.89	Fiedler	Abri des Battus 5
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.47	42.05	61331.89	Fiedler	Cueva Millan 1a
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.95	45.61	61331.89	Fiedler	Grotte di Veja C
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	20.30	48.50	61331.89	Fiedler	Horvolgy
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.50	45.03	61331.89	Fiedler	La Grotte des Fees
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.02	51.47	61594.40	Fiedler	Bettenroder Berg 14
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.16	46.20	61594.40	Fiedler	Riparo Predastel
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.50	44.01	61700.00	Fiedler	Gr. de la Nauterie I [La Romieu]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.25	45.42	61725.66	Fiedler	Soave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.09	44.82	61856.91	Fiedler	Abri du Morin B1

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	22.50	41.05	61856.91	Fiedler	Agios Georgios
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	13.70	45.90	61856.91	Fiedler	Grotta Azzurra
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	13.75	45.67	61856.91	Fiedler	Grotta Benussi
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.50	41.93	61856.91	Fiedler	Monte Delle Gioie
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.15	45.63	61988.17	Fiedler	Artenac 10
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	39.00	45.00	61988.17	Fiedler	Mezmaiskaya Cave 2A
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.37	43.11	61988.17	Fiedler	Montousse I (Haute Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.87	46.71	62250.68	Fiedler	A. Rousseau [Dousse]
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.27	44.85	62250.68	Fiedler	Abri Caminade-Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.09	44.82	62250.68	Fiedler	Abri du Morin A4
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.03	49.30	62250.68	Fiedler	Cleon
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.33	40.87	62250.68	Fiedler	Cueva del Congosto, Guadalajara
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.83	42.00	62250.68	Fiedler	Grotta Cola
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.36	45.28	62250.68	Fiedler	Grotta Perin
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.52	42.10	62250.68	Fiedler	Riano
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	18.30	40.11	62250.68	Fiedler	San Sidero

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.40	41.78	62250.68	Fiedler	Vitinia (Upper Beds) (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	39.00	45.00	62513.19	Fiedler	Mezmaiskaya Cave 1–2
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.50	41.92	62513.19	Fiedler	Prati Fiscali
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.25	42.45	62644.44	Fiedler	Brecce di Soave
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-0.71	40.90	62644.44	Fiedler	Cueva de los Huesos
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.30	51.43	62644.44	Fiedler	Purfleet gravels
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-4.37	40.80	62644.44	Fiedler	Villacastin C2
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.50	41.15	62906.95	Fiedler	Ambrona
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.73	42.22	62906.95	Fiedler	Fara Sabina
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
PALEODB_EAST	*Cervus elaphus*	3.00	55.00	63000.00	PALEODB	Dogger Bank
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	47.00	43.30	63038.21	Fiedler	Alkhast
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	22.58	37.00	63038.21	Fiedler	Apidima Cave B
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	22.58	37.00	63038.21	Fiedler	Apidima Cave C
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.10	41.98	63038.21	Fiedler	Cerveteri (Rome)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-5.50	36.22	63038.21	Fiedler	Devil's Tower
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	43.00	45.60	63038.21	Fiedler	Zejukovo, Nal'chik
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	32.00	49.00	63169.47	Fiedler	Andreevka

Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	13.70	41.45	63300.72	Fiedler	Pontecorvo (Frosinone)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.25	41.90	63825.74	Fiedler	La Polledrara di Cecanibbio
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	39.00	45.00	64088.25	Fiedler	Mezmaiskaya Cave 2B
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	0.63	43.21	64088.25	Fiedler	Montmaurin
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	12.57	41.92	64482.02	Fiedler	Casal De’ Pazzi (Rebibbia)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	9.16	48.58	65925.83	Fiedler	Steinheim lower level
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	2.71	43.33	68000.00	Radiometric	Grotte d'Aldene, Couche K (Herault)
PALEODB_EAST	*Cervus elaphus*	7.30	50.53	68500.00	PALEODB	Ariendorf, Aufschluß B (outcrop B), base of Löss-Decke III (LD III)
PALEODB_EAST	*Cervus elaphus*	4.07	51.98	68500.00	PALEODB	Eurogeul
PALEODB_EAST	*Cervus elaphus*	110.00	40.66	68500.00	PALEODB	Houshuigou, bed 2, Baotou
PALEODB_EAST	*Cervus elaphus*	110.00	40.66	68500.00	PALEODB	Houshuigou, bed 4, Baotou
PALEODB_EAST	*Cervus elaphus*	110.00	40.66	68500.00	PALEODB	Houshuigou, bed 6, Baotou
PALEODB_EAST	*Cervus elaphus*	160.00	68.75	68500.00	PALEODB	Kolyma River, between the mouth of Omolon and Anjuj, Jedoma-Suite
PALEODB_EAST	*Cervus elaphus*	68.50	38.58	68500.00	PALEODB	Samarkand Paleolithic Horse

PALEODB_EAST	*Cervus elaphus*	35.05	32.72	68500.00	PALEODB	Tabun Cave Level C & D
PALEODB_EAST	*Cervus elaphus*	-5.34	36.13	68500.00	PALEODB	Vangaurd Cave
NOW	*Cervus elaphus*	51.00	52.70	70000.00	NOW	Alekseevka late
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
NOW	*Cervus elaphus*	68.66	38.66	70000.00	NOW	Khudji
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	-8.59	39.53	70000.00	Radiometric	Oliveira Cave
NOW	*Cervus elaphus*	4.39	50.98	70000.00	NOW	Zemst IIIC
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Cervus elaphus*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli
NOW	*Cervus nippon*	132.00	43.50	10000.00	NOW	Suchan caves
NOW	*Coelodonta antiquitatis*	134.45	60.35	10000.00	NOW	Verkhne-Troitskaja
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown ''A'' and grey loamy soil)
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	130.00	61.00	13978.00	radio	Lena-Amga interfluve (Lena-Amga)
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	130.00	61.00	13999.00	radio	Lena-Amga interfluve (Lena-Amga)
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	130.00	61.00	14040.00	radio	Lena-Amga interfluve (Lena-Amga)
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	158.70	68.70	14164.00	radio	Ust'-Omolon
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	60.07	59.47	14165.00	radio	Lobvinsky Grotto (Lobva Cave)
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	161.92	68.23	14384.00	radio	Molotkovskiy Kamen'
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	123.00	69.20	14443.00	radio	Molodo R., the first terrace (Molodo)
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	126.00	70.20	14572.00	radio	Lena R., left bank 0,5 km down Govorovo
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	123.20	69.20	14647.00	radio	Molodo R., the first terrace (Molodo)
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	32.00	52.40	14700.00	Radiometric	Chulatov (Chulatovo I)
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	146.77	67.64	14763.00	radio	Orto-Tirekhtyakh.R.
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	56.35	59.91	14872.00	radio	Kama R. 40 km upstream of Solikamsk, Gremyachevo
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	56.35	59.91	14933.00	radio	Kama R. 40 km upstream of Solikamsk, Gremyachevo
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	123.00	69.20	14961.00	radio	Molodo R., the first terrace (Molodo)

Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	56.35	59.91	15006.00	radio	Kama R. 40 km upstream of Solikamsk, Gremyachevo
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	141.34	73.33	15323.00	radio	Bolshoy Lyakhovskiy Island
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	41.00	49.00	15500.00	Radiometric	Don settlements
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	58.45	57.45	15595.00	radio	Kotel Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	19.80	50.06	15990.00	Radiometric	Zawalona cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	61.27	57.27	16028.00	radio	Pershinskaya 1 Cave
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	141.34	73.33	16126.00	radio	Bolshoy Lyakhovskiy Island
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	105.80	54.00	16127.00	radio	Lena Upper
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown ''B'' loamy soil)
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	58.75	57.75	16210.00	radio	Grotto Kotel, Urals
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	141.33	73.36	16369.00	radio	New Siberian Islands
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	141.33	73.36	16463.00	radio	New Siberian Islands
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	172.80	65.12	16478.00	radio	Anadyr' Region, Otrozhniy Mine
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	141.34	73.33	16494.00	radio	Bolshoy Lyakhovskiy Island
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	61.45	57.45	16739.00	radio	Grotto Pershinsky 1, Urals
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	6.96	47.00	17060.00	radio	Vaumarcus, Neuchatel
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	106.44	50.35	17162.00	radio	Kyakhta
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	155.00	69.40	17327.00	radio	Alazeya R.
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	157.17	67.00	17356.00	radio	Yukagir Plateau
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	17.58	45.20	17500.00	Radiometric	Kamenika
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	110.10	54.00	17504.00	radio	Barguzin R.
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	60.05	60.40	17585.00	radio	Grotto Nikolsky, Urals
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	19.92	50.05	18427.00	Radiometric	Spadzista St. A
Lister_&_Stuart_(2012)	*Coelodonta antiquitatis*	60.07	59.47	18691.00	radio	Lobvinsky Grotto, Urals
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
NOW	*Coelodonta antiquitatis*	20.00	40.36	20000.00	NOW	Cardamone

NOW	*Coelodonta antiquitatis*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Coelodonta antiquitatis*	4.40	50.97	20000.00	NOW	Hofstade II
NOW	*Coelodonta antiquitatis*	75.00	51.50	20000.00	NOW	Irtysh left bank
NOW	*Coelodonta antiquitatis*	68.51	60.90	20000.00	NOW	Lugovskoe
NOW	*Coelodonta antiquitatis*	85.05	51.00	20000.00	NOW	Maloialomanskaja l.2
NOW	*Coelodonta antiquitatis*	103.53	52.83	20000.00	NOW	Mal'ta main 8
NOW	*Coelodonta antiquitatis*	83.55	57.73	20000.00	NOW	Mogochino I, exc. 1-3
NOW	*Coelodonta antiquitatis*	27.08	48.55	20000.00	NOW	Molodova I l.1-3 LtPal
NOW	*Coelodonta antiquitatis*	109.85	52.12	20000.00	NOW	Sannyj Mys 3-5
NOW	*Coelodonta antiquitatis*	102.46	52.61	20000.00	NOW	Shamotnyj Zavod 1-2
NOW	*Coelodonta antiquitatis*	113.43	52.02	20000.00	NOW	Sokhatino II
NOW	*Coelodonta antiquitatis*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Coelodonta antiquitatis*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Coelodonta antiquitatis*	116.00	52.00	20000.00	NOW	Tsagan Ola
NOW	*Coelodonta antiquitatis*	100.33	58.30	20000.00	NOW	Ust'-Kova lower
NOW	*Coelodonta antiquitatis*	100.33	58.30	20000.00	NOW	Ust'-Kova middle
NOW	*Coelodonta antiquitatis*	133.12	59.65	20000.00	NOW	Ust'-Mil' II A-C
NOW	*Coelodonta antiquitatis*	77.00	56.00	20000.00	NOW	Vengerovo V
NOW	*Coelodonta antiquitatis*	104.32	52.30	20000.00	NOW	Voennyj Gospital'
NOW	*Coelodonta antiquitatis*	179.66	71.25	20000.00	NOW	Wrangel Island
NOW	*Coelodonta antiquitatis*	16.66	42.26	20000.00	NOW	Zitny cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.43	46.38	21379.00	Radiometric	La Balme d'Epy [Jura]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	15.88	48.24	21591.00	Radiometric	Langmannersdorf A
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	16.75	49.41	22603.00	Radiometric	Kulna Cave6a
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	36.00	51.10	23000.00	Radiometric	Avdeevskaja
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	27.90	50.05	23000.00	Radiometric	Dovginichi
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.50	50.99	23000.00	Radiometric	Hofstade III
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	31.28	49.45	23000.00	Radiometric	Kanev
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	36.20	50.00	23000.00	Radiometric	Kharkov

Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	8.13	50.42	23300.00	Radiometric	Wildenscheuer cave st. III
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	31.00	52.50	23400.00	Radiometric	Berdyzhskaja stojanka
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	34.12	53.34	23660.00	Radiometric	Khotylevo II
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.97	50.48	24700.00	Radiometric	Gr. de la Princesse [Marche-les-Dames]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	1.33	44.77	26800.00	Radiometric	Roc de Combe6
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	60.03	60.24	27350.00	Radiometric	Cheremukhovo 4 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-2.04	52.02	27650.00	Radiometric	Beckford
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-3.48	53.23	27815.00	Radiometric	Pontnewydd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.15	48.55	27876.00	Radiometric	Bockstein-Torle
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-0.16	43.11	27931.00	Radiometric	Trou du Rhinoceros [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.28	47.53	28240.00	Radiometric	Montagne de Girault [Genay]1
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	1.85	44.72	28400.00	Radiometric	A. du Mas Viel [St-Simon]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	1.33	44.77	28600.00	Radiometric	Roc de Combe7a
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	1.06	44.98	29500.00	Radiometric	Abri du Facteur
NOW	*Coelodonta antiquitatis*	143.95	70.43	30000.00	NOW	Berelekh rhino
NOW	*Coelodonta antiquitatis*	27.28	48.27	30000.00	NOW	Korman IV

NOW	*Coelodonta antiquitatis*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Coelodonta antiquitatis*	105.80	54.02	30000.00	NOW	Makarovo III
NOW	*Coelodonta antiquitatis*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
NOW	*Coelodonta antiquitatis*	86.37	54.58	30000.00	NOW	Mokhovo II
NOW	*Coelodonta antiquitatis*	4.50	52.50	30000.00	NOW	North Sea combined
NOW	*Coelodonta antiquitatis*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	60.03	60.24	30140.00	Radiometric	Cheremukhovo 2, 3
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-3.50	50.46	30185.00	Radiometric	Kent's Cavern
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-1.19	53.27	30240.00	Radiometric	Robin Hood's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-4.24	51.55	31717.00	Radiometric	Paviland Cave [Goat's Hole]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.29	50.42	32560.00	Radiometric	Trou Al'Wesse
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.17	48.55	34365.00	Radiometric	Hohlenstein-Stadel [IV]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	9.77	48.40	36169.00	Radiometric	Das GeissenklosterleI
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3

Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
NOW	*Coelodonta antiquitatis*	4.00	44.00	40000.00	NOW	Baume NÃ©ron
NOW	*Coelodonta antiquitatis*	30.00	54.10	40000.00	NOW	Pashino
NOW	*Coelodonta antiquitatis*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.97	50.21	43760.00	Radiometric	Trou MagriteM3
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	13.33	52.30	45000.00	Radiometric	Niederweningen
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	20.47	47.97	50000.00	Radiometric	Subalyuk1
NOW	*Coelodonta antiquitatis*	11.33	51.00	50000.00	NOW	Taubach-Weimar Ehringsdorf 7
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.32	52.17	51000.00	Radiometric	Salzgitter
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	11.83	48.93	52012.76	Fiedler	Große Schulerloch E-F
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	9.80	48.41	52012.76	Fiedler	Rusenschloss
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	41.90	49.60	52669.04	Fiedler	Lebiazhenskoe
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-2.10	52.31	54244.10	Fiedler	Upton Warren gravels

Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	0.48	52.57	56212.93	Fiedler	Wretton
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-7.64	39.66	56475.44	Fiedler	Foz do Enxarrique
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	-0.03	51.46	56475.44	Fiedler	Willments gravels
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	16.67	49.27	57394.23	Fiedler	Ztiny cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	20.57	50.87	57400.00	Fiedler	Raj cave 6
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	19.05	47.75	57656.74	Fiedler	Remete cave
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.45	48.82	58313.02	Fiedler	Große Ofnethöhle V
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.03	50.50	58444.27	Fiedler	Princesse Pauline
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.10	51.04	58706.78	Fiedler	Dendermonde
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	6.65	50.23	59363.06	Fiedler	Buchenloch

Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	9.16	48.58	59888.08	Fiedler	Steinheim upper level
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
NOW	*Coelodonta antiquitatis*	92.82	55.97	60000.00	NOW	Bolshaja Oreshnaja cave
NOW	*Coelodonta antiquitatis*	92.81	55.97	60000.00	NOW	Devjatka cave early
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
NOW	*Coelodonta antiquitatis*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
NOW	*Coelodonta antiquitatis*	91.65	55.22	60000.00	NOW	Ust'-Izhul
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	6.24	43.44	60019.34	Fiedler	Trou du Renard
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	7.30	50.53	60281.85	Fiedler	Ariendorf
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	4.50	50.99	62500.00	Radiometric	Hofstade I
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave

Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	8.13	50.42	62500.00	Radiometric	Wildenscheuer cave st. I-II
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	0.67	52.50	65500.00	Radiometric	Lynford
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
Raia et al. 2009; Carotenuto et al. 2010	*Coelodonta antiquitatis*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
NOW	*Coelodonta antiquitatis*	92.82	55.98	70000.00	NOW	Majachnaja cave
NOW	*Coelodonta antiquitatis*	4.39	50.98	70000.00	NOW	Zemst IIIC
PALEODB_EAST	*Connochaetes gnou*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Connochaetes gnou*	22.40	-34.05	68500.00	PALEODB	Herolds Bay
PALEODB_EAST	*Connochaetes taurinus*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 80-0cm
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, 170-0cm
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, 330-170cm
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, Undated rockshelter
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya HIll GvJm 62, 390-180cm
PALEODB_EAST	*Connochaetes taurinus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 62 180-70cm
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	17.58	45.20	17500.00	Radiometric	Kamenika
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	16.17	43.83	18388.00	Radiometric	Pecine u Brini East&West caves
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
NOW	*Crocuta crocuta*	20.00	40.36	20000.00	NOW	Cardamone
NOW	*Crocuta crocuta*	-7.50	54.00	20000.00	NOW	Castlepook cave LGM
NOW	*Crocuta crocuta*	4.40	50.97	20000.00	NOW	Hofstade II
NOW	*Crocuta crocuta*	85.05	51.00	20000.00	NOW	Maloialomanskaja l.2
NOW	*Crocuta crocuta*	86.00	52.50	20000.00	NOW	Srostki
NOW	*Crocuta crocuta*	26.90	48.00	20000.00	NOW	Trinka I l.2
NOW	*Crocuta crocuta*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	5.43	46.38	21379.00	Radiometric	La Balme d'Epy [Jura]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-3.84	43.36	21500.00	Radiometric	Cueva Morin
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-2.26	43.16	22220.00	Radiometric	Ekain Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	16.75	49.41	22603.00	Radiometric	Kulna Cave6a
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	27.50	47.98	23000.00	Radiometric	Starye Duruitory l.1 upper
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	15.87	45.84	23000.00	Radiometric	Veternica cave f
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	2.34	43.31	24025.00	Radiometric	Canecaude I [Villardonel]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.85	47.70	25114.00	Radiometric	Les Cottes [St. Pierre de Maille]???
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.33	44.77	26800.00	Radiometric	Roc de Combe6
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]K
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.15	48.55	27876.00	Radiometric	Bockstein-Torle

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.72	46.38	28313.00	Radiometric	L'Ermitage [Lussac-les-Chateaux]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-3.66	50.49	29176.00	Radiometric	Tornewton Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Crocuta crocuta*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Crocuta crocuta*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
NOW	*Crocuta crocuta*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Crocuta crocuta*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-1.19	53.27	30240.00	Radiometric	Robin Hood's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-4.24	51.55	31717.00	Radiometric	Paviland Cave [Goat's Hole]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	5.29	50.42	32560.00	Radiometric	Trou Al'Wesse
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.30	45.50	32659.00	Radiometric	La Quina Y-Z [Villebois la Valette]1
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	3.87	45.06	32903.00	Radiometric	Les Rivaux, Loc. 1 [Espaly-St-Marcel]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.85	47.70	32979.00	Radiometric	Les Cottes [St. Pierre de Maille]E3
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.17	48.55	34365.00	Radiometric	Hohlenstein-Stadel [IV]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.33	44.77	34500.00	Radiometric	Roc de Combe4
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	15.24	40.50	34540.00	Radiometric	Castelcivitagic
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.90	45.57	34939.00	Radiometric	Abri Fumane
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.85	47.70	34999.00	Radiometric	Les Cottes [St. Pierre de Maille]1
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.30	45.50	36543.00	Radiometric	La Quina Y-Z [Villebois la Valette]3
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-7.31	43.48	36700.00	Radiometric	Valina
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.37	43.53	38000.00	Radiometric	Smolucka Pecina

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
NOW	*Crocuta crocuta*	4.00	44.00	40000.00	NOW	Baume NÃ©ron
NOW	*Crocuta crocuta*	84.33	51.67	40000.00	NOW	Okladnikov cave
NOW	*Crocuta crocuta*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
NOW	*Crocuta crocuta*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-8.58	52.22	41631.00	Radiometric	Castlepook Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-2.66	51.84	51618.99	Fiedler	King Arthur's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	11.83	48.93	52012.76	Fiedler	Große Schulerloch E-F
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	13.10	41.23	54200.00	Radiometric	Gr. Guattari
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	22.26	44.59	56344.19	Fiedler	Pestera Climente
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	13.67	45.37	56344.19	Fiedler	Romualdo Cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-7.64	39.66	56475.44	Fiedler	Foz do Enxarrique
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	3.90	43.94	57200.00	Radiometric	La Roquette II [Conquerac]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.57	50.87	57400.00	Fiedler	Raj cave 6
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	9.77	48.41	58181.76	Fiedler	Brillenhohle8
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.45	48.82	58313.02	Fiedler	Große Ofnethöhle V
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.15	45.63	59363.06	Fiedler	Artenac 6
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	9.72	48.37	59756.83	Fiedler	Kogelstein

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	40.00	44.90	60000.00	Radiometric	Dakhovskaja cave
NOW	*Crocuta crocuta*	5.01	50.43	60000.00	NOW	Goyet Cave st.4
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	22.37	47.20	60000.00	Radiometric	Igrita cave
NOW	*Crocuta crocuta*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
NOW	*Crocuta crocuta*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	6.24	43.44	60019.34	Fiedler	Trou du Renard
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.15	45.63	60150.59	Fiedler	Artenac 8
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.18	51.26	60150.59	Fiedler	Bacon hole
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.65	48.12	60413.10	Fiedler	Budospest
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.84	44.88	60500.00	Fiedler	Baume Moula-Guercy IV ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	13.70	45.72	60544.36	Fiedler	GabrovizzaII
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	15.24	40.50	60675.61	Fiedler	Castelcivita
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.33	43.93	60938.12	Fiedler	Buca della Iena
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-3.01	41.01	61100.00	Fiedler	Las Figuras (Alcorlo)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	20.30	48.50	61331.89	Fiedler	Horvolgy
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.50	44.01	61700.00	Fiedler	Gr. de la Nauterie I [La Romieu]
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	22.50	41.05	61856.91	Fiedler	Agios Georgios
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.15	45.63	61988.17	Fiedler	Artenac 10
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-3.33	40.87	62250.68	Fiedler	Cueva del Congosto, Guadalajara
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	16.67	49.40	62500.00	Radiometric	Barova cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	4.50	50.99	62500.00	Radiometric	Hofstade I
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	16.90	50.23	62500.00	Radiometric	Jaskinia Niedwiedzia

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	8.13	50.42	62500.00	Radiometric	Wildenscheuer cave st. I-II
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.30	51.43	62644.44	Fiedler	Purfleet gravels
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-4.37	40.80	62644.44	Fiedler	Villacastin C2
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-5.50	36.22	63038.21	Fiedler	Devil's Tower
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	12.57	41.92	64482.02	Fiedler	Casal De' Pazzi (Rebibbia)
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	0.67	52.50	65500.00	Radiometric	Lynford
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	2.71	43.33	68000.00	Radiometric	Grotte d'Aldene, Couche K (Herault)
PALEODB_EAST	*Crocuta crocuta*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 10', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Crocuta crocuta*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 6 composite list', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Crocuta crocuta*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 7', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Crocuta crocuta*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 8', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Crocuta crocuta*	4.07	51.98	68500.00	PALEODB	Eurogeul
PALEODB_EAST	*Crocuta crocuta*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
PALEODB_EAST	*Crocuta crocuta*	37.05	-1.47	68500.00	PALEODB	Lukenya HIll GvJm 62, 390-180cm
PALEODB_EAST	*Crocuta crocuta*	4.05	51.96	68500.00	PALEODB	Maasvlakte, Fauna II
PALEODB_EAST	*Crocuta crocuta*	-5.34	36.13	68500.00	PALEODB	Vangaurd Cave
NOW	*Crocuta crocuta*	66.93	39.31	70000.00	NOW	Aman Kutan

Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	-8.59	39.53	70000.00	Radiometric	Oliveira Cave
NOW	*Crocuta crocuta*	27.36	47.86	70000.00	NOW	Starye Duruitory l. 3-4
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Crocuta crocuta*	19.77	50.22	70600.00	Radiometric	Jaskinia Nietoperzowa
NOW	*Cuon alpinus*	43.50	42.50	10000.00	NOW	Kudaro 3 l.2 Hol
NOW	*Cuon alpinus*	92.80	56.01	10000.00	NOW	Ledjanaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
NOW	*Cuon alpinus*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	15.87	45.84	23000.00	Radiometric	Veternica cave f
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Cuon alpinus*	9.51	48.53	64088.25	Fiedler	Heppenloch
NOW	*Cuon alpinus*	92.82	55.98	70000.00	NOW	Majachnaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Cuon priscus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Cuon priscus*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	12.52	42.10	62250.68	Fiedler	Riano

Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	-4.37	40.80	62644.44	Fiedler	Villacastin C2
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Dama clactoniana*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
NOW	*Dama dama*	23.50	38.00	10000.00	NOW	Vraona cave
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	5.00	52.00	32500.00	Radiometric	Raalte
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	15.24	40.50	34540.00	Radiometric	Castelcivitagic
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	15.65	41.77	40000.00	Radiometric	Ingarano c
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	12.44	43.19	59363.06	Fiedler	Monte Cucco
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
NOW	*Dama dama*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)

Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	11.25	45.42	61725.66	Fiedler	Soave
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	12.50	41.93	61856.91	Fiedler	Monte Delle Gioie
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	0.83	42.00	62250.68	Fiedler	Grotta Cola
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	12.40	41.78	62250.68	Fiedler	Vitinia (Upper Beds) (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	12.50	41.92	62513.19	Fiedler	Prati Fiscali
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	11.25	42.45	62644.44	Fiedler	Brecce di Soave
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	0.30	51.43	62644.44	Fiedler	Purfleet gravels
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	-2.50	41.15	62906.95	Fiedler	Ambrona
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	12.73	42.22	62906.95	Fiedler	Fara Sabina
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	22.58	37.00	63038.21	Fiedler	Apidima Cave B
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	22.58	37.00	63038.21	Fiedler	Apidima Cave C
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	12.10	41.98	63038.21	Fiedler	Cerveteri (Rome)
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	12.57	41.92	64482.02	Fiedler	Casal De' Pazzi (Rebibbia)

Raia et al. 2009; Carotenuto et al. 2010	*Dama dama*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli
NOW	*Dicerorhinus sumatrensis*	118.00	4.00	10000.00	NOW	Madai
PALEODB_EAST	*Diceros bicornis*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Diceros bicornis*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
PALEODB_EAST	*Diceros bicornis*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
PALEODB_EAST	*Diceros bicornis*	18.43	-33.67	68500.00	PALEODB	Melkbos
PALEODB_EAST	*Elaphodus cephalophus*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Elaphurus davidianus*	120.00	23.00	68500.00	PALEODB	Penghu Channel
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	1.66	44.62	18388.00	Radiometric	Gr. Pegourie [Caniac du Causse]
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	0.86	46.70	26728.00	Radiometric	Fontenioux [St Pierre de Maille]
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	5.00	52.00	32500.00	Radiometric	Raalte
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	13.10	41.23	54200.00	Radiometric	Gr. Guattari
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	9.16	48.58	61200.64	Fiedler	Steinheim middle level
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.50	41.93	61856.91	Fiedler	Monte Delle Gioie
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	1.03	49.30	62250.68	Fiedler	Cleon
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.52	42.10	62250.68	Fiedler	Riano
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.40	41.78	62250.68	Fiedler	Vitinia (Upper Beds) (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.50	41.92	62513.19	Fiedler	Prati Fiscali

Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	-2.50	41.15	62906.95	Fiedler	Ambrona
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.73	42.22	62906.95	Fiedler	Fara Sabina
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.10	41.98	63038.21	Fiedler	Cerveteri (Rome)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	-5.50	36.22	63038.21	Fiedler	Devil's Tower
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	13.70	41.45	63300.72	Fiedler	Pontecorvo (Frosinone)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.25	41.90	63825.74	Fiedler	La Polledrara di Cecanibbio
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	12.57	41.92	64482.02	Fiedler	Casal De' Pazzi (Rebibbia)
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Elephas antiquus*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli
NOW	*Elephas maximus*	110.26	-7.37	10000.00	NOW	Holocene caves
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown "A" and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	32.00	52.40	14700.00	Radiometric	Chulatov (Chulatovo I)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	31.50	49.65	15950.00	Radiometric	Mezherich
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	19.80	50.06	15990.00	Radiometric	Zawalona cave

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown ''B'' loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	17.88	45.42	17500.00	Radiometric	Zarilac
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	39.00	44.10	18040.00	Radiometric	Anetovka II
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.66	44.62	18388.00	Radiometric	Gr. Pegourie [Caniac du Causse]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	16.17	43.83	18388.00	Radiometric	Pecine u Brini East&West caves
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.43	46.38	21379.00	Radiometric	La Balme d'Epy [Jura]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.95	44.97	21466.00	Radiometric	Laugerie-Haute Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.84	43.36	21500.00	Radiometric	Cueva Morin
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.47	44.35	21500.00	Radiometric	Gr. de La Baume d'Oullins (a.k.a. d'Oulen\) [Labastide-de-Virac]"
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-0.60	43.11	22166.00	Radiometric	Gr. des Bisons [Lurbe-St-Christau]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-0.49	45.04	22200.00	Radiometric	Roc de la Melca
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.95	44.97	22207.00	Radiometric	Laugerie-Haute Est
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-4.84	43.42	22280.00	Radiometric	La Riera23
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.01	45.21	22383.00	Radiometric	Gr. des Cottier[s] [Retournac]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.72	46.40	22696.00	Radiometric	Gr. de Laraux
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	16.67	49.25	23000.00	Radiometric	Adler cave

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	36.00	51.10	23000.00	Radiometric	Avdeevskaja
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	27.90	50.05	23000.00	Radiometric	Dovginichi
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	35.50	48.50	23000.00	Radiometric	Jamburg
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	31.28	49.45	23000.00	Radiometric	Kanev
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	36.20	50.00	23000.00	Radiometric	Kharkov
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	16.67	49.25	23000.00	Radiometric	Pekarna cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	27.50	47.98	23000.00	Radiometric	Starye Duruitory l.1 upper
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	17.96	40.15	23151.00	Radiometric	Cavallo
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	2.34	43.31	24025.00	Radiometric	Canecaude I [Villardonel]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.97	50.48	24700.00	Radiometric	Gr. de la Princesse [Marche-les-Dames]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.85	47.70	25114.00	Radiometric	Les Cottes [St. Pierre de Maille]???
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.08	44.85	25752.00	Radiometric	Le Flageolet I [Bezenac]VI
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	40.48	56.13	25848.00	Radiometric	Sungir'
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.86	46.70	26728.00	Radiometric	Fontenioux [St Pierre de Maille]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.33	44.77	26800.00	Radiometric	Roc de Combe6
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]K
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	60.03	60.24	27350.00	Radiometric	Cheremukhovo 4 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.04	52.02	27650.00	Radiometric	Beckford
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.48	53.23	27815.00	Radiometric	Pontnewydd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.08	44.85	27870.00	Radiometric	Le Flageolet I [Bezenac]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-4.84	43.42	28147.00	Radiometric	Cueto de la Mina
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.85	44.72	28400.00	Radiometric	A. du Mas Viel [St-Simon]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.08	44.85	28595.00	Radiometric	Le Flageolet I [Bezenac]IX
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.33	44.77	28600.00	Radiometric	Roc de Combe7a
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.66	50.49	29176.00	Radiometric	Tornewton Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.06	44.98	29500.00	Radiometric	Abri du Facteur
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-5.30	36.13	29544.00	Radiometric	Gorham's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-9.22	38.90	30100.00	Radiometric	Pego do Diabo
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	60.03	60.24	30140.00	Radiometric	Cheremukhovo 2, 3
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-1.19	53.27	30240.00	Radiometric	Robin Hood's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	16.73	48.84	30939.00	Radiometric	Milovice I
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.33	44.77	31300.00	Radiometric	Roc de Combe1c
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-4.13	36.95	31300.00	Radiometric	Zafarraya Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.29	50.42	32560.00	Radiometric	Trou Al'Wesse
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.30	45.50	32659.00	Radiometric	La Quina Y-Z [Villebois la Valette]1
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.85	47.70	32979.00	Radiometric	Les Cottes [St. Pierre de Maille]E3
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.47	45.00	33800.00	Radiometric	Sirejol [Gignac]

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.33	44.77	34500.00	Radiometric	Roc de Combe4
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.85	47.70	34999.00	Radiometric	Les Cottes [St. Pierre de Maille]1
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.75	42.16	36260.00	Radiometric	Mollet Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.26	44.88	36366.00	Radiometric	Abri Caminade [Caneda]D21
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.33	43.93	36448.00	Radiometric	Esquicho-Grapaou
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.30	45.50	36543.00	Radiometric	La Quina Y-Z [Villebois la Valette]3
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-7.31	43.48	36700.00	Radiometric	Valina
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.26	44.88	37894.00	Radiometric	Abri Caminade [Caneda]F
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	17.93	48.55	38400.00	Radiometric	Certova Pec (Radosina)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.22	44.81	41900.00	Radiometric	Combe Grenal [Domme, Dordogne]1
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.02	51.32	43730.00	Radiometric	Brean Down
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.97	50.21	43760.00	Radiometric	Trou MagriteM3
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.33	52.30	45000.00	Radiometric	Niederweningen
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.32	52.17	51000.00	Radiometric	Salzgitter
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.56	44.84	52931.55	Fiedler	Abri de Combe-Cullier
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.10	41.23	54200.00	Radiometric	Gr. Guattari
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.10	52.31	54244.10	Fiedler	Upton Warren gravels
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.65	43.92	54375.36	Fiedler	Torrente Conca (Morciano di Romagna)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	11.40	50.62	55031.63	Fiedler	Teufelsbrücke 2-3a
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	9.77	48.41	55819.17	Fiedler	Brillenhohle7

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	11.40	50.62	55950.42	Fiedler	Teufelsbrücke 3
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.48	52.57	56212.93	Fiedler	Wretton
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.61	45.34	56400.00	Radiometric	Fonseigner [Bourdeilles]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-7.64	39.66	56475.44	Fiedler	Foz do Enxarrique
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-0.03	51.46	56475.44	Fiedler	Willments gravels
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	11.40	50.62	56737.95	Fiedler	Teufelsbrücke 2-3b
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	3.90	43.94	57200.00	Radiometric	La Roquette II [Conquerac]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	20.57	50.87	57400.00	Fiedler	Raj cave 6
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.02	44.97	57656.74	Fiedler	Abri de la Madeleine
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	9.77	48.41	58181.76	Fiedler	Brillenhohle8
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.45	48.82	58313.02	Fiedler	Große Ofnethöhle V
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.03	50.50	58444.27	Fiedler	Princesse Pauline
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.59	42.86	58838.04	Fiedler	Abri du Flageolet II
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.08	44.84	59363.06	Fiedler	Abri du Flageolet I
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.15	45.63	59363.06	Fiedler	Artenac 6
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	6.65	50.23	59363.06	Fiedler	Buchenloch
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.44	43.19	59363.06	Fiedler	Monte Cucco

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.87	44.60	59494.32	Fiedler	Saint Eulaile
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	9.16	48.58	59888.08	Fiedler	Steinheim upper level
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	44.30	48.40	60000.00	Radiometric	Sukhaja Mechetka l.4
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-7.63	52.10	60019.34	Fiedler	Shandon Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	6.24	43.44	60019.34	Fiedler	Trou du Renard
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.72	44.08	60150.59	Fiedler	Abri des Battus 3
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.15	45.63	60150.59	Fiedler	Artenac 8
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	7.30	50.53	60281.85	Fiedler	Ariendorf
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.70	45.72	60544.36	Fiedler	GabrovizzaII
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.18	44.82	60544.36	Fiedler	Grotte Maldidier
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.33	43.93	60938.12	Fiedler	Buca della Iena
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.01	41.01	61100.00	Fiedler	Las Figuras (Alcorlo)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	5.23	45.07	61331.89	Fiedler	Abri de Campalou
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.72	44.08	61331.89	Fiedler	Abri des Battus 5
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.47	42.05	61331.89	Fiedler	Cueva Millan 1a
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.50	45.03	61331.89	Fiedler	La Grotte des Fees
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	84.50	57.09	61594.40	Fiedler	Krasny Jar 2
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.50	44.01	61700.00	Fiedler	Gr. de la Nauterie I [La Romieu]

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.09	44.82	61856.91	Fiedler	Abri du Morin B1
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	22.50	41.05	61856.91	Fiedler	Agios Georgios
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.15	45.63	61988.17	Fiedler	Artenac 10
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.37	43.11	61988.17	Fiedler	Montousse I (Haute Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.87	46.71	62250.68	Fiedler	A. Rousseau [Dousse]
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.27	44.85	62250.68	Fiedler	Abri Caminade-Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.09	44.82	62250.68	Fiedler	Abri du Morin A4
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.33	40.87	62250.68	Fiedler	Cueva del Congosto, Guadalajara
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.50	41.92	62513.19	Fiedler	Prati Fiscali
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	11.25	42.45	62644.44	Fiedler	Brecce di Soave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-0.71	40.90	62644.44	Fiedler	Cueva de los Huesos
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.30	51.43	62644.44	Fiedler	Purfleet gravels

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-4.37	40.80	62644.44	Fiedler	Villacastin C2
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.50	41.15	62906.95	Fiedler	Ambrona
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.73	42.22	62906.95	Fiedler	Fara Sabina
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	47.00	43.30	63038.21	Fiedler	Alkhast
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.10	41.98	63038.21	Fiedler	Cerveteri (Rome)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	43.00	45.60	63038.21	Fiedler	Zejukovo, Nal'chik
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	32.00	49.00	63169.47	Fiedler	Andreevka
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	13.70	41.45	63300.72	Fiedler	Pontecorvo (Frosinone)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.25	41.90	63825.74	Fiedler	La Polledrara di Cecanibbio
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.63	43.21	64088.25	Fiedler	Montmaurin
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	12.57	41.92	64482.02	Fiedler	Casal De' Pazzi (Rebibbia)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	0.67	52.50	65500.00	Radiometric	Lynford
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)

Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	9.16	48.58	65925.83	Fiedler	Steinheim lower level
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	2.71	43.33	68000.00	Radiometric	Grotte d'Aldene, Couche K (Herault)
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	-8.59	39.53	70000.00	Radiometric	Oliveira Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus ferus*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli
NOW	*Equus gmelini*	60.40	60.69	10000.00	NOW	Laksejskaja cave
NOW	*Equus gmelini*	60.04	59.28	10000.00	NOW	Lobvinskaja cave
NOW	*Equus gmelini*	41.00	48.00	10000.00	NOW	Sarkel castle (Belaja Vezha)
PALEODB_EAST	*Equus grevyi*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Equus grevyi*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
PALEODB_EAST	*Equus grevyi*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, 170-0cm
PALEODB_EAST	*Equus grevyi*	37.05	-1.47	68500.00	PALEODB	Lukenya HIll GvJm 62, 390-180cm
NOW	*Equus hemionus*	49.80	40.40	10000.00	NOW	Baku
NOW	*Equus hemionus*	60.00	43.00	10000.00	NOW	Khoresm, Uchashchi st.
NOW	*Equus hemionus*	105.82	54.03	10000.00	NOW	Makarovo II 3-4
NOW	*Equus hemionus*	91.42	53.08	10000.00	NOW	Oznachennoe I
NOW	*Equus hemionus*	44.40	40.30	10000.00	NOW	Sarajbulakhskij, Urtskij khreb
NOW	*Equus hemionus*	103.43	52.87	10000.00	NOW	Sosnovyj Bor l. 3-4
NOW	*Equus hemionus*	91.44	52.97	10000.00	NOW	Ui II, 2-7, exc. 1
Raia et al. 2009; Carotenuto et al. 2010	*Equus hemionus*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
NOW	*Equus hemionus*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Equus hemionus*	89.45	54.42	20000.00	NOW	Malaja Syja l. 1-2
NOW	*Equus hemionus*	90.95	54.97	20000.00	NOW	Novoselovo XIII 1-2
NOW	*Equus hemionus*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Equus hemionus*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Equus hemionus*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Equus hemionus*	91.43	52.97	20000.00	NOW	Ui I, 2-2/3
NOW	*Equus hemionus*	100.33	58.30	20000.00	NOW	Ust'-Kova lower
NOW	*Equus hemionus*	100.33	58.30	20000.00	NOW	Ust'-Kova middle

NOW	*Equus hemionus*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Equus hemionus*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Equus hemionus*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus hemionus*	8.37	47.50	58313.02	Fiedler	Niederleme
PALEODB_EAST	*Equus hemionus*	79.12	23.01	68500.00	PALEODB	GSI 20032
PALEODB_EAST	*Equus hemionus*	77.97	22.83	68500.00	PALEODB	GSI 20033
PALEODB_EAST	*Equus hemionus*	79.12	23.01	68500.00	PALEODB	GSI 20034
PALEODB_EAST	*Equus hemionus*	79.02	23.03	68500.00	PALEODB	GSI 20035
PALEODB_EAST	*Equus hemionus*	77.86	22.85	68500.00	PALEODB	GSI 20036
PALEODB_EAST	*Equus hemionus*	77.87	22.84	68500.00	PALEODB	GSI 20037
PALEODB_EAST	*Equus hemionus*	79.11	23.01	68500.00	PALEODB	GSI 20038
PALEODB_EAST	*Equus hemionus*	35.05	32.72	68500.00	PALEODB	Tabun Cave Level C & D
PALEODB_EAST	*Equus hemionus*	84.75	50.95	68500.00	PALEODB	Ust'-Kanskaia Cave
NOW	*Equus hemionus*	68.66	38.66	70000.00	NOW	Khudji
NOW	*Equus hydruntinus*	23.50	38.00	10000.00	NOW	Vraona cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	16.90	43.60	12392.50	Radiometric	Kopacina
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	23.90	37.92	16932.50	Radiometric	Vraona cave (Attiki)
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	16.17	43.83	18388.00	Radiometric	Pecine u Brini East&West caves
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
NOW	*Equus hydruntinus*	20.00	40.36	20000.00	NOW	Cardamone
NOW	*Equus hydruntinus*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	-4.84	43.42	21765.00	Radiometric	La Riera1
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	27.50	47.98	23000.00	Radiometric	Starye Duruitory l.1 upper
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone

Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.08	44.85	27870.00	Radiometric	Le Flageolet I [Bezenac]
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.85	44.72	28400.00	Radiometric	A. du Mas Viel [St-Simon]
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.08	44.85	28595.00	Radiometric	Le Flageolet I [Bezenac]IX
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.06	44.98	29500.00	Radiometric	Abri du Facteur
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.26	44.88	36366.00	Radiometric	Abri Caminade [Caneda]D21
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	18.89	47.39	51400.00	Radiometric	Erd

Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	41.90	49.60	52669.04	Fiedler	Lebiazhenskoe
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.08	44.84	59363.06	Fiedler	Abri du Flageolet I
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.15	45.63	59363.06	Fiedler	Artenac 6
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.72	44.08	60150.59	Fiedler	Abri des Battus 3
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.15	45.63	60150.59	Fiedler	Artenac 8
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	10.33	43.93	60938.12	Fiedler	Buca della Iena
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)

Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	22.50	41.05	61856.91	Fiedler	Agios Georgios
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.15	45.63	61988.17	Fiedler	Artenac 10
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.87	46.71	62250.68	Fiedler	A. Rousseau [Dousse]
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	0.09	44.82	62250.68	Fiedler	Abri du Morin A4
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	39.00	45.00	62513.19	Fiedler	Mezmaiskaya Cave 1–2
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	12.73	42.22	62906.95	Fiedler	Fara Sabina
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	32.00	49.00	63169.47	Fiedler	Andreevka
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Equus hydruntinus*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
Raia et al. 2009; Carotenuto et al. 2010	*Equus suessenbornensis*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
NOW	*Gazella subgutturosa*	49.80	40.40	10000.00	NOW	Baku
NOW	*Gazella subgutturosa*	44.50	40.20	10000.00	NOW	Karmir Blur (Tejshebaini) cast
NOW	*Gazella subgutturosa*	60.00	43.00	10000.00	NOW	Khoresm, Uchashchi st.
NOW	*Gazella subgutturosa*	106.30	50.53	10000.00	NOW	Ust'-Kjakhta IV(1-2)
NOW	*Gazella subgutturosa*	42.72	43.90	20000.00	NOW	Malyj Yankul, Kalaus
NOW	*Gazella subgutturosa*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Gazella subgutturosa*	109.33	51.22	20000.00	NOW	Tolbaga
Raia et al. 2009; Carotenuto et al. 2010	*Gazella subgutturosa*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
PALEODB_EAST	*Giraffa camelopardalis*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
NOW	*Gulo gulo*	92.82	55.97	10000.00	NOW	Badzhejskaja cave
NOW	*Gulo gulo*	92.80	56.01	10000.00	NOW	Bezdonnaja Yama cave
NOW	*Gulo gulo*	37.00	52.00	10000.00	NOW	Eliseevichi
NOW	*Gulo gulo*	60.40	60.69	10000.00	NOW	Laksejskaja cave
NOW	*Gulo gulo*	92.80	56.01	10000.00	NOW	Ledjanaja cave

NOW	*Gulo gulo*	92.79	56.01	10000.00	NOW	Ledopadnaja cave
NOW	*Gulo gulo*	92.80	56.01	10000.00	NOW	Lovushka cave (Belaja)
NOW	*Gulo gulo*	36.00	51.10	20000.00	NOW	Avdeevskaja
NOW	*Gulo gulo*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Gulo gulo*	42.50	42.00	20000.00	NOW	Gvardzhilas-Klde
NOW	*Gulo gulo*	34.12	53.33	20000.00	NOW	Khotylevo II
NOW	*Gulo gulo*	17.00	51.50	20000.00	NOW	Krems-Wachtberg
NOW	*Gulo gulo*	103.53	52.83	20000.00	NOW	Mal'ta main 8
NOW	*Gulo gulo*	90.95	54.97	20000.00	NOW	Novoselovo XI
NOW	*Gulo gulo*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Gulo gulo*	26.90	48.00	20000.00	NOW	Trinka I l.2
NOW	*Gulo gulo*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
NOW	*Gulo gulo*	38.88	54.76	20000.00	NOW	Zarajsk
NOW	*Gulo gulo*	1.50	45.05	30000.00	NOW	Jaurens
NOW	*Gulo gulo*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Gulo gulo*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
NOW	*Gulo gulo*	84.33	51.67	40000.00	NOW	Okladnikov cave
NOW	*Gulo gulo*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Gulo gulo*	89.47	54.45	40000.00	NOW	Proskurjakov cave
NOW	*Gulo gulo*	9.76	48.40	60000.00	NOW	Sirgenstein cave
PALEODB_EAST	*Gulo gulo*	160.00	68.75	68500.00	PALEODB	Kolyma River, between the mouth of Omolon and Anjuj, Jedoma-Suite
PALEODB_EAST	*Gulo gulo*	-3.66	50.13	68500.00	PALEODB	Tornewton Cave
NOW	*Helarctos malayanus*	118.00	4.00	10000.00	NOW	Madai
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus albus*	-7.64	39.66	56475.44	Fiedler	Foz do Enxarrique
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus bonali*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus bonali*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus bonali*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus bonali*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus bonali*	2.71	43.33	68000.00	Radiometric	Grotte d'Aldene, Couche K (Herault)
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus cedrensis*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus cedrensis*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)

Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus cedrensis*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus cedrensis*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus cedrensis*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Hemitragus cedrensis*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
NOW	*Hippopotamus amphibius*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	12.50	41.93	61856.91	Fiedler	Monte Delle Gioie
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	22.58	37.00	63038.21	Fiedler	Apidima Cave B
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	13.70	41.45	63300.72	Fiedler	Pontecorvo (Frosinone)
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	12.57	41.92	64482.02	Fiedler	Casal De' Pazzi (Rebibbia)
PALEODB_EAST	*Hippopotamus amphibius*	-0.47	52.14	68500.00	PALEODB	Bedford
PALEODB_EAST	*Hippopotamus amphibius*	0.92	52.72	68500.00	PALEODB	Beetley
PALEODB_EAST	*Hippopotamus amphibius*	-0.13	50.82	68500.00	PALEODB	Black Rock
PALEODB_EAST	*Hippopotamus amphibius*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Hippopotamus amphibius*	-1.41	52.88	68500.00	PALEODB	Boulton Moor
PALEODB_EAST	*Hippopotamus amphibius*	-0.31	51.49	68500.00	PALEODB	Brentford
PALEODB_EAST	*Hippopotamus amphibius*	0.13	52.20	68500.00	PALEODB	Cambridge
PALEODB_EAST	*Hippopotamus amphibius*	-3.08	52.98	68500.00	PALEODB	Cefn Cave
PALEODB_EAST	*Hippopotamus amphibius*	0.47	51.74	68500.00	PALEODB	Chelmsford
PALEODB_EAST	*Hippopotamus amphibius*	-1.20	53.26	68500.00	PALEODB	Crewsell Crags
PALEODB_EAST	*Hippopotamus amphibius*	-2.00	52.10	68500.00	PALEODB	Cropthorn
PALEODB_EAST	*Hippopotamus amphibius*	-2.62	52.47	68500.00	PALEODB	Durdham Down
PALEODB_EAST	*Hippopotamus amphibius*	0.98	51.79	68500.00	PALEODB	East Mersea

PALEODB_EAST	*Hippopotamus amphibius*	-4.00	50.35	68500.00	PALEODB	Eastern Torrs Quarry
PALEODB_EAST	*Hippopotamus amphibius*	-1.86	53.09	68500.00	PALEODB	Elderbush Cave
PALEODB_EAST	*Hippopotamus amphibius*	0.33	51.48	68500.00	PALEODB	Grays
PALEODB_EAST	*Hippopotamus amphibius*	-3.19	50.80	68500.00	PALEODB	Honiton
PALEODB_EAST	*Hippopotamus amphibius*	0.80	52.11	68500.00	PALEODB	Lavenham
PALEODB_EAST	*Hippopotamus amphibius*	-1.55	53.80	68500.00	PALEODB	Leeds
PALEODB_EAST	*Hippopotamus amphibius*	18.43	-33.67	68500.00	PALEODB	Melkbos
PALEODB_EAST	*Hippopotamus amphibius*	-2.65	51.21	68500.00	PALEODB	Milton Hill
PALEODB_EAST	*Hippopotamus amphibius*	1.26	51.75	68500.00	PALEODB	Oxford
PALEODB_EAST	*Hippopotamus amphibius*	-4.19	51.55	68500.00	PALEODB	Ravenscliff Cave
PALEODB_EAST	*Hippopotamus amphibius*	-2.07	53.91	68500.00	PALEODB	Raygill Fissure
PALEODB_EAST	*Hippopotamus amphibius*	-0.17	54.10	68500.00	PALEODB	Sewerby
PALEODB_EAST	*Hippopotamus amphibius*	0.92	52.50	68500.00	PALEODB	Shropham
PALEODB_EAST	*Hippopotamus amphibius*	-1.31	54.57	68500.00	PALEODB	Stockton-on-Tees
PALEODB_EAST	*Hippopotamus amphibius*	35.05	32.72	68500.00	PALEODB	Tabun Cave Level C & D
PALEODB_EAST	*Hippopotamus amphibius*	1.04	51.37	68500.00	PALEODB	Tankerton
PALEODB_EAST	*Hippopotamus amphibius*	-3.66	50.13	68500.00	PALEODB	Tornewton Cave
PALEODB_EAST	*Hippopotamus amphibius*	-0.13	51.51	68500.00	PALEODB	Trafalgar Square
PALEODB_EAST	*Hippopotamus amphibius*	1.29	51.87	68500.00	PALEODB	Walton-on-the-Naze, Late Pleistocene
PALEODB_EAST	*Hippopotamus amphibius*	-0.64	52.04	68500.00	PALEODB	Water Hall Farm
PALEODB_EAST	*Hippopotamus amphibius*	-2.04	52.11	68500.00	PALEODB	Wick
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Hippopotamus amphibius*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli
PALEODB_EAST	*Hippotragus leucophaeus*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Hippotragus leucophaeus*	22.40	-34.05	68500.00	PALEODB	Herolds Bay
Raia et al. 2009; Carotenuto et al. 2010	*Homotherium latidens*	0.63	43.21	64088.25	Fiedler	Montmaurin
PALEODB_EAST	*Hydropotes inermis*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
Raia et al. 2009; Carotenuto et al. 2010	*Hyena prisca*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Hyena prisca*	0.63	43.21	64088.25	Fiedler	Montmaurin
PALEODB_EAST	*Loxodonta africana*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Loxodonta africana*	18.43	-33.67	68500.00	PALEODB	Melkbos
NOW	*Lutra lutra*	35.40	48.40	10000.00	NOW	Kichkas
NOW	*Lutra lutra*	4.05	51.95	10000.00	NOW	Maasvlakte (Fauna III)
NOW	*Lutra lutra*	92.80	56.01	10000.00	NOW	Namrut grotto

NOW	*Lutra lutra*	28.00	47.00	10000.00	NOW	Rud'
NOW	*Lutra lutra*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Lutra lutra*	9.76	48.40	60000.00	NOW	Sirgenstein cave
NOW	*Lutra lutra*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
PALEODB_EAST	*Lutra lutra*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Lycaon pictus*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
NOW	*Lynx lynx*	92.82	55.97	10000.00	NOW	Bolshaja Oreshnaja cave Hol
NOW	*Lynx lynx*	92.80	56.01	10000.00	NOW	Ledjanaja cave
NOW	*Lynx lynx*	92.79	56.01	10000.00	NOW	Ledopadnaja cave
NOW	*Lynx lynx*	92.80	56.01	10000.00	NOW	Lovushka cave (Belaja)
NOW	*Lynx lynx*	92.82	55.98	10000.00	NOW	Majachnaja cave Hol
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	33.00	50.10	14365.00	Radiometric	Gontsy
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	20.10	40.17	15000.00	Radiometric	Klithi
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
NOW	*Lynx lynx*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XVI-XVII
NOW	*Lynx lynx*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Lynx lynx*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Lynx lynx*	15.87	45.84	20000.00	NOW	Veternica cave st. d
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C

Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	10.90	45.57	34939.00	Radiometric	Abri Fumane
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	15.65	41.77	40000.00	Radiometric	Ingarano c
NOW	*Lynx lynx*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Lynx lynx*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	60.03	60.24	54800.00	Fiedler	Cheremukhovo 1 (1-4)
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	-0.21	53.64	55687.91	Fiedler	Stellmoor
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	1.08	44.84	59363.06	Fiedler	Abri du Flageolet I
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	2.75	51.28	59494.32	Fiedler	Gough's cave
NOW	*Lynx lynx*	5.01	50.43	60000.00	NOW	Goyet Cave st.4
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	15.24	40.50	60675.61	Fiedler	Castelcivita
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	24.71	44.42	60675.61	Fiedler	Icoana
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	11.16	46.20	61594.40	Fiedler	Riparo Predastel

Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	-4.37	40.80	62644.44	Fiedler	Villacastin C2
Raia et al. 2009; Carotenuto et al. 2010	*Lynx lynx*	22.58	37.00	63038.21	Fiedler	Apidima Cave C
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	-5.30	36.13	29544.00	Radiometric	Gorham's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	-9.22	38.90	30100.00	Radiometric	Pego do Diabo
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Lynx pardinus*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
NOW	*Mammuthus primigenius*	143.95	70.43	10000.00	NOW	Berelekh ""kitchen""
NOW	*Mammuthus primigenius*	37.00	52.00	10000.00	NOW	Eliseevichi
NOW	*Mammuthus primigenius*	100.00	75.00	10000.00	NOW	Engelgardt L latest, Tajmyr
NOW	*Mammuthus primigenius*	5.00	49.00	10000.00	NOW	Etiolles

NOW	*Mammuthus primigenius*	-3.00	50.00	10000.00	NOW	Gough's cave
NOW	*Mammuthus primigenius*	138.00	75.30	10000.00	NOW	Kotelnyj island, Baliktjakh, N
NOW	*Mammuthus primigenius*	101.13	73.60	10000.00	NOW	Kupchiktach L late, Tajmyr
NOW	*Mammuthus primigenius*	68.30	70.00	10000.00	NOW	Mutnaja Sejakha river
NOW	*Mammuthus primigenius*	7.10	47.50	10000.00	NOW	Praz Rodet
NOW	*Mammuthus primigenius*	26.28	58.58	10000.00	NOW	Puurmani
NOW	*Mammuthus primigenius*	68.50	71.00	10000.00	NOW	Sabbetajaha river
NOW	*Mammuthus primigenius*	54.00	71.50	10000.00	NOW	Severnaja Zemlja islands
NOW	*Mammuthus primigenius*	37.85	59.10	10000.00	NOW	Sheksna
NOW	*Mammuthus primigenius*	66.37	56.32	10000.00	NOW	Shikaevka
NOW	*Mammuthus primigenius*	91.05	55.05	10000.00	NOW	Tarachikha loc. 1
NOW	*Mammuthus primigenius*	100.33	58.30	10000.00	NOW	Ust'-Kova upper
NOW	*Mammuthus primigenius*	134.45	60.35	10000.00	NOW	Verkhne-Troitskaja
NOW	*Mammuthus primigenius*	80.25	54.65	10000.00	NOW	Volchja Griva
NOW	*Mammuthus primigenius*	37.00	51.80	10000.00	NOW	Yudinovo
NOW	*Mammuthus primigenius*	66.50	65.00	10000.00	NOW	Yuribej r. lower Yamal
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown "A" and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	33.00	50.10	14365.00	Radiometric	Gontsy
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	32.00	52.40	14700.00	Radiometric	Chulatov (Chulatovo I)
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	104	72.12	14800.00	radio	Ulakhan-Yuriakh River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	80.2	54.5	14800.00	radio	Volchya Griva (2)
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	1.02	44.9	14850.00	radio	La Croze-sur-Suran 1
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	104	43	14940.00	radio	Angara River Basin
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	139.73	72.36	15000.00	radio	Shirokostan Peninsula
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	171	65	15100.00	radio	Mayn River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	33.08	51.75	15100.00	radio	Mezin
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	30.97	52.83	15100.00	radio	Berdyzh
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	34.33	53.33	15110.00	radio	Timonovka I
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	150	68.45	15130.00	radio	Kolyma River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	62.34	59.24	15150.00	radio	Gari
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	150	68.45	15200.00	radio	Kolyma River

Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	131.78	44.15	15300.00	radio	Khorol
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-179	71	15400.00	radio	Wrangel Island
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	68.57	61.05	15420.00	radio	Lugovskoye
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	138	75	15420.00	radio	Kotelny Island
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	15.68	48.52	15560.00	radio	Schönberg Am Kamp
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	33.28	52.67	15660.00	radio	Yudinovo
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	8.53	50.07	15810.00	radio	Kelsterbach
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	25.43	60.37	15910.00	radio	Helsinki, Herttoniemi
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	133	62.42	16000.00	radio	Khayrgas
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	81.05	58.5	16000.00	radio	Bolshoi Istok
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown "B" loamy soil)
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	59.29	55.29	16130.00	radio	Nikolskaya Cave
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-147	64.4	16168.00	radio	Cleary Creek
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	61.4	54.1	16300.00	radio	Troitskaya
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	92.33	55.92	16300.00	radio	Listvenka
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	34.33	53.33	16300.00	radio	Timonovka I
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	62.34	59.24	16320.00	radio	Gari
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	105	75.3	16330.00	radio	Bolshaya Balachnya River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	36	51.7	16565.00	radio	Avdeevo
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	62.34	59.24	16700.00	radio	Gari
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	36	51.7	16960.00	radio	Avdeevo
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	62.33	59.38	17050.00	radio	Evalga
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	86.68	52.85	17100.00	radio	Ushlep 6
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	27.21	48.19	17200.00	Radiometric	Cosauti
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	92.33	55.92	17200.00	radio	Listvenka
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	86.32	52.01	17220.00	radio	Isha River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	112.25	57.23	17290.00	radio	Kaverga River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	2.74	42.17	17320.00	radio	L'Arbreda B Superior
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	131.78	44.15	17400.00	radio	Khorol
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	111.83	57.22	17450.00	radio	Niryakyan River
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	17.88	45.42	17500.00	Radiometric	Zarilac
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	75.46	70.11	17500.00	radio	Parisento River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	86.32	52.01	17600.00	radio	Isha River

Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	112	57.3	17610.00	radio	Tesa River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	2.74	42.17	17720.00	radio	L'Arbreda B Superior
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	125	70	17780.00	radio	Lower Le River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	80.2	54.5	17800.00	radio	Volchya Griva (2)
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	62.33	59.27	17810.00	radio	Rychkovo
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	69.73	54.25	17930.00	radio	Gagarino
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-3.37	53.26	18000.00	radio	Cae Gwyn Cave
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	31.4	49.63	18020.00	radio	Mezhirich
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	88	55.64	18040.00	radio	Shestakovo
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	65.92	56	18050.00	radio	Shikaevka 2
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	20.17	49.42	18160.00	radio	Oblazowa Cave
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	100.48	73.6	18190.00	radio	Bolshaya Balakhnya River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	68.57	61.05	18250.00	radio	Lugovskoye
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	39.45	55.27	18300.00	radio	Zaraisk
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	57.38	65.02	18320.00	radio	Byzovaya
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	19.92	50.05	18427.00	Radiometric	Spadzista St. A
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	144	75.26	18500.00	radio	Faddeyevsky Island
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	88.05	55.85	18580.00	radio	Kochegur
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	62.38	59.3	18600.00	radio	Berezovy Mys
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	92.05	55.2	18600.00	radio	Shlenka
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	119	71.4	18680.00	radio	Bur River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	33.23	52.85	18690.00	radio	Pogon
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	119	70	18700.00	radio	Amydai River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	91.1	55.15	18930.00	radio	Tarachikha
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	63.57	57.07	18990.00	radio	Komsomolsky
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	29.23	50.55	19000.00	radio	Randomyshl
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	39	51.29	19010.00	radio	Kostienki I
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	88	55.64	19190.00	radio	Shestakovo
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	27.5	56.58	19200.00	radio	Leski
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	28.58	45.82	19200.00	radio	Kirillovka
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	19.50	50.53	19250.00	Radiometric	Deszczowa Cave
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	31.4	49.63	19280.00	radio	Mezhirich
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-2.83	52.44	19300.00	radio	Condover, Shrosphire
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	15.53	48.14	19380.00	Radiometric	Grubgraben

Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	8.98	44.38	19400.00	radio	P7
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	92	53.55	19500.00	radio	Middle Yenisei River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-98.03	39.89	19530.00	radio	Lovewell Reservoir
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	94.58	79.9	19640.00	radio	Island
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-5.83	43.35	19700.00	radio	Cueto de la Mi
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	92	53.55	19700.00	radio	Middle Yenisei River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	62.33	59.38	19710.00	radio	Evalga
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	33.27	52	19800.00	radio	Novgorod-Severskii
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	39	51.29	19860.00	radio	Kostienki I
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	103.5	53	19900.00	radio	Mal'ta (Belaya River)
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	105.82	73.53	19910.00	radio	Bolshaya Balachnya River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	90	55.05	19960.00	radio	Chulym River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	96.75	79.47	19970.00	radio	Island
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-4.24	51.55	19980.00	radio	Hole]
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	138	75	19990.00	radio	Kotelny Island
NOW	*Mammuthus primigenius*	57.00	57.50	20000.00	NOW	Bolshoj Glukhoj grot l.V-IX
NOW	*Mammuthus primigenius*	20.00	40.36	20000.00	NOW	Cardamone
NOW	*Mammuthus primigenius*	-7.50	54.00	20000.00	NOW	Castlepook cave LGM
NOW	*Mammuthus primigenius*	4.40	50.97	20000.00	NOW	Hofstade II
NOW	*Mammuthus primigenius*	75.00	51.50	20000.00	NOW	Irtysh left bank
NOW	*Mammuthus primigenius*	129.40	71.79	20000.00	NOW	Lena delta late,Bykovskij,main
NOW	*Mammuthus primigenius*	125.00	68.00	20000.00	NOW	Lena lower course
NOW	*Mammuthus primigenius*	68.51	60.90	20000.00	NOW	Lugovskoe
NOW	*Mammuthus primigenius*	103.53	52.83	20000.00	NOW	Mal'ta main 8
NOW	*Mammuthus primigenius*	83.55	57.73	20000.00	NOW	Mogochino I, exc. 1-3
NOW	*Mammuthus primigenius*	27.08	48.55	20000.00	NOW	Molodova I l.1-3 LtPal
NOW	*Mammuthus primigenius*	4.50	52.50	20000.00	NOW	North Sea Reindeer culture
NOW	*Mammuthus primigenius*	90.95	54.97	20000.00	NOW	Novoselovo XI
NOW	*Mammuthus primigenius*	102.46	52.61	20000.00	NOW	Shamotnyj Zavod 1-2
NOW	*Mammuthus primigenius*	87.95	55.90	20000.00	NOW	Shestakovo
NOW	*Mammuthus primigenius*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Mammuthus primigenius*	113.43	52.02	20000.00	NOW	Sokhatino II
NOW	*Mammuthus primigenius*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Mammuthus primigenius*	86.70	52.50	20000.00	NOW	Ushlep VI, l.2
NOW	*Mammuthus primigenius*	100.33	58.30	20000.00	NOW	Ust'-Kova lower

NOW	*Mammuthus primigenius*	100.33	58.30	20000.00	NOW	Ust'-Kova middle
NOW	*Mammuthus primigenius*	133.12	59.65	20000.00	NOW	Ust'-Mil' II A-C
NOW	*Mammuthus primigenius*	104.32	52.30	20000.00	NOW	Voennyj Gospital'
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-179	71	20000.00	radio	Wrangel Island
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	38.88	54.77	20450.00	Radiometric	Zarajsk
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	8.32	44.20	20470.00	Radiometric	Arene Candide
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.43	46.38	21379.00	Radiometric	La Balme d'Epy [Jura]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.95	44.97	21466.00	Radiometric	Laugerie-Haute Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	15.88	48.24	21591.00	Radiometric	Langmannersdorf A
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.95	44.97	22207.00	Radiometric	Laugerie-Haute Est
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-179	71	22400.00	radio	Wrangel Island
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-179	71	22400.00	radio	Wrangel Island
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	88	55.64	22410.00	radio	Shestakovo
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	28.62	62.85	22420.00	radio	Nilsia, Syvari
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	88	55.64	22450.00	radio	Kiya River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	112	57.3	22480.00	radio	Basin, Tesa R.
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	88	55.64	22500.00	radio	Tesa River
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	28.50	47.50	22600.00	Radiometric	Climauti II S
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.75	49.41	22603.00	Radiometric	Kulna Cave6a
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	-4.24	51.55	22620.00	radio	Hole]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	17.89	48.61	22630.00	Radiometric	Moravany-Lopata II
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	39	51.29	22700.00	radio	Kostienki I
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	88	55.64	22750.00	radio	Shestakovo
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	100	74.03	22750.00	radio	Baskura Peninsula
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	39	51.29	22760.00	radio	Kostienki I
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	39.04	51.39	22780.00	radio	Gora]
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	62.2	57.68	22860.00	radio	Tavda River
Lorenzen_et_al.,(2011)	*Mammuthus primigenius*	103.5	53	22900.00	radio	Mal'ta (Belaya River)
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	36.00	51.10	23000.00	Radiometric	Avdeevskaja

Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	27.90	50.05	23000.00	Radiometric	Dovginichi
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.50	50.99	23000.00	Radiometric	Hofstade III
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	35.50	48.50	23000.00	Radiometric	Jamburg
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	31.28	49.45	23000.00	Radiometric	Kanev
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	36.20	50.00	23000.00	Radiometric	Kharkov
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.67	49.25	23000.00	Radiometric	Pekarna cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	32.50	50.50	23000.00	Radiometric	Zhuravka
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	8.13	50.42	23300.00	Radiometric	Wildenscheuer cave st. III
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	31.00	52.50	23400.00	Radiometric	Berdyzhskaja stojanka
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	34.12	53.34	23660.00	Radiometric	Khotylevo II
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.97	50.48	24700.00	Radiometric	Gr. de la Princesse [Marche-les-Dames]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	40.48	56.13	25848.00	Radiometric	Sungir'
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	1.33	44.77	26800.00	Radiometric	Roc de Combe6
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	3.99	50.47	26885.00	Radiometric	Maisieres-Canal
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	60.03	60.24	27350.00	Radiometric	Cheremukhovo 4 (stratum 2)

Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	17.00	51.50	27450.00	Radiometric	Krems-Wachtberg
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-2.04	52.02	27650.00	Radiometric	Beckford
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	10.15	48.55	27876.00	Radiometric	Bockstein-Torle
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-4.84	43.42	28147.00	Radiometric	Cueto de la Mina
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.28	47.53	28240.00	Radiometric	Montagne de Girault [Genay]1
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Mammuthus primigenius*	129.35	71.81	30000.00	NOW	Holocene shore, Bykovskij p, L
NOW	*Mammuthus primigenius*	27.28	48.27	30000.00	NOW	Korman IV
NOW	*Mammuthus primigenius*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Mammuthus primigenius*	97.00	73.30	30000.00	NOW	Logata r, Tajmyr
NOW	*Mammuthus primigenius*	105.80	54.02	30000.00	NOW	Makarovo III
NOW	*Mammuthus primigenius*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
NOW	*Mammuthus primigenius*	4.50	52.50	30000.00	NOW	North Sea combined
NOW	*Mammuthus primigenius*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	21.39	48.13	30677.00	Radiometric	Bodrogkeresztur [Henye Hill]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.73	48.84	30939.00	Radiometric	Milovice I
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	1.33	44.77	31300.00	Radiometric	Roc de Combe1c
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-4.24	51.55	31717.00	Radiometric	Paviland Cave [Goat's Hole]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C

Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.29	50.42	32560.00	Radiometric	Trou Al'Wesse
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.30	45.50	32659.00	Radiometric	La Quina Y-Z [Villebois la Valette]1
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	10.17	48.55	34365.00	Radiometric	Hohlenstein-Stadel [IV]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.85	47.70	34999.00	Radiometric	Les Cottes [St. Pierre de Maille]1
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	6.80	50.70	36163.00	Radiometric	Lommersum
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.77	48.40	36169.00	Radiometric	Das GeissenklosterleI
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
NOW	*Mammuthus primigenius*	4.00	44.00	40000.00	NOW	Baume NÃ©ron

NOW	*Mammuthus primigenius*	141.33	73.36	40000.00	NOW	Bolshoj Lyakhovskij isl, 1TC
NOW	*Mammuthus primigenius*	101.13	73.60	40000.00	NOW	Kupchiktach L, Tajmyr
NOW	*Mammuthus primigenius*	129.40	71.79	40000.00	NOW	Lena delta, Bykovskij,MKh main
NOW	*Mammuthus primigenius*	125.00	63.70	40000.00	NOW	Lena lower course, Sangary r.
NOW	*Mammuthus primigenius*	30.00	54.10	40000.00	NOW	Pashino
NOW	*Mammuthus primigenius*	89.47	54.45	40000.00	NOW	Proskurjakov cave
NOW	*Mammuthus primigenius*	34.00	45.00	40000.00	NOW	Zaskal'naya V-VI
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-8.58	52.22	41631.00	Radiometric	Castlepook Cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-3.02	51.32	43730.00	Radiometric	Brean Down
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.97	50.21	43760.00	Radiometric	Trou MagriteM3
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	13.33	52.30	45000.00	Radiometric	Niederweningen
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
NOW	*Mammuthus primigenius*	129.38	71.78	50000.00	NOW	Lena delta, MKh, shore&bar ear
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	20.47	47.97	50000.00	Radiometric	Subalyuk1
NOW	*Mammuthus primigenius*	11.33	51.00	50000.00	NOW	Taubach-Weimar Ehringsdorf 7
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	10.32	52.17	51000.00	Radiometric	Salzgitter
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-2.66	51.84	51618.99	Fiedler	King Arthur's Cave

Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	11.83	48.93	52012.76	Fiedler	Große Schulerloch E-F
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.80	48.41	52012.76	Fiedler	Rusenschloss
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	41.90	49.60	52669.04	Fiedler	Lebiazhenskoe
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-2.10	52.31	54244.10	Fiedler	Upton Warren gravels
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	12.65	43.92	54375.36	Fiedler	Torrente Conca (Morciano di Romagna)
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	28.50	47.50	55031.63	Fiedler	Climauti II i
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	11.40	50.62	55950.42	Fiedler	Teufelsbrücke 3
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.48	52.57	56212.93	Fiedler	Wretton
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.61	45.34	56400.00	Radiometric	Fonseigner [Bourdeilles]
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-0.03	51.46	56475.44	Fiedler	Willments gravels
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	20.57	50.87	57400.00	Fiedler	Raj cave 6
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.03	50.50	58444.27	Fiedler	Princesse Pauline
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.10	51.04	58706.78	Fiedler	Dendermonde
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	18.72	47.72	58838.04	Fiedler	Dorog

Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	6.65	50.23	59363.06	Fiedler	Buchenloch
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-4.10	43.40	59363.06	Fiedler	Cueva de Altamira Sol
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.16	48.58	59888.08	Fiedler	Steinheim upper level
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
NOW	*Mammuthus primigenius*	40.00	44.90	60000.00	NOW	Dakhovskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	44.30	48.40	60000.00	Radiometric	Sukhaja Mechetka l.4
NOW	*Mammuthus primigenius*	91.65	55.22	60000.00	NOW	Ust'-Izhul
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	-7.63	52.10	60019.34	Fiedler	Shandon Cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.18	51.26	60150.59	Fiedler	Bacon hole
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	7.30	50.53	60281.85	Fiedler	Ariendorf
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	5.21	50.59	60675.61	Fiedler	Trou du Docteur

Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	4.50	50.99	62500.00	Radiometric	Hofstade I
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	0.67	52.50	65500.00	Radiometric	Lynford
NOW	*Mammuthus primigenius*	51.00	52.70	70000.00	NOW	Alekseevka late
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
NOW	*Mammuthus primigenius*	100.00	74.00	70000.00	NOW	Tajmyr p-la LtPl
NOW	*Mammuthus primigenius*	4.39	50.98	70000.00	NOW	Zemst IIIC
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus primigenius*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus trogontherii*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus trogontherii*	84.50	57.09	61594.40	Fiedler	Krasny Jar 2
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus trogontherii*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus trogontherii*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus trogontherii*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus trogontherii*	9.16	48.58	65925.83	Fiedler	Steinheim lower level
Raia et al. 2009; Carotenuto et al. 2010	*Mammuthus trogontherii*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
NOW	*Megaloceros giganteus*	58.47	55.15	10000.00	NOW	Kulmetovsk cave
NOW	*Megaloceros giganteus*	60.20	57.50	10000.00	NOW	Neviansk
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	13.83	44.86	15790.00	Radiometric	Sandalja b
NOW	*Megaloceros giganteus*	4.40	50.97	20000.00	NOW	Hofstade II
NOW	*Megaloceros giganteus*	13.90	44.88	20000.00	NOW	Sandalija l.B-C

Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-4.84	43.42	21765.00	Radiometric	La Riera1
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-2.26	43.16	22220.00	Radiometric	Ekain Cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.50	50.99	23000.00	Radiometric	Hofstade III
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	27.50	47.98	23000.00	Radiometric	Starye Duruitory l.1 upper
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.73	46.30	24400.00	Radiometric	Solutre [O/A]
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	6.14	47.61	25677.00	Radiometric	Gr. d'Echenoz-la-Meline [La Baume]
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	17.44	49.43	28366.00	Radiometric	Predmosti
NOW	*Megaloceros giganteus*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Megaloceros giganteus*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-3.50	50.46	30185.00	Radiometric	Kent's Cavern
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-4.24	51.55	31717.00	Radiometric	Paviland Cave [Goat's Hole]
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave

Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	15.89	46.18	32461.00	Radiometric	Krapina
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	16.04	46.29	33850.00	Radiometric	Velica Pecina j
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	10.90	45.57	34939.00	Radiometric	Abri Fumane
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	9.77	48.40	36169.00	Radiometric	Das GeissenklosterleI
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
NOW	*Megaloceros giganteus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Megaloceros giganteus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-8.58	52.22	41631.00	Radiometric	Castlepook Cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-3.02	51.32	43730.00	Radiometric	Brean Down
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-2.66	51.84	51618.99	Fiedler	King Arthur's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	41.90	49.60	52669.04	Fiedler	Lebiazhenskoe

Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	-0.03	51.46	56475.44	Fiedler	Willments gravels
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.10	51.04	58706.78	Fiedler	Dendermonde
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	9.16	48.58	59888.08	Fiedler	Steinheim upper level
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	40.00	44.90	60000.00	Radiometric	Dakhovskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)

Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.68	50.83	60281.85	Fiedler	Maastricht-Belvedere 4
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	9.16	48.58	61200.64	Fiedler	Steinheim middle level
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	0.09	44.82	61856.91	Fiedler	Abri du Morin B1
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)

Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	4.50	50.99	62500.00	Radiometric	Hofstade I
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	8.13	50.42	62500.00	Radiometric	Wildenscheuer cave st. I-II
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	13.70	41.45	63300.72	Fiedler	Pontecorvo (Frosinone)
Raia et al. 2009; Carotenuto et al. 2010	*Megaloceros giganteus*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
NOW	*Megaloceros giganteus*	4.39	50.98	70000.00	NOW	Zemst IIIC
NOW	*Meles meles*	40.16	43.50	10000.00	NOW	Akhshtyrskaja cave Hol
NOW	*Meles meles*	92.82	55.97	10000.00	NOW	Badzhejskaja cave
NOW	*Meles meles*	42.61	42.32	10000.00	NOW	Belaja cave Kolkhida Hol
NOW	*Meles meles*	92.80	56.01	10000.00	NOW	Bezdonnaja Yama cave
NOW	*Meles meles*	92.80	56.01	10000.00	NOW	Gnilaja Yama cave
NOW	*Meles meles*	30.50	50.40	10000.00	NOW	Kiev zemljanki
NOW	*Meles meles*	43.50	42.50	10000.00	NOW	Kudaro 1 Hol
NOW	*Meles meles*	92.80	56.01	10000.00	NOW	Ledjanaja cave
NOW	*Meles meles*	92.79	56.01	10000.00	NOW	Ledopadnaja cave
NOW	*Meles meles*	92.80	56.01	10000.00	NOW	Lovushka cave (Belaja)
NOW	*Meles meles*	92.82	55.98	10000.00	NOW	Majachnaja cave Hol
NOW	*Meles meles*	23.02	43.13	10000.00	NOW	Pestera Cioarei st. XVIII
NOW	*Meles meles*	28.00	47.00	10000.00	NOW	Rud'
NOW	*Meles meles*	44.40	40.30	10000.00	NOW	Sarajbulakhskij, Urtskij khreb
NOW	*Meles meles*	49.30	40.50	10000.00	NOW	Sevan lake
NOW	*Meles meles*	43.00	42.45	10000.00	NOW	Shagat-Khokh-Leget
NOW	*Meles meles*	28.10	47.10	10000.00	NOW	Skok
NOW	*Meles meles*	41.20	44.00	10000.00	NOW	Treugol'naja cave 1-2
NOW	*Meles meles*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
NOW	*Meles meles*	22.37	47.20	20000.00	NOW	Igrita cave
NOW	*Meles meles*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Meles meles*	15.87	45.84	20000.00	NOW	Veternica cave st. d
NOW	*Meles meles*	20.36	43.53	30000.00	NOW	Smolucka Pecina
NOW	*Meles meles*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Meles meles*	84.33	51.67	40000.00	NOW	Okladnikov cave
NOW	*Meles meles*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Meles meles*	89.47	54.45	40000.00	NOW	Proskurjakov cave
NOW	*Meles meles*	40.00	44.90	60000.00	NOW	Dakhovskaja cave

NOW	*Meles meles*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
NOW	*Meles meles*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
NOW	*Meles meles*	91.65	55.22	60000.00	NOW	Ust'-Izhul
PALEODB_EAST	*Meles meles*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 5', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Meles meles*	20.43	50.42	68500.00	PALEODB	Little Cave - near Dzialoszyn
PALEODB_EAST	*Meles meles*	84.75	50.95	68500.00	PALEODB	Ust'-Kanskaia Cave
PALEODB_EAST	*Mellivora capensis*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Mellivora capensis*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
PALEODB_EAST	*Mellivora capensis*	18.32	-32.32	68500.00	PALEODB	Eland's Bay Cave
PALEODB_EAST	*Mellivora capensis*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Mellivora capensis*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 80-0cm
NOW	*Moschus moschiferus*	92.79	56.01	10000.00	NOW	Ledopadnaja cave
NOW	*Moschus moschiferus*	132.00	43.50	10000.00	NOW	Suchan caves
NOW	*Moschus moschiferus*	104.28	52.37	20000.00	NOW	Verkholenskaja Gora 1 l.2
PALEODB_EAST	*Moschus moschiferus*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
NOW	*Muntiacus muntjak*	110.26	-7.37	10000.00	NOW	Holocene caves
NOW	*Muntiacus muntjak*	118.00	4.00	10000.00	NOW	Madai
PALEODB_EAST	*Muntiacus muntjak*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Muntiacus muntjak*	111.03	-8.14	68500.00	PALEODB	Punung
PALEODB_EAST	*Muntiacus reevesi*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Neofelis nebulosa*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Oreotragus oreotragus*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Oreotragus oreotragus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
PALEODB_EAST	*Oreotragus oreotragus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Oreotragus oreotragus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 80-0cm
PALEODB_EAST	*Oreotragus oreotragus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
PALEODB_EAST	*Oryx gazella*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
PALEODB_EAST	*Oryx gazella*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Oryx gazella*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
NOW	*Ovibos moschatus*	9.13	48.07	20000.00	NOW	BurghÃ¶hle Dietfurt
NOW	*Ovibos moschatus*	68.51	60.90	20000.00	NOW	Lugovskoe

NOW	*Ovibos moschatus*	27.08	48.55	20000.00	NOW	Molodova I l.1-3 LtPal
NOW	*Ovibos moschatus*	133.12	59.65	20000.00	NOW	Ust'-Mil' II A-C
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	17.00	51.50	27450.00	Radiometric	Krems-Wachtberg
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	-2.04	52.02	27650.00	Radiometric	Beckford
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	5.00	52.00	32500.00	Radiometric	Raalte
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	8.37	47.50	58313.02	Fiedler	Niederleme
NOW	*Ovibos moschatus*	5.01	50.43	60000.00	NOW	Goyet Cave st.4
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos moschatus*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
PALEODB_EAST	*Ovibos moschatus*	4.07	51.98	68500.00	PALEODB	Eurogeul
NOW	*Ovibos moschatus*	100.00	74.00	70000.00	NOW	Tajmyr p-la LtPl
NOW	*Ovibos pallantis*	138.00	75.30	10000.00	NOW	Kotelnyj island, Baliktjakh, N
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos pallantis*	60.00	59.35	12800.00	Radiometric	Kakva-4
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos pallantis*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown "A" and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos pallantis*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown "B" loamy soil)
NOW	*Ovibos pallantis*	100.00	75.00	20000.00	NOW	Engelgardt L, Tajmyr
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos pallantis*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Ovibos pallantis*	60.03	60.24	30140.00	Radiometric	Cheremukhovo 2, 3

Raia et al. 2009; Carotenuto et al. 2010	*Ovibos pallantis*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
NOW	*Ovibos pallantis*	141.33	73.36	40000.00	NOW	Bolshoj Lyakhovskij isl, 1TC
NOW	*Ovis ammon*	108.50	50.17	10000.00	NOW	Studenoe l. 14-19
NOW	*Ovis ammon*	91.05	55.05	10000.00	NOW	Tarachikha loc. 1
NOW	*Ovis ammon*	91.02	54.60	10000.00	NOW	Tashtyk I l.1-3, exc.2
NOW	*Ovis ammon*	91.01	54.61	10000.00	NOW	Tashtyk II 1-2
NOW	*Ovis ammon*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
Raia et al. 2009; Carotenuto et al. 2010	*Ovis ammon*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
NOW	*Ovis ammon*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Ovis ammon*	89.45	54.42	20000.00	NOW	Malaja Syja l. 1-2
NOW	*Ovis ammon*	42.10	42.10	20000.00	NOW	Mgvimevi
NOW	*Ovis ammon*	90.95	54.97	20000.00	NOW	Novoselovo XIII 1-2
NOW	*Ovis ammon*	91.07	54.58	20000.00	NOW	Sabanikha
NOW	*Ovis ammon*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Ovis ammon*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Ovis ammon*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Ovis ammon*	91.43	52.97	20000.00	NOW	Ui I, 2-2/3
NOW	*Ovis ammon*	105.80	54.02	30000.00	NOW	Makarovo III
NOW	*Ovis ammon*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
NOW	*Ovis ammon*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Ovis ammon*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Ovis ammon*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
NOW	*Ovis ammon*	9.76	48.40	60000.00	NOW	Sirgenstein cave
NOW	*Ovis ammon*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
Raia et al. 2009; Carotenuto et al. 2010	*Ovis ammon*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
PALEODB_EAST	*Ovis ammon*	84.75	50.95	68500.00	PALEODB	Ust'-Kanskaia Cave
NOW	*Ovis nivicola*	103.53	52.83	20000.00	NOW	Mal'ta main 8
NOW	*Ovis nivicola*	102.46	52.61	20000.00	NOW	Shamotnyj Zavod 1-2
NOW	*Ovis nivicola*	105.80	54.02	30000.00	NOW	Makarovo III
NOW	*Ovis nivicola*	92.82	55.98	70000.00	NOW	Majachnaja cave
NOW	*Panthera leo*	91.02	54.60	10000.00	NOW	Tashtyk I l.1-3, exc.2
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown "A" and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	13.83	44.86	15790.00	Radiometric	Sandalja b

Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	19.80	50.06	15990.00	Radiometric	Zawalona cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown "B" loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	14.50	45.33	17500.00	Radiometric	Pecina na Gradini
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
NOW	*Panthera leo*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Panthera leo*	68.51	60.90	20000.00	NOW	Lugovskoe
NOW	*Panthera leo*	42.10	42.10	20000.00	NOW	Mgvimevi
NOW	*Panthera leo*	91.77	57.01	20000.00	NOW	Pereselencheskij Punkt
NOW	*Panthera leo*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XVI-XVII
NOW	*Panthera leo*	102.46	52.61	20000.00	NOW	Shamotnyj Zavod 1-2
NOW	*Panthera leo*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	4.50	50.99	23000.00	Radiometric	Hofstade III
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	15.87	45.84	23000.00	Radiometric	Veternica cave e
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	15.87	45.84	23000.00	Radiometric	Veternica cave f
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	8.13	50.42	23300.00	Radiometric	Wildenscheuer cave st. III
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	0.85	47.70	25114.00	Radiometric	Les Cottes [St. Pierre de Maille]???
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	6.14	47.61	25677.00	Radiometric	Gr. d'Echenoz-la-Meline [La Baume]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	40.48	56.13	25848.00	Radiometric	Sungir'
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	14.97	48.84	26235.00	Radiometric	Herdengelhoehle s.6

Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	60.03	60.24	27350.00	Radiometric	Cheremukhovo 4 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
NOW	*Panthera leo*	11.81	46.75	30000.00	NOW	Conturines cave
NOW	*Panthera leo*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Panthera leo*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	60.03	60.24	30140.00	Radiometric	Cheremukhovo 2, 3
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-1.19	53.27	30240.00	Radiometric	Robin Hood's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	21.39	48.13	30677.00	Radiometric	Bodrogkeresztur [Henye Hill]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	16.73	48.84	30939.00	Radiometric	Milovice I
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	0.30	45.50	32659.00	Radiometric	La Quina Y-Z [Villebois la Valette]1
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	20.59	44.29	33800.00	Radiometric	Risovaca

Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	16.04	46.29	33850.00	Radiometric	Velica Pecina j
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	6.80	50.70	36163.00	Radiometric	Lommersum
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
NOW	*Panthera leo*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Panthera leo*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
NOW	*Panthera leo*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	20.41	48.07	52000.00	Radiometric	Istallosko cave

Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	41.90	49.60	52669.04	Fiedler	Lebiazhenskoe
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	28.50	47.50	55031.63	Fiedler	Climauti II i
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	11.40	50.62	55031.63	Fiedler	Teufelsbrücke 2-3a
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	13.67	45.37	56344.19	Fiedler	Romualdo Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	5.43	45.09	58444.27	Fiedler	Gr. de Preletang [Presles]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	0.15	45.63	59363.06	Fiedler	Artenac 6
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	40.00	44.90	60000.00	Radiometric	Dakhovskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	22.37	47.20	60000.00	Radiometric	Igrita cave
NOW	*Panthera leo*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	0.15	45.63	60150.59	Fiedler	Artenac 8
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt

Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	20.65	48.12	60413.10	Fiedler	Budospest
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	13.70	45.72	60544.36	Fiedler	GabrovizzaII
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	0.50	44.01	61700.00	Fiedler	Gr. de la Nauterie I [La Romieu]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	0.15	45.63	61988.17	Fiedler	Artenac 10
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)

Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	16.67	49.40	62500.00	Radiometric	Barova cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	16.90	50.23	62500.00	Radiometric	Jaskinia Niedwiedzia
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	11.25	42.45	62644.44	Fiedler	Brecce di Soave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	14.97	48.84	64800.00	Radiometric	Herdengelhoehle
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	2.71	43.33	68000.00	Radiometric	Grotte d'Aldene, Couche K (Herault)
PALEODB_EAST	*Panthera leo*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 6 composite list', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Panthera leo*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 8', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Panthera leo*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
PALEODB_EAST	*Panthera leo*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 80-0cm
PALEODB_EAST	*Panthera leo*	4.05	51.96	68500.00	PALEODB	Maasvlakte, Fauna II
PALEODB_EAST	*Panthera leo*	18.43	-33.67	68500.00	PALEODB	Melkbos
NOW	*Panthera leo*	27.36	47.86	70000.00	NOW	Starye Duruitory l. 3-4
NOW	*Panthera leo*	4.39	50.98	70000.00	NOW	Zemst IIIC
Raia et al. 2009; Carotenuto et al. 2010	*Panthera leo*	19.77	50.22	70600.00	Radiometric	Jaskinia Nietoperzowa
NOW	*Panthera pardus*	41.20	44.00	10000.00	NOW	Treugol'naja cave 1-2

Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	1.66	44.62	18388.00	Radiometric	Gr. Pegourie [Caniac du Causse]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave
NOW	*Panthera pardus*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	16.04	46.29	33850.00	Radiometric	Velica Pecina j
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	20.37	43.53	38000.00	Radiometric	Smolucka Pecina
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-2.87	51.32	43244.00	Radiometric	Banwell Bone Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	20.47	47.97	50000.00	Radiometric	Subalyuk1

Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	13.10	41.23	54200.00	Radiometric	Gr. Guattari
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	11.40	50.62	56737.95	Fiedler	Teufelsbrücke 2-3b
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	13.51	41.22	59100.55	Fiedler	Gr. di Sant'Agostino
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	0.15	45.63	59363.06	Fiedler	Artenac 6
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	4.84	44.88	60500.00	Fiedler	Baume Moula-Guercy IV ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	10.33	43.93	60938.12	Fiedler	Buca della Iena
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	39.00	45.00	61988.17	Fiedler	Mezmaiskaya Cave 2A

Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	39.00	45.00	62513.19	Fiedler	Mezmaiskaya Cave 1–2
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	12.50	41.92	62513.19	Fiedler	Prati Fiscali
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	11.25	42.45	62644.44	Fiedler	Brecce di Soave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	22.58	37.00	63038.21	Fiedler	Apidima Cave B
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	22.58	37.00	63038.21	Fiedler	Apidima Cave C
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
PALEODB_EAST	*Panthera pardus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 6 composite list', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Panthera pardus*	109.72	28.32	68500.00	PALEODB	Luosixuan cave, bed 1, Jishou county
PALEODB_EAST	*Panthera pardus*	109.72	28.32	68500.00	PALEODB	Luosixuan cave, bed 3, Jishou county
PALEODB_EAST	*Panthera pardus*	35.05	32.72	68500.00	PALEODB	Tabun Cave Level C & D
PALEODB_EAST	*Panthera pardus*	-5.34	36.13	68500.00	PALEODB	Vangaurd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Panthera pardus*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
NOW	*Panthera tigris*	110.26	-7.37	10000.00	NOW	Holocene caves
NOW	*Panthera tigris*	118.00	4.00	10000.00	NOW	Madai
NOW	*Panthera tigris*	112.73	-8.10	10000.00	NOW	Wajak
NOW	*Panthera tigris*	89.47	54.45	40000.00	NOW	Proskurjakov cave

PALEODB_EAST	*Panthera tigris*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Panthera tigris*	120.00	23.00	68500.00	PALEODB	Penghu Channel
PALEODB_EAST	*Panthera tigris*	141.43	41.41	68500.00	PALEODB	Shiriya, Locality 2
PALEODB_EAST	*Panthera tigris*	141.43	41.40	68500.00	PALEODB	Shiriya, Locality 3-2
PALEODB_EAST	*Phacochoerus aethiopicus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
PALEODB_EAST	*Phacochoerus aethiopicus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Phacochoerus aethiopicus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 80-0cm
PALEODB_EAST	*Phacochoerus aethiopicus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
PALEODB_EAST	*Phacochoerus aethiopicus*	23.40	-34.10	68500.00	PALEODB	Nelson Bay Cave, Pleistocene
NOW	*Poephagus baikalensis*	108.50	50.17	10000.00	NOW	Studenoe l. 14-19
NOW	*Poephagus baikalensis*	85.05	51.00	20000.00	NOW	Maloialomanskaja l.2
NOW	*Poephagus baikalensis*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Poephagus baikalensis*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Poephagus baikalensis*	89.47	54.45	40000.00	NOW	Proskurjakov cave
PALEODB_EAST	*Potamochoerus porcus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
PALEODB_EAST	*Potamochoerus porcus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Potamochoerus porcus*	23.40	-34.10	68500.00	PALEODB	Nelson Bay Cave, Pleistocene
Raia et al. 2009; Carotenuto et al. 2010	*Praeovibos priscus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Praeovibos priscus*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
NOW	*Procapreolus loczyi*	16.60	47.28	60000.00	NOW	Genesapati
NOW	*Rangifer tarandus*	143.95	70.43	10000.00	NOW	Berelekh ""kitchen""
NOW	*Rangifer tarandus*	-7.50	54.00	10000.00	NOW	Castlepook cave LG
NOW	*Rangifer tarandus*	37.00	52.00	10000.00	NOW	Eliseevichi
NOW	*Rangifer tarandus*	60.40	60.69	10000.00	NOW	Laksejskaja cave
NOW	*Rangifer tarandus*	27.08	48.55	10000.00	NOW	Molodova I Mesolith
NOW	*Rangifer tarandus*	91.42	53.08	10000.00	NOW	Oznachennoe I
NOW	*Rangifer tarandus*	57.06	65.07	10000.00	NOW	Pechora, Unja caves
NOW	*Rangifer tarandus*	66.37	56.32	10000.00	NOW	Shikaevka
NOW	*Rangifer tarandus*	103.43	52.87	10000.00	NOW	Sosnovyj Bor l. 3-4
NOW	*Rangifer tarandus*	95.92	56.18	10000.00	NOW	Strizhova Gora l.4, 8-16,17
NOW	*Rangifer tarandus*	91.05	55.05	10000.00	NOW	Tarachikha loc. 1

NOW	*Rangifer tarandus*	91.02	54.60	10000.00	NOW	Tashtyk I l.1-3, exc.2
NOW	*Rangifer tarandus*	91.01	54.61	10000.00	NOW	Tashtyk II 1-2
NOW	*Rangifer tarandus*	91.01	54.61	10000.00	NOW	Tashtyk IV 1-2
NOW	*Rangifer tarandus*	26.90	48.00	10000.00	NOW	Trinka I l.1
NOW	*Rangifer tarandus*	159.97	56.17	10000.00	NOW	Ushki I
NOW	*Rangifer tarandus*	100.33	58.30	10000.00	NOW	Ust'-Kova upper
NOW	*Rangifer tarandus*	134.45	60.35	10000.00	NOW	Verkhne-Troitskaja
NOW	*Rangifer tarandus*	37.00	51.80	10000.00	NOW	Yudinovo
Sommer et al., (2014)	*Rangifer tarandus*	9.7000	57.4000	10307.00	radiometric	Nørre Lyngby 7, Hjørring
Sommer et al., (2014)	*Rangifer tarandus*	11.9833	55.4333	10375.00	radiometric	Risbanke, Ringsted
Sommer et al., (2014)	*Rangifer tarandus*	9.3167	55.5500	10402.00	radiometric	Jordrup, Kolding
Sommer et al., (2014)	*Rangifer tarandus*	9.5833	56.3667	10446.00	radiometric	Skavngård Mose, Viborg
Sommer et al., (2014)	*Rangifer tarandus*	11.4605 64	54.7299 75	10654.00	radiometric	Lolland
Sommer et al., (2014)	*Rangifer tarandus*	9.57456	55.6581 9	10847.00	radiometric	Linnet, Vejle
Sommer et al., (2014)	*Rangifer tarandus*	9.54474 4	56.2009 58	10938.00	radiometric	Silkeborg
Sommer et al., (2014)	*Rangifer tarandus*	14.7000	55.1000	10999.00	radiometric	Bornholm
Sommer et al., (2014)	*Rangifer tarandus*	14.7000	55.1000	11043.00	radiometric	Almindingen, Bornholm
Sommer et al., (2014)	*Rangifer tarandus*	12.3333	55.5000	11045.00	radiometric	Vollerslev, Køge
Sommer et al., (2014)	*Rangifer tarandus*	9.7000	57.4000	11136.15	radiometric	Nørre Lyngby Hjørring
Sommer et al., (2014)	*Rangifer tarandus*	14.8000	55.1000	11205.00	radiometric	Lindegård, Bornholm
Sommer et al., (2014)	*Rangifer tarandus*	11.6100 89	55.2006 14	11220.00	radiometric	Karrebækstorp, Næstved
Sommer et al., (2014)	*Rangifer tarandus*	10.3426 87	55.1161 46	11221.00	radiometric	Grøderup, Fåborg
Sommer et al., (2014)	*Rangifer tarandus*	9.53382 2	55.7388 21	11441.00	radiometric	Grejsdalen, Vejle
Sommer et al., (2014)	*Rangifer tarandus*	12.1000	55.6833	11464.00	radiometric	Vedde, Sorø
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	19.92	50.08	12000.00	Radiometric	Mamutowa Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	60.00	59.35	12800.00	Radiometric	Kakva-4
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown ''A'' and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	33.00	50.10	14365.00	Radiometric	Gontsy
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	32.00	52.40	14700.00	Radiometric	Chulatov (Chulatovo I)

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	31.50	49.65	15950.00	Radiometric	Mezherich
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	19.80	50.06	15990.00	Radiometric	Zawalona cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown ''B'' loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.05	43.11	16270.00	Radiometric	Cueva de Eralla
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	14.50	45.32	16780.00	Radiometric	Zupanov Spodmol
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.10	43.18	17050.00	Radiometric	Cueva de Urtiaga
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	27.21	48.19	17200.00	Radiometric	Cosauti
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.10	43.18	17950.00	Radiometric	Cueva de Aitzbitarte
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	39.00	44.10	18040.00	Radiometric	Anetovka II
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.66	44.62	18388.00	Radiometric	Gr. Pegourie [Caniac du Causse]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	19.92	50.05	18427.00	Radiometric	Spadzista St. A
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	19.50	50.53	19250.00	Radiometric	Deszczowa Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	15.53	48.14	19380.00	Radiometric	Grubgraben
NOW	*Rangifer tarandus*	57.00	57.50	20000.00	NOW	Bolshoj Glukhoj grot l.V-IX
NOW	*Rangifer tarandus*	9.13	48.07	20000.00	NOW	BurghÃ¶hle Dietfurt
NOW	*Rangifer tarandus*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Rangifer tarandus*	129.40	71.79	20000.00	NOW	Lena delta late,Bykovskij,main
NOW	*Rangifer tarandus*	68.51	60.90	20000.00	NOW	Lugovskoe
NOW	*Rangifer tarandus*	89.45	54.42	20000.00	NOW	Malaja Syja l. 1-2
NOW	*Rangifer tarandus*	103.53	52.83	20000.00	NOW	Mal'ta main 8

NOW	*Rangifer tarandus*	83.55	57.73	20000.00	NOW	Mogochino I, exc. 1-3
NOW	*Rangifer tarandus*	27.08	48.55	20000.00	NOW	Molodova I l.1-3 LtPal
NOW	*Rangifer tarandus*	108.00	59.90	20000.00	NOW	Nepa
NOW	*Rangifer tarandus*	4.50	52.50	20000.00	NOW	North Sea Reindeer culture
NOW	*Rangifer tarandus*	90.95	54.97	20000.00	NOW	Novoselovo XI
NOW	*Rangifer tarandus*	90.95	54.97	20000.00	NOW	Novoselovo XII
NOW	*Rangifer tarandus*	90.95	54.97	20000.00	NOW	Novoselovo XIII 1-2
NOW	*Rangifer tarandus*	91.77	57.01	20000.00	NOW	Pereselencheskij Punkt
NOW	*Rangifer tarandus*	91.07	54.58	20000.00	NOW	Sabanikha
NOW	*Rangifer tarandus*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Rangifer tarandus*	109.85	52.12	20000.00	NOW	Sannyj Mys 3-5
NOW	*Rangifer tarandus*	87.95	55.90	20000.00	NOW	Shestakovo
NOW	*Rangifer tarandus*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Rangifer tarandus*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Rangifer tarandus*	109.33	51.22	20000.00	NOW	Tolbaga
NOW	*Rangifer tarandus*	26.90	48.00	20000.00	NOW	Trinka I l.2
NOW	*Rangifer tarandus*	93.00	54.00	20000.00	NOW	Ulazy
NOW	*Rangifer tarandus*	100.33	58.30	20000.00	NOW	Ust'-Kova lower
NOW	*Rangifer tarandus*	100.33	58.30	20000.00	NOW	Ust'-Kova middle
NOW	*Rangifer tarandus*	133.12	59.65	20000.00	NOW	Ust'-Mil' II A-C
NOW	*Rangifer tarandus*	104.32	52.30	20000.00	NOW	Voennyj Gospital'
NOW	*Rangifer tarandus*	16.66	42.26	20000.00	NOW	Zitny cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	38.88	54.77	20450.00	Radiometric	Zarajsk
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.95	44.97	21466.00	Radiometric	Laugerie-Haute Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.47	44.35	21500.00	Radiometric	Gr. de La Baume d'Oullins (a.k.a. d'Oulen\) [Labastide-de-Virac]"
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	15.88	48.24	21591.00	Radiometric	Langmannersdorf A
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	32.50	51.60	22050.00	Radiometric	Mezinskaja

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	27.04	48.24	22100.00	Radiometric	Ciuntu
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-0.60	43.11	22166.00	Radiometric	Gr. des Bisons [Lurbe-St-Christau]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.95	44.97	22207.00	Radiometric	Laugerie-Haute Est
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.01	45.21	22383.00	Radiometric	Gr. des Cottier[s] [Retournac]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	28.50	47.50	22600.00	Radiometric	Climauti II S
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.75	49.41	22603.00	Radiometric	Kulna Cave6a
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	17.89	48.61	22630.00	Radiometric	Moravany-Lopata II
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.72	46.40	22696.00	Radiometric	Gr. de Laraux
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.67	49.25	23000.00	Radiometric	Adler cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	36.00	51.10	23000.00	Radiometric	Avdeevskaja
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	27.90	50.05	23000.00	Radiometric	Dovginichi
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.50	50.99	23000.00	Radiometric	Hofstade III
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	35.50	48.50	23000.00	Radiometric	Jamburg
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	31.28	49.45	23000.00	Radiometric	Kanev
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.67	49.25	23000.00	Radiometric	Pekarna cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	27.50	47.98	23000.00	Radiometric	Starye Duruitory l.1 upper
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	32.50	50.50	23000.00	Radiometric	Zhuravka
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	8.13	50.42	23300.00	Radiometric	Wildenscheuer cave st. III
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	2.34	43.31	24025.00	Radiometric	Canecaude I [Villardonel]

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.73	46.30	24400.00	Radiometric	Solutre [O/A]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.97	50.48	24700.00	Radiometric	Gr. de la Princesse [Marche-les-Dames]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.85	47.70	25114.00	Radiometric	Les Cottes [St. Pierre de Maille]???
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-1.90	43.27	25500.00	Radiometric	Aitzbitarte III
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	27.00	54.30	25550.00	Radiometric	Smorgon late Pleist
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.08	44.85	25752.00	Radiometric	Le Flageolet I [Bezenac]VI
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	40.48	56.13	25848.00	Radiometric	Sungir'
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	14.97	48.84	26235.00	Radiometric	Herdengelhoehle s.6
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.33	44.77	26800.00	Radiometric	Roc de Combe6
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	3.99	50.47	26885.00	Radiometric	Maisieres-Canal
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]K
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	60.03	60.24	27350.00	Radiometric	Cheremukhovo 4 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	17.00	51.50	27450.00	Radiometric	Krems-Wachtberg
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.04	52.02	27650.00	Radiometric	Beckford
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-3.48	53.23	27815.00	Radiometric	Pontnewydd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.08	44.85	27870.00	Radiometric	Le Flageolet I [Bezenac]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.15	48.55	27876.00	Radiometric	Bockstein-Torle
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-0.16	43.11	27931.00	Radiometric	Trou du Rhinoceros [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.28	47.53	28240.00	Radiometric	Montagne de Girault [Genay]1
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.72	46.38	28313.00	Radiometric	L'Ermitage [Lussac-les-Chateaux]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	17.44	49.43	28366.00	Radiometric	Predmosti
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.85	44.72	28400.00	Radiometric	A. du Mas Viel [St-Simon]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.16	46.26	28500.00	Radiometric	Vindija Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.08	44.85	28595.00	Radiometric	Le Flageolet I [Bezenac]IX
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.33	44.77	28600.00	Radiometric	Roc de Combe7a
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-3.66	50.49	29176.00	Radiometric	Tornewton Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.06	44.98	29500.00	Radiometric	Abri du Facteur
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Rangifer tarandus*	1.50	45.05	30000.00	NOW	Jaurens
NOW	*Rangifer tarandus*	27.28	48.27	30000.00	NOW	Korman IV
NOW	*Rangifer tarandus*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Rangifer tarandus*	105.80	54.02	30000.00	NOW	Makarovo III
NOW	*Rangifer tarandus*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
NOW	*Rangifer tarandus*	4.50	52.50	30000.00	NOW	North Sea combined
NOW	*Rangifer tarandus*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	60.03	60.24	30140.00	Radiometric	Cheremukhovo 2, 3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-3.50	50.46	30185.00	Radiometric	Kent's Cavern
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-1.19	53.27	30240.00	Radiometric	Robin Hood's Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.73	48.84	30939.00	Radiometric	Milovice I
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.33	44.77	31300.00	Radiometric	Roc de Combe1c
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-4.24	51.55	31717.00	Radiometric	Paviland Cave [Goat's Hole]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	15.58	48.28	32000.00	Radiometric	Gross Weikersdorf C
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.00	52.00	32500.00	Radiometric	Raalte
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.29	50.42	32560.00	Radiometric	Trou Al'Wesse
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.30	45.50	32659.00	Radiometric	La Quina Y-Z [Villebois la Valette]1
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	3.87	45.06	32903.00	Radiometric	Les Rivaux, Loc. 1 [Espaly-St-Marcel]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.85	47.70	32979.00	Radiometric	Les Cottes [St. Pierre de Maille]E3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.47	45.00	33800.00	Radiometric	Sirejol [Gignac]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.17	48.55	34365.00	Radiometric	Hohlenstein-Stadel [IV]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.33	44.77	34500.00	Radiometric	Roc de Combe4

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.85	47.70	34999.00	Radiometric	Les Cottes [St. Pierre de Maille]1
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	6.80	50.70	36163.00	Radiometric	Lommersum
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.77	48.40	36169.00	Radiometric	Das GeissenklosterleI
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.26	44.88	36366.00	Radiometric	Abri Caminade [Caneda]D21
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.33	43.93	36448.00	Radiometric	Esquicho-Grapaou
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.30	45.50	36543.00	Radiometric	La Quina Y-Z [Villebois la Valette]3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.26	44.88	37894.00	Radiometric	Abri Caminade [Caneda]F
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	2.06	42.85	37905.00	Radiometric	Caune de Belvis [Belvis]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	17.93	48.55	38400.00	Radiometric	Certova Pec (Radosina)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
NOW	*Rangifer tarandus*	4.00	44.00	40000.00	NOW	Baume NÃ©ron
NOW	*Rangifer tarandus*	101.13	73.60	40000.00	NOW	Kupchiktach L, Tajmyr
NOW	*Rangifer tarandus*	129.40	71.79	40000.00	NOW	Lena delta, Bykovskij,MKh main
NOW	*Rangifer tarandus*	30.00	54.10	40000.00	NOW	Pashino
NOW	*Rangifer tarandus*	34.00	45.00	40000.00	NOW	Zaskal'naya V-VI

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-8.58	52.22	41631.00	Radiometric	Castlepook Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.22	44.81	41900.00	Radiometric	Combe Grenal [Domme, Dordogne]1
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.87	51.32	43244.00	Radiometric	Banwell Bone Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-3.02	51.32	43730.00	Radiometric	Brean Down
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.97	50.21	43760.00	Radiometric	Trou MagriteM3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	20.47	47.97	50000.00	Radiometric	Subalyuk1
NOW	*Rangifer tarandus*	11.33	51.00	50000.00	NOW	Taubach-Weimar Ehringsdorf 7
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.32	52.17	51000.00	Radiometric	Salzgitter
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	57.57	59.85	51356.48	Fiedler	Kamen’ Pisany
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	56.00	60.80	51356.48	Fiedler	Ushminskaya cave (stratum 1-2)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	11.83	48.93	52012.76	Fiedler	Große Schulerloch E-F
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.80	48.41	52012.76	Fiedler	Rusenschloss

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	41.90	49.60	52669.04	Fiedler	Lebiazhenskoe
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.56	44.84	52931.55	Fiedler	Abri de Combe-Cullier
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	58.60	61.83	53456.57	Fiedler	Uninskaya
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.17	45.06	53978.00	Radiometric	Regourdou [Montignac]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.10	52.31	54244.10	Fiedler	Upton Warren gravels
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	60.50	61.27	54769.12	Fiedler	Burmantovo1, 2
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	60.03	60.24	54800.00	Fiedler	Cheremukhovo 1 (1-4)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	28.50	47.50	55031.63	Fiedler	Climauti II i
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	11.40	50.62	55031.63	Fiedler	Teufelsbrücke 2-3a
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	58.21	61.80	55294.14	Fiedler	Kaninskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.84	44.88	55400.00	Fiedler	Baume Moula-Guercy V-VII ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	11.40	50.62	55950.42	Fiedler	Teufelsbrücke 3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.48	52.57	56212.93	Fiedler	Wretton
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.61	45.34	56400.00	Radiometric	Fonseigner [Bourdeilles]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-7.64	39.66	56475.44	Fiedler	Foz do Enxarrique
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	11.40	50.62	56737.95	Fiedler	Teufelsbrücke 2-3b
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	16.67	49.27	57394.23	Fiedler	Ztiny cave

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	20.57	50.87	57400.00	Fiedler	Raj cave 6
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.02	44.97	57656.74	Fiedler	Abri de la Madeleine
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	19.05	47.75	57656.74	Fiedler	Remete cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.77	48.41	58181.76	Fiedler	Brillenhohle8
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.03	50.50	58444.27	Fiedler	Princesse Pauline
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.10	51.04	58706.78	Fiedler	Dendermonde
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.59	42.86	58838.04	Fiedler	Abri du Flageolet II
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.07	51.09	58969.29	Fiedler	Maasvlakte 2
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.08	44.84	59363.06	Fiedler	Abri du Flageolet I
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.15	45.63	59363.06	Fiedler	Artenac 6
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	6.65	50.23	59363.06	Fiedler	Buchenloch
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-4.10	43.40	59363.06	Fiedler	Cueva de Altamira Sol
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.72	50.96	59363.06	Fiedler	Rotselaar
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.25	45.07	59400.00	Fiedler	Grotte du Tai C''
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.88	51.29	59494.32	Fiedler	Picken's Hole, Layer 5
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.87	44.60	59494.32	Fiedler	Saint Eulaile

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
NOW	*Rangifer tarandus*	5.01	50.43	60000.00	NOW	Goyet Cave st.4
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	22.37	47.20	60000.00	Radiometric	Igrita cave
NOW	*Rangifer tarandus*	105.00	54.00	60000.00	NOW	Makarovo IV
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	44.30	48.40	60000.00	Radiometric	Sukhaja Mechetka l.4
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-7.63	52.10	60019.34	Fiedler	Shandon Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	6.24	43.44	60019.34	Fiedler	Trou du Renard
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.72	44.08	60150.59	Fiedler	Abri des Battus 3
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.15	45.63	60150.59	Fiedler	Artenac 8
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-1.34	43.08	60413.10	Fiedler	Cueva de Abauntz
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.84	44.88	60500.00	Fiedler	Baume Moula-Guercy IV ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.18	44.82	60544.36	Fiedler	Grotte Maldidier
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.21	50.59	60675.61	Fiedler	Trou du Docteur

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	-2.10	43.18	60806.87	Fiedler	Cueva de Ermittia
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	5.23	45.07	61331.89	Fiedler	Abri de Campalou
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.72	44.08	61331.89	Fiedler	Abri des Battus 5
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.50	45.03	61331.89	Fiedler	La Grotte des Fees
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	10.02	51.47	61594.40	Fiedler	Bettenroder Berg 14
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.09	44.82	61856.91	Fiedler	Abri du Morin B1
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	39.00	45.00	61988.17	Fiedler	Mezmaiskaya Cave 2A
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.87	46.71	62250.68	Fiedler	A. Rousseau [Dousse]
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.27	44.85	62250.68	Fiedler	Abri Caminade-Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.09	44.82	62250.68	Fiedler	Abri du Morin A4
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	4.50	50.99	62500.00	Radiometric	Hofstade I
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
PALEODB_EAST	*Rangifer tarandus*	3.00	55.00	63000.00	PALEODB	Dogger Bank
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)

Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	0.67	52.50	65500.00	Radiometric	Lynford
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
PALEODB_EAST	*Rangifer tarandus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 5', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Rangifer tarandus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 6 composite list', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Rangifer tarandus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 7', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Rangifer tarandus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 8', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Rangifer tarandus*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 9', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Rangifer tarandus*	4.88	60.53	68500.00	PALEODB	Blomvag
PALEODB_EAST	*Rangifer tarandus*	4.07	51.98	68500.00	PALEODB	Eurogeul
PALEODB_EAST	*Rangifer tarandus*	160.00	68.75	68500.00	PALEODB	Kolyma River, between the mouth of Omolon and Anjuj, Jedoma-Suite
PALEODB_EAST	*Rangifer tarandus*	161.00	69.00	68500.00	PALEODB	Lower part of Kolyma River, Aljoschka-Suite
PALEODB_EAST	*Rangifer tarandus*	4.05	51.96	68500.00	PALEODB	Maasvlakte, Fauna II
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
NOW	*Rangifer tarandus*	100.00	74.00	70000.00	NOW	Tajmyr p-la LtPl
NOW	*Rangifer tarandus*	4.39	50.98	70000.00	NOW	Zemst IIIC
Raia et al. 2009; Carotenuto et al. 2010	*Rangifer tarandus*	19.77	50.22	70600.00	Radiometric	Jaskinia Nietoperzowa
PALEODB_EAST	*Raphicerus campestris*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Raphicerus campestris*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
PALEODB_EAST	*Raphicerus campestris*	18.32	-32.32	68500.00	PALEODB	Eland's Bay Cave
PALEODB_EAST	*Raphicerus campestris*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
PALEODB_EAST	*Raphicerus campestris*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Raphicerus campestris*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 80-0cm
PALEODB_EAST	*Raphicerus campestris*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm

PALEODB_EAST	*Raphicerus campestris*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, 170-0cm
PALEODB_EAST	*Raphicerus campestris*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, Undated rockshelter
PALEODB_EAST	*Raphicerus campestris*	17.25	-30.04	68500.00	PALEODB	Swart Duinen
PALEODB_EAST	*Raphicerus melanotis*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Raphicerus sharpei*	18.32	-32.32	68500.00	PALEODB	Eland's Bay Cave
PALEODB_EAST	*Redunca arundinum*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Redunca arundinum*	16.93	-29.21	68500.00	PALEODB	Boegoeberg 1
PALEODB_EAST	*Redunca arundinum*	23.40	-34.10	68500.00	PALEODB	Nelson Bay Cave, Pleistocene
PALEODB_EAST	*Redunca fulvorufula*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 110-80cm
PALEODB_EAST	*Redunca fulvorufula*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Redunca fulvorufula*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 80-0cm
PALEODB_EAST	*Redunca fulvorufula*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 22, 250-100cm
PALEODB_EAST	*Redunca fulvorufula*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, 170-0cm
PALEODB_EAST	*Redunca fulvorufula*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 46, Undated rockshelter
PALEODB_EAST	*Redunca fulvorufula*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 62 180-70cm
PALEODB_EAST	*Redunca fulvorufula*	23.40	-34.10	68500.00	PALEODB	Nelson Bay Cave, Pleistocene
NOW	*Rhinoceros sondaicus*	110.26	-7.37	10000.00	NOW	Holocene caves
NOW	*Rhinoceros sondaicus*	112.73	-8.10	10000.00	NOW	Wajak
NOW	*Rupicapra rupicapra*	46.00	42.30	10000.00	NOW	Lesgor I&II
NOW	*Rupicapra rupicapra*	27.28	48.27	10000.00	NOW	Molodova V [Kosoutsy]
NOW	*Rupicapra rupicapra*	43.24	42.00	10000.00	NOW	Tsona cave Hol
NOW	*Rupicapra rupicapra*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	16.90	43.60	12392.50	Radiometric	Kopacina
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	20.10	40.17	15000.00	Radiometric	Klithi
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	19.80	50.06	15990.00	Radiometric	Zawalona cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
NOW	*Rupicapra rupicapra*	22.37	47.20	20000.00	NOW	Igrita cave
NOW	*Rupicapra rupicapra*	41.26	43.02	20000.00	NOW	Kholodnyj Grot/ Kej Bogaz
NOW	*Rupicapra rupicapra*	13.90	44.88	20000.00	NOW	Sandalija l.B-C

NOW	*Rupicapra rupicapra*	15.87	45.84	20000.00	NOW	Veternica cave st. d
NOW	*Rupicapra rupicapra*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-3.84	43.36	21500.00	Radiometric	Cueva Morin
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-4.84	43.42	21765.00	Radiometric	La Riera1
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-0.60	43.11	22166.00	Radiometric	Gr. des Bisons [Lurbe-St-Christau]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-0.49	45.04	22200.00	Radiometric	Roc de la Melca
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	0.95	44.97	22207.00	Radiometric	Laugerie-Haute Est
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-2.26	43.16	22220.00	Radiometric	Ekain Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	4.01	45.21	22383.00	Radiometric	Gr. des Cottier[s] [Retournac]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	0.72	46.40	22696.00	Radiometric	Gr. de Laraux
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	41.50	42.30	23000.00	Radiometric	Devis-Khvreli cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	42.50	42.00	23000.00	Radiometric	Gvardzhilas-Klde
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	15.87	45.84	23000.00	Radiometric	Veternica cave e
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	2.34	43.31	24025.00	Radiometric	Canecaude I [Villardonel]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	4.54	44.33	24200.00	Radiometric	Gr. St-Marcel [d'Ardeche] [Bidon]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-1.90	43.27	25500.00	Radiometric	Aitzbitarte III
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.08	44.85	25752.00	Radiometric	Le Flageolet I [Bezenac]VI

Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-4.84	43.42	28147.00	Radiometric	Cueto de la Mina
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	16.16	46.26	28500.00	Radiometric	Vindija Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.08	44.85	28595.00	Radiometric	Le Flageolet I [Bezenac]IX
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.06	44.98	29500.00	Radiometric	Abri du Facteur
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Rupicapra rupicapra*	20.36	43.53	30000.00	NOW	Smolucka Pecina
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-9.22	38.90	30100.00	Radiometric	Pego do Diabo
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.33	44.77	31300.00	Radiometric	Roc de Combe1c
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.00	44.93	34480.00	Radiometric	Abri Pataud7
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.33	44.77	34500.00	Radiometric	Roc de Combe4
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	15.24	40.50	34540.00	Radiometric	Castelcivitagic

Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	10.90	45.57	34939.00	Radiometric	Abri Fumane
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	9.77	48.40	36169.00	Radiometric	Das GeissenklosterleI
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-2.75	42.16	36260.00	Radiometric	Mollet Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.26	44.88	37894.00	Radiometric	Abri Caminade [Caneda]F
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	2.06	42.85	37905.00	Radiometric	Caune de Belvis [Belvis]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.22	44.81	41900.00	Radiometric	Combe Grenal [Domme, Dordogne]1
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	11.57	45.47	42224.00	Radiometric	Gr. del Broion
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	18.50	42.78	43730.00	Radiometric	Crvena Stijena
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	4.97	50.21	43760.00	Radiometric	Trou MagriteM3
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	20.47	47.97	50000.00	Radiometric	Subalyuk1

Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.56	44.84	52931.55	Fiedler	Abri de Combe-Cullier
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	22.26	44.59	56344.19	Fiedler	Pestera Climente
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.02	44.97	57656.74	Fiedler	Abri de la Madeleine
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	19.05	47.75	57656.74	Fiedler	Remete cave
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.59	42.86	58838.04	Fiedler	Abri du Flageolet II
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.08	44.84	59363.06	Fiedler	Abri du Flageolet I
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	12.44	43.19	59363.06	Fiedler	Monte Cucco
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	5.25	45.07	59400.00	Fiedler	Grotte du Tai C''
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.87	44.60	59494.32	Fiedler	Saint Eulaile
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
NOW	*Rupicapra rupicapra*	5.01	50.43	60000.00	NOW	Goyet Cave st.4
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.72	44.08	60150.59	Fiedler	Abri des Battus 3
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	20.65	48.12	60413.10	Fiedler	Budospest
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.18	44.82	60544.36	Fiedler	Grotte Maldidier

Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	15.24	40.50	60675.61	Fiedler	Castelcivita
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	24.71	44.42	60675.61	Fiedler	Icoana
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-3.01	41.01	61100.00	Fiedler	Las Figuras (Alcorlo)
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	1.72	44.08	61331.89	Fiedler	Abri des Battus 5
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-3.47	42.05	61331.89	Fiedler	Cueva Millan 1a
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	0.50	45.03	61331.89	Fiedler	La Grotte des Fees
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	11.00	45.27	61331.89	Fiedler	Quinzano
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Rupicapra rupicapra*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
PALEODB_EAST	*Rupicapra rupicapra*	11.55	45.55	68500.00	PALEODB	Grotta Maggiore do S. Bernardino (Pleistocene), Colli Berici, Northern Italy
NOW	*Saiga tatarica*	66.37	56.32	10000.00	NOW	Shikaevka
NOW	*Saiga tatarica*	91.02	54.60	10000.00	NOW	Tashtyk I l.1-3, exc.2
NOW	*Saiga tatarica*	91.01	54.61	10000.00	NOW	Tashtyk II 1-2

Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	59.00	62.20	13260.00	Radiometric	Medvezhaya cave (greyish-brown "A" and grey loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown "B" loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	39.00	44.10	18040.00	Radiometric	Anetovka II
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
NOW	*Saiga tatarica*	75.00	51.50	20000.00	NOW	Irtysh left bank
NOW	*Saiga tatarica*	91.65	57.05	20000.00	NOW	Karaul'nyj Byk l. 3-9
NOW	*Saiga tatarica*	42.72	43.90	20000.00	NOW	Malyj Yankul, Kalaus
NOW	*Saiga tatarica*	90.95	54.97	20000.00	NOW	Novoselovo XII
NOW	*Saiga tatarica*	91.60	57.10	20000.00	NOW	Shalunin Byk
NOW	*Saiga tatarica*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Saiga tatarica*	109.33	51.22	20000.00	NOW	Tolbaga
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	0.95	44.97	22207.00	Radiometric	Laugerie-Haute Est
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	16.75	49.41	22603.00	Radiometric	Kulna Cave6a
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	36.00	51.10	23000.00	Radiometric	Avdeevskaja
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	32.50	50.50	23000.00	Radiometric	Zhuravka
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	39.04	51.39	28143.00	Radiometric	Kostienki XIV [Markina Gora]
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	16.16	46.26	28500.00	Radiometric	Vindija Cave
NOW	*Saiga tatarica*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
NOW	*Saiga tatarica*	89.47	54.45	40000.00	NOW	Proskurjakov cave

NOW	*Saiga tatarica*	34.00	45.00	40000.00	NOW	Zaskal'naya V-VI
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	1.56	44.84	52931.55	Fiedler	Abri de Combe-Cullier
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	11.40	50.62	55031.63	Fiedler	Teufelsbrücke 2-3a
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	11.40	50.62	55950.42	Fiedler	Teufelsbrücke 3
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	33.85	44.67	56000.00	Radiometric	Staroselje
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	11.40	50.62	56737.95	Fiedler	Teufelsbrücke 2-3b
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	39.00	45.00	58181.76	Fiedler	Mezmaiskaya Cave 2
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	1.59	42.86	58838.04	Fiedler	Abri du Flageolet II
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
NOW	*Saiga tatarica*	40.00	44.90	60000.00	NOW	Dakhovskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
NOW	*Saiga tatarica*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	44.30	48.40	60000.00	Radiometric	Sukhaja Mechetka l.4
NOW	*Saiga tatarica*	70.30	43.80	60000.00	NOW	Ushbas cave
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	6.24	43.44	60019.34	Fiedler	Trou du Renard
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	0.50	45.03	61331.89	Fiedler	La Grotte des Fees
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29

Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	47.44	47.02	61856.91	Fiedler	Singil
PALEODB_EAST	*Saiga tatarica*	161.00	69.00	68500.00	PALEODB	Lower part of Kolyma River, Aljoschka-Suite
Raia et al. 2009; Carotenuto et al. 2010	*Saiga tatarica*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
Raia et al. 2009; Carotenuto et al. 2010	*Soergelia elisabethae*	11.10	51.35	69700.00	Fiedler	Bad Frankenhausen
NOW	*Spirocerus kiakhtensis*	108.50	50.17	10000.00	NOW	Studenoe l. 14-19
NOW	*Spirocerus kiakhtensis*	113.43	52.02	20000.00	NOW	Sokhatino IV l. 1-10
NOW	*Spirocerus kiakhtensis*	109.33	51.22	20000.00	NOW	Tolbaga
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus etruscus*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-9.19	39.30	30660.00	Radiometric	Columbeira
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.65	43.92	54375.36	Fiedler	Torrente Conca (Morciano di Romagna)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	22.87	41.05	59756.83	Fiedler	Kilkis (Central Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	0.05	51.48	59888.08	Fiedler	Waterhall farm (Hertford)
NOW	*Stephanorhinus hemitoechus*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	0.18	51.26	60150.59	Fiedler	Bacon hole
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	5.68	50.83	60281.85	Fiedler	Maastricht-Belvedere 4
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	9.16	48.58	61200.64	Fiedler	Steinheim middle level

Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	84.50	57.09	61594.40	Fiedler	Krasny Jar 2
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.50	41.93	61856.91	Fiedler	Monte Delle Gioie
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	0.37	43.11	61988.17	Fiedler	Montousse I (Haute Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	1.03	49.30	62250.68	Fiedler	Cleon
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-3.33	40.87	62250.68	Fiedler	Cueva del Congosto, Guadalajara
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.52	42.10	62250.68	Fiedler	Riano
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.50	41.92	62513.19	Fiedler	Prati Fiscali
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-2.50	41.15	62906.95	Fiedler	Ambrona
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.73	42.22	62906.95	Fiedler	Fara Sabina
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	9.51	48.53	64088.25	Fiedler	Heppenloch

Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hemitoechus*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus hundsheimensis*	2.71	43.33	68000.00	Radiometric	Grotte d'Aldene, Couche K (Herault)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	15.89	46.18	32461.00	Radiometric	Krapina
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	-7.31	43.48	36700.00	Radiometric	Valina
NOW	*Stephanorhinus kirchbergensis*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	0.28	51.43	55556.65	Fiedler	Swanscombe
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	8.37	47.50	58313.02	Fiedler	Niederleme
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	9.16	48.58	61200.64	Fiedler	Steinheim middle level
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	3.87	43.80	61594.40	Fiedler	Hortus Grotte
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)

Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	0.63	43.21	64088.25	Fiedler	Montmaurin
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	9.16	48.58	65925.83	Fiedler	Steinheim lower level
Raia et al. 2009; Carotenuto et al. 2010	*Stephanorhinus kirchbergensis*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli
NOW	*Sus barbatus*	118.00	4.00	10000.00	NOW	Madai
NOW	*Sus scrofa*	40.16	43.50	10000.00	NOW	Akhshtyrskaja cave Hol
NOW	*Sus scrofa*	44.00	52.00	10000.00	NOW	Alimov cave
NOW	*Sus scrofa*	42.00	42.00	10000.00	NOW	Anaklia
NOW	*Sus scrofa*	9.13	48.07	10000.00	NOW	BurghÃ¶hle Dietfurt Hol
NOW	*Sus scrofa*	110.26	-7.37	10000.00	NOW	Holocene caves
NOW	*Sus scrofa*	44.50	40.20	10000.00	NOW	Karmir Blur (Tejshebaini) cast
NOW	*Sus scrofa*	60.00	43.00	10000.00	NOW	Khoresm, Uchashchi st.
NOW	*Sus scrofa*	35.40	48.40	10000.00	NOW	Kichkas
NOW	*Sus scrofa*	30.50	50.40	10000.00	NOW	Kiev zemljanki
NOW	*Sus scrofa*	12.60	42.10	10000.00	NOW	L'Elceto
NOW	*Sus scrofa*	4.05	51.95	10000.00	NOW	Maasvlakte (Fauna III)
NOW	*Sus scrofa*	40.85	44.20	10000.00	NOW	Monasheskaja l.1/Barakaevskaja
NOW	*Sus scrofa*	23.02	43.13	10000.00	NOW	Pestera Cioarei st. XVIII
NOW	*Sus scrofa*	132.00	43.50	10000.00	NOW	Suchan caves
NOW	*Sus scrofa*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.08	43.91	12000.00	Radiometric	Chinchon I
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	16.90	43.60	12392.50	Radiometric	Kopacina
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	33.00	50.10	14365.00	Radiometric	Gontsy
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	41.00	49.00	15500.00	Radiometric	Don settlements
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	14.50	45.32	16780.00	Radiometric	Zupanov Spodmol
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	23.90	37.92	16932.50	Radiometric	Vraona cave (Attiki)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	17.88	45.42	17500.00	Radiometric	Zarilac

Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	16.17	43.83	18388.00	Radiometric	Pecine u Brini East&West caves
NOW	*Sus scrofa*	41.26	43.02	20000.00	NOW	Kholodnyj Grot/ Kej Bogaz
NOW	*Sus scrofa*	42.72	43.90	20000.00	NOW	Malyj Yankul, Kalaus
NOW	*Sus scrofa*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Sus scrofa*	15.87	45.84	20000.00	NOW	Veternica cave st. d
NOW	*Sus scrofa*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	8.32	44.20	20470.00	Radiometric	Arene Candide
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	20.50	39.42	20800.00	Radiometric	Kastritsa
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-3.84	43.36	21500.00	Radiometric	Cueva Morin
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	25.48	45.54	22000.00	Radiometric	Gura Cheii-Rasnov
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-0.49	45.04	22200.00	Radiometric	Roc de la Melca
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-4.84	43.42	22280.00	Radiometric	La Riera23
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	41.50	42.30	23000.00	Radiometric	Devis-Khvreli cave
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	42.50	42.00	23000.00	Radiometric	Gvardzhilas-Klde
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	31.28	49.45	23000.00	Radiometric	Kanev
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	36.20	50.00	23000.00	Radiometric	Kharkov
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	32.50	50.50	23000.00	Radiometric	Zhuravka
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	17.96	40.15	23151.00	Radiometric	Cavallo
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.94	44.96	23662.00	Radiometric	La FerrassieD2
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.00	44.93	24045.00	Radiometric	Abri Pataud3

Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	4.54	44.33	24200.00	Radiometric	Gr. St-Marcel [d'Ardeche] [Bidon]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	40.17	43.50	24500.00	Radiometric	Akhshtyrskaja cave, Akhshatyr
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	6.14	47.61	25677.00	Radiometric	Gr. d'Echenoz-la-Meline [La Baume]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]K
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-4.84	43.42	28147.00	Radiometric	Cueto de la Mina
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.85	44.72	28400.00	Radiometric	A. du Mas Viel [St-Simon]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.94	44.96	28545.00	Radiometric	La Ferrassie
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.08	44.85	28595.00	Radiometric	Le Flageolet I [Bezenac]IX
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-5.30	36.13	29544.00	Radiometric	Gorham's Cave
NOW	*Sus scrofa*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-4.13	36.95	31300.00	Radiometric	Zafarraya Cave
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	15.89	46.18	32461.00	Radiometric	Krapina
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.00	44.93	34480.00	Radiometric	Abri Pataud7

Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	15.24	40.50	34540.00	Radiometric	Castelcivitagic
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.26	44.88	36366.00	Radiometric	Abri Caminade [Caneda]D21
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-7.31	43.48	36700.00	Radiometric	Valina
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
NOW	*Sus scrofa*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Sus scrofa*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	11.49	45.42	40843.00	Radiometric	Gr. di Paina
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	18.50	42.78	43730.00	Radiometric	Crvena Stijena
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	4.97	50.21	43760.00	Radiometric	Trou MagriteM3
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-1.68	41.54	45437.00	Radiometric	Abric Romani
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	18.89	47.39	51400.00	Radiometric	Erd

Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.73	45.00	51500.00	Radiometric	La Chapelle-aux-Saints
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.17	45.06	53978.00	Radiometric	Regourdou [Montignac]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.10	41.23	54200.00	Radiometric	Gr. Guattari
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-0.21	53.64	55687.91	Fiedler	Stellmoor
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	39.00	45.00	58181.76	Fiedler	Mezmaiskaya Cave 2
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.51	41.22	59100.55	Fiedler	Gr. di Sant'Agostino
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
NOW	*Sus scrofa*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	6.24	43.44	60019.34	Fiedler	Trou du Renard
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.15	45.63	60150.59	Fiedler	Artenac 8
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-1.34	43.08	60413.10	Fiedler	Cueva de Abauntz
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.70	45.72	60544.36	Fiedler	GabrovizzaII
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	15.24	40.50	60675.61	Fiedler	Castelcivita
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)

Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-2.10	43.18	60806.87	Fiedler	Cueva de Ermittia
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	10.33	43.93	60938.12	Fiedler	Buca della Iena
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.43	47.34	61200.64	Fiedler	La Roche Cotard [37 - Langeais]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	9.16	48.58	61200.64	Fiedler	Steinheim middle level
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	5.23	45.07	61331.89	Fiedler	Abri de Campalou
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.72	44.08	61331.89	Fiedler	Abri des Battus 5
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	10.95	45.61	61331.89	Fiedler	Grotte di Veja C
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.50	45.03	61331.89	Fiedler	La Grotte des Fees
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.90	50.90	61463.15	Fiedler	Biache Saint Waast (Pas de Calais)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	24.20	41.40	61463.15	Fiedler	Drama basin (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	10.02	51.47	61594.40	Fiedler	Bettenroder Berg 14
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	11.16	46.20	61594.40	Fiedler	Riparo Predastel
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena

Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.09	44.82	61856.91	Fiedler	Abri du Morin B1
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.70	45.90	61856.91	Fiedler	Grotta Azzurra
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.75	45.67	61856.91	Fiedler	Grotta Benussi
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	9.18	48.79	61988.17	Fiedler	Cannstatt I
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.87	46.71	62250.68	Fiedler	A. Rousseau [Dousse]
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.27	44.85	62250.68	Fiedler	Abri Caminade-Ouest
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.09	44.82	62250.68	Fiedler	Abri du Morin A4
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-3.33	40.87	62250.68	Fiedler	Cueva del Congosto, Guadalajara
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.83	42.00	62250.68	Fiedler	Grotta Cola
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	11.36	45.28	62250.68	Fiedler	Grotta Perin
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	16.90	50.23	62500.00	Radiometric	Jaskinia Niedwiedzia
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-4.37	40.80	62644.44	Fiedler	Villacastin C2
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	12.73	42.22	62906.95	Fiedler	Fara Sabina

Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	47.00	43.30	63038.21	Fiedler	Alkhast
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-5.50	36.22	63038.21	Fiedler	Devil's Tower
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	43.00	45.60	63038.21	Fiedler	Zejukovo, Nal'chik
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	32.00	49.00	63169.47	Fiedler	Andreevka
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	12.62	42.00	63431.98	Fiedler	Sedia Del Diavolo
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	12.18	41.88	63957.00	Fiedler	Malagrotta (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	39.00	45.00	64088.25	Fiedler	Mezmaiskaya Cave 2B
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	0.63	43.21	64088.25	Fiedler	Montmaurin
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	12.57	41.92	64482.02	Fiedler	Casal De' Pazzi (Rebibbia)
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	-2.91	37.57	65138.30	Fiedler	La Solana del Zamborino, Granada
PALEODB_EAST	*Sus scrofa*	0.15	45.65	68500.00	PALEODB	Artenac 'Bed 8', Commune de Saint-Mary, Charente,
PALEODB_EAST	*Sus scrofa*	11.55	45.55	68500.00	PALEODB	Grotta Maggiore do S. Bernardino (Pleistocene), Colli Berici, Northern Italy
PALEODB_EAST	*Sus scrofa*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Sus scrofa*	109.72	28.32	68500.00	PALEODB	Luosixuan cave, bed 1, Jishou county
PALEODB_EAST	*Sus scrofa*	109.72	28.32	68500.00	PALEODB	Luosixuan cave, bed 3, Jishou county
PALEODB_EAST	*Sus scrofa*	-5.34	36.13	68500.00	PALEODB	Vangaurd Cave
NOW	*Sus scrofa*	68.66	38.66	70000.00	NOW	Khudji
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Sus scrofa*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli

NOW	*Sus verrucosus*	110.26	-7.37	10000.00	NOW	Holocene caves
PALEODB_EAST	*Syncerus caffer*	21.22	-34.42	68500.00	PALEODB	Blombos Cave
PALEODB_EAST	*Syncerus caffer*	18.32	-32.32	68500.00	PALEODB	Eland's Bay Cave
PALEODB_EAST	*Syncerus caffer*	23.40	-34.10	68500.00	PALEODB	Nelson Bay Cave, Pleistocene
PALEODB_EAST	*Syncerus caffer*	35.95	3.37	68500.00	PALEODB	West Turkana - Eliye Springs
NOW	*Tapirus indicus*	110.26	-7.37	10000.00	NOW	Holocene caves
NOW	*Tapirus indicus*	112.73	-8.10	10000.00	NOW	Wajak
PALEODB_EAST	*Tragelaphus scriptus*	37.05	-1.47	68500.00	PALEODB	Lukenya Hill GvJm 19, 160-110cm
PALEODB_EAST	*Tragelaphus strepsiceros*	36.37	4.67	68500.00	PALEODB	East Turkana - Area 105 - Galana Boi
NOW	*Ursus arctos*	40.16	43.50	10000.00	NOW	Akhshtyrskaja cave Hol
NOW	*Ursus arctos*	92.82	55.97	10000.00	NOW	Badzhejskaja cave
NOW	*Ursus arctos*	92.80	56.01	10000.00	NOW	Bezdonnaja Yama cave
NOW	*Ursus arctos*	18.91	47.63	10000.00	NOW	Bivak cave Hol
NOW	*Ursus arctos*	92.82	55.97	10000.00	NOW	Bolshaja Oreshnaja cave Hol
NOW	*Ursus arctos*	92.81	55.97	10000.00	NOW	Devjatka cave
NOW	*Ursus arctos*	37.00	52.00	10000.00	NOW	Eliseevichi
NOW	*Ursus arctos*	92.80	56.01	10000.00	NOW	Gnilaja Yama cave
NOW	*Ursus arctos*	30.50	50.40	10000.00	NOW	Kiev zemljanki
NOW	*Ursus arctos*	60.40	60.69	10000.00	NOW	Laksejskaja cave
NOW	*Ursus arctos*	92.80	56.01	10000.00	NOW	Ledjanaja cave
NOW	*Ursus arctos*	92.79	56.01	10000.00	NOW	Ledopadnaja cave
NOW	*Ursus arctos*	60.04	59.28	10000.00	NOW	Lobvinskaja cave
NOW	*Ursus arctos*	92.80	56.01	10000.00	NOW	Lovushka cave (Belaja)
NOW	*Ursus arctos*	92.82	55.98	10000.00	NOW	Majachnaja cave Hol
NOW	*Ursus arctos*	27.28	48.27	10000.00	NOW	Molodova V [Kosoutsy]
NOW	*Ursus arctos*	92.79	56.01	10000.00	NOW	Nizhnesliznevskaja cave
NOW	*Ursus arctos*	44.40	40.30	10000.00	NOW	Sarajbulakhskij, Urtskij khreb
NOW	*Ursus arctos*	43.00	42.45	10000.00	NOW	Shagat-Khokh-Leget
NOW	*Ursus arctos*	41.20	44.00	10000.00	NOW	Treugol'naja cave 1-2
NOW	*Ursus arctos*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
NOW	*Ursus arctos*	23.50	38.00	10000.00	NOW	Vraona cave
NOW	*Ursus arctos*	37.00	51.80	10000.00	NOW	Yudinovo
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	60.00	59.35	12800.00	Radiometric	Kakva-4

Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	33.00	50.10	14365.00	Radiometric	Gontsy
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	32.00	52.40	14700.00	Radiometric	Chulatov (Chulatovo I)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	33.15	52.00	15000.00	Radiometric	Novgorod-Severskij
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	31.50	49.65	15950.00	Radiometric	Mezherich
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown ''B'' loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	23.90	37.92	16932.50	Radiometric	Vraona cave (Attiki)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.10	43.18	17050.00	Radiometric	Cueva de Urtiaga
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	27.21	48.19	17200.00	Radiometric	Cosauti
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.10	43.18	17950.00	Radiometric	Cueva de Aitzbitarte
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	15.53	48.14	19380.00	Radiometric	Grubgraben
NOW	*Ursus arctos*	41.50	42.30	20000.00	NOW	Devis-Khvreli cave
NOW	*Ursus arctos*	41.26	43.02	20000.00	NOW	Kholodnyj Grot/ Kej Bogaz
NOW	*Ursus arctos*	68.51	60.90	20000.00	NOW	Lugovskoe
NOW	*Ursus arctos*	103.53	52.83	20000.00	NOW	Mal'ta main 8
NOW	*Ursus arctos*	108.00	59.90	20000.00	NOW	Nepa
NOW	*Ursus arctos*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XVI-XVII
NOW	*Ursus arctos*	13.90	44.88	20000.00	NOW	Sandalija l.B-C
NOW	*Ursus arctos*	87.95	55.90	20000.00	NOW	Shestakovo
NOW	*Ursus arctos*	91.95	55.22	20000.00	NOW	Shlenka
NOW	*Ursus arctos*	86.07	51.20	20000.00	NOW	Tytkesken' III l.7
NOW	*Ursus arctos*	104.28	52.37	20000.00	NOW	Verkholenskaja Gora 1 l.2
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	39.00	51.29	21307.50	Radiometric	Kostienki I, l.1
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]

Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	27.04	48.24	22100.00	Radiometric	Ciuntu
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	17.89	48.61	22630.00	Radiometric	Moravany-Lopata II
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	36.00	51.10	23000.00	Radiometric	Avdeevskaja
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	42.50	42.00	23000.00	Radiometric	Gvardzhilas-Klde
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	31.60	52.00	23000.00	Radiometric	Pogorilivka
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	4.73	46.30	24400.00	Radiometric	Solutre [O/A]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	40.17	43.50	24500.00	Radiometric	Akhshtyrskaja cave, Akhshatyr
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-9.19	38.89	24820.00	Radiometric	Salemas
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	3.99	50.47	26885.00	Radiometric	Maisieres-Canal
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	17.44	49.43	28366.00	Radiometric	Predmosti
NOW	*Ursus arctos*	86.21	54.35	30000.00	NOW	Kuznetskaja kotlovina l. VI
NOW	*Ursus arctos*	105.80	54.02	30000.00	NOW	Makarovo III
NOW	*Ursus arctos*	89.45	54.42	30000.00	NOW	Malaja Syja l. 3
NOW	*Ursus arctos*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Ursus arctos*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-0.16	43.11	30778.00	Radiometric	Grotte de Courau (Grotte Saucet) [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]

Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-4.13	36.95	31300.00	Radiometric	Zafarraya Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	15.89	46.18	32461.00	Radiometric	Krapina
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.75	42.16	36260.00	Radiometric	Mollet Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	1.10	45.01	37716.00	Radiometric	A. Castanet [Sergeac]
NOW	*Ursus arctos*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X
NOW	*Ursus arctos*	89.47	54.45	40000.00	NOW	Proskurjakov cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	7.63	48.59	40100.00	Radiometric	Achenheim
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-8.58	52.22	41631.00	Radiometric	Castlepook Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-4.50	51.76	41954.00	Radiometric	Coygan Cave

Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.87	51.32	43244.00	Radiometric	Banwell Bone Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	57.57	59.85	51356.48	Fiedler	Kamen' Pisany
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	56.00	60.80	51356.48	Fiedler	Ushminskaya cave (stratum 1-2)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	41.90	49.60	52669.04	Fiedler	Lebiazhenskoe
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	58.60	61.83	53456.57	Fiedler	Uninskaya
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	12.65	43.92	54375.36	Fiedler	Torrente Conca (Morciano di Romagna)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	60.50	61.27	54769.12	Fiedler	Burmantovo1, 2
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	60.03	60.24	54800.00	Fiedler	Cheremukhovo 1 (1-4)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	58.21	61.80	55294.14	Fiedler	Kaninskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	62.00	59.23	55819.17	Fiedler	Usolcevskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.40	50.62	55950.42	Fiedler	Teufelsbrücke 3
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	22.26	44.59	56344.19	Fiedler	Pestera Climente
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	13.67	45.37	56344.19	Fiedler	Romualdo Cave

Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.40	50.62	56737.95	Fiedler	Teufelsbrücke 2-3b
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.00	50.43	57788.00	Fiedler	Grotte Scladina4A
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	4.10	51.04	58706.78	Fiedler	Dendermonde
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	12.44	43.19	59363.06	Fiedler	Monte Cucco
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.88	51.29	59494.32	Fiedler	Picken's Hole, Layer 5
NOW	*Ursus arctos*	83.02	51.17	60000.00	NOW	Strashnaja cave l.3
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-7.63	52.10	60019.34	Fiedler	Shandon Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-1.34	43.08	60413.10	Fiedler	Cueva de Abauntz
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	15.24	40.50	60675.61	Fiedler	Castelcivita
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	24.71	44.42	60675.61	Fiedler	Icoana
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	21.36	40.30	60675.61	Fiedler	Neapolis (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz

Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche 4 (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	5.30	43.80	60700.00	Fiedler	Bau de l'Aubesiere, Couche IH (Vaucluse)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.10	43.18	60806.87	Fiedler	Cueva de Ermittia
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-3.01	41.01	61100.00	Fiedler	Las Figuras (Alcorlo)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	20.30	48.50	61331.89	Fiedler	Horvolgy
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	15.65	41.77	61331.89	Fiedler	Ingarano d/e
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.16	46.20	61594.40	Fiedler	Riparo Predastel
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	13.70	45.90	61856.91	Fiedler	Grotta Azzurra
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	13.75	45.67	61856.91	Fiedler	Grotta Benussi
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.36	45.28	62250.68	Fiedler	Grotta Perin
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	4.50	50.99	62500.00	Radiometric	Hofstade I
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	16.90	50.23	62500.00	Radiometric	Jaskinia Niedwiedzia
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	11.62	43.47	62775.70	Fiedler	Bucine (Arezzo)

Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-5.50	36.22	63038.21	Fiedler	Devil's Tower
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	3.05	45.91	63300.72	Fiedler	Maar de Saint Hippolyte
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	14.97	48.84	64800.00	Radiometric	Herdengelhoehle
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	0.67	52.50	65500.00	Radiometric	Lynford
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
PALEODB_EAST	*Ursus arctos*	4.07	51.98	68500.00	PALEODB	Eurogeul
PALEODB_EAST	*Ursus arctos*	11.55	45.55	68500.00	PALEODB	Grotta Maggiore do S. Bernardino (Pleistocene), Colli Berici, Northern Italy
PALEODB_EAST	*Ursus arctos*	160.00	68.75	68500.00	PALEODB	Kolyma River, between the mouth of Omolon and Anjuj, Jedoma-Suite
PALEODB_EAST	*Ursus arctos*	120.00	23.00	68500.00	PALEODB	Penghu Channel
PALEODB_EAST	*Ursus arctos*	141.43	41.41	68500.00	PALEODB	Shiriya, Locality 2
PALEODB_EAST	*Ursus arctos*	141.43	41.40	68500.00	PALEODB	Shiriya, Locality 3-1
PALEODB_EAST	*Ursus arctos*	141.43	41.40	68500.00	PALEODB	Shiriya, Locality 3-2
PALEODB_EAST	*Ursus arctos*	-3.66	50.13	68500.00	PALEODB	Tornewton Cave
PALEODB_EAST	*Ursus arctos*	-5.34	36.13	68500.00	PALEODB	Vangaurd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	-8.59	39.53	70000.00	Radiometric	Oliveira Cave
NOW	*Ursus arctos*	27.36	47.86	70000.00	NOW	Starye Duruitory l. 3-4
NOW	*Ursus arctos*	4.39	50.98	70000.00	NOW	Zemst IIIC
Raia et al. 2009; Carotenuto et al. 2010	*Ursus arctos*	19.77	50.22	70600.00	Radiometric	Jaskinia Nietoperzowa
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	39.00	45.00	58181.76	Fiedler	Mezmaiskaya Cave 2
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	39.00	45.00	61988.17	Fiedler	Mezmaiskaya Cave 2A
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	39.00	45.00	62513.19	Fiedler	Mezmaiskaya Cave 1–2

Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	1.25	44.87	63957.00	Fiedler	Pech de l'Aze, Couche 9 (Dordogne)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	39.00	45.00	64088.25	Fiedler	Mezmaiskaya Cave 2B
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus deningeri*	2.71	43.33	68000.00	Radiometric	Grotte d'Aldene, Couche K (Herault)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus etruscus*	10.32	52.17	51000.00	Radiometric	Salzgitter
PALEODB_EAST	*Ursus maritimus*	10.03	57.56	68500.00	PALEODB	Asdal
PALEODB_EAST	*Ursus maritimus*	12.05	57.75	68500.00	PALEODB	Bohuslan
PALEODB_EAST	*Ursus maritimus*	12.57	56.96	68500.00	PALEODB	Halland
PALEODB_EAST	*Ursus maritimus*	9.99	53.55	68500.00	PALEODB	Hamburg
PALEODB_EAST	*Ursus maritimus*	5.88	59.17	68500.00	PALEODB	Judaberg
PALEODB_EAST	*Ursus maritimus*	-0.29	51.49	68500.00	PALEODB	Kew Bridge
PALEODB_EAST	*Ursus maritimus*	52.88	66.66	68500.00	PALEODB	Pechora River
PALEODB_EAST	*Ursus maritimus*	13.82	55.43	68500.00	PALEODB	Scania
PALEODB_EAST	*Ursus maritimus*	23.67	77.55	68500.00	PALEODB	Svalbard Pleistocene
NOW	*Ursus spelaeus*	43.50	42.50	10000.00	NOW	Kudaro 1 Hol
NOW	*Ursus spelaeus*	43.50	42.50	10000.00	NOW	Kudaro 3 l.2 Hol
NOW	*Ursus spelaeus*	26.90	48.00	10000.00	NOW	Trinka I l.1
NOW	*Ursus spelaeus*	16.03	46.28	10000.00	NOW	Velica Pecina a-c, Hol
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	13.83	44.86	15790.00	Radiometric	Sandalja b
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	19.80	50.06	15990.00	Radiometric	Zawalona cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	17.58	45.20	17500.00	Radiometric	Kamenika
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	14.50	45.33	17500.00	Radiometric	Pecina na Gradini
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	1.66	44.62	18388.00	Radiometric	Gr. Pegourie [Caniac du Causse]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.17	43.83	18388.00	Radiometric	Pecine u Brini East&West caves
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	19.92	50.05	18427.00	Radiometric	Spadzista St. A
NOW	*Ursus spelaeus*	42.61	42.32	20000.00	NOW	Belaja cave Kolkhida LtPal
NOW	*Ursus spelaeus*	57.00	57.50	20000.00	NOW	Bolshoj Glukhoj grot l.V-IX

NOW	*Ursus spelaeus*	90.95	54.13	20000.00	NOW	Dvuglazka 6-7 rest
NOW	*Ursus spelaeus*	41.26	43.02	20000.00	NOW	Kholodnyj Grot/ Kej Bogaz
NOW	*Ursus spelaeus*	42.10	42.10	20000.00	NOW	Mgvimevi
NOW	*Ursus spelaeus*	25.00	48.00	20000.00	NOW	Molochnyj Kamen' Molochnyj Kam
NOW	*Ursus spelaeus*	39.92	43.56	20000.00	NOW	Navalishinskaja cave upper
NOW	*Ursus spelaeus*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XIV-XV
NOW	*Ursus spelaeus*	23.02	45.13	20000.00	NOW	Pestera Cioarei st. XVI-XVII
NOW	*Ursus spelaeus*	26.90	48.00	20000.00	NOW	Trinka I l.2
NOW	*Ursus spelaeus*	15.87	45.84	20000.00	NOW	Veternica cave st. d
NOW	*Ursus spelaeus*	15.87	45.84	20000.00	NOW	Veternica cave st. e-f
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	25.48	45.54	22000.00	Radiometric	Gura Cheii-Rasnov
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-0.60	43.11	22166.00	Radiometric	Gr. des Bisons [Lurbe-St-Christau]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-2.26	43.16	22220.00	Radiometric	Ekain Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.75	49.41	22603.00	Radiometric	Kulna Cave6a
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	41.50	42.30	23000.00	Radiometric	Devis-Khvreli cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	42.50	42.00	23000.00	Radiometric	Gvardzhilas-Klde
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	27.50	47.98	23000.00	Radiometric	Starye Duruitory l.1 upper
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	15.87	45.84	23000.00	Radiometric	Veternica cave e
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	15.87	45.84	23000.00	Radiometric	Veternica cave f

Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	8.13	50.42	23300.00	Radiometric	Wildenscheuer cave st. III
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	2.34	43.31	24025.00	Radiometric	Canecaude I [Villardonel]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	40.17	43.50	24500.00	Radiometric	Akhshtyrskaja cave, Akhshatyr
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.97	50.48	24700.00	Radiometric	Gr. de la Princesse [Marche-les-Dames]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	39.70	50.96	24850.00	Radiometric	Gmelinskaja Kostienki 21 lower
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	6.14	47.61	25677.00	Radiometric	Gr. d'Echenoz-la-Meline [La Baume]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	14.97	48.84	26235.00	Radiometric	Herdengelhoehle s.6
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	13.08	41.23	26750.00	Radiometric	Gr. del Fossellone
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
NOW	*Ursus spelaeus*	11.81	46.75	30000.00	NOW	Conturines cave
NOW	*Ursus spelaeus*	83.02	51.17	30000.00	NOW	Strashnaja cave 3a-b
NOW	*Ursus spelaeus*	16.03	46.28	30000.00	NOW	Velica Pecina st. h-k
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-0.16	43.11	30778.00	Radiometric	Grotte de Courau (Grotte Saucet) [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.72	50.59	31333.00	Radiometric	Trou Walou

Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.42	44.39	31679.00	Radiometric	Grotte Chauvet
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-4.24	51.55	31717.00	Radiometric	Paviland Cave [Goat's Hole]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	15.89	46.18	32461.00	Radiometric	Krapina
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.04	46.29	33850.00	Radiometric	Velica Pecina j
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.72	49.39	35400.00	Radiometric	Pod Hradem Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	18.35	47.63	35940.00	Radiometric	Tata
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.77	48.40	36169.00	Radiometric	Das GeissenklosterleI
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.37	43.53	38000.00	Radiometric	Smolucka Pecina
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	17.93	48.55	38400.00	Radiometric	Certova Pec (Radosina)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.77	48.40	39059.00	Radiometric	Das GeissenklosterleIII
NOW	*Ursus spelaeus*	4.00	44.00	40000.00	NOW	Baume NÃ©ron
NOW	*Ursus spelaeus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. I-II,VII-V
NOW	*Ursus spelaeus*	23.02	45.13	40000.00	NOW	Pestera Cioarei st. III-VI, X

Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	11.57	45.47	42224.00	Radiometric	Gr. del Broion
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-2.75	42.16	43047.00	Radiometric	Reclau Viver
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	18.50	42.78	43730.00	Radiometric	Crvena Stijena
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	11.83	48.93	52012.76	Fiedler	Große Schulerloch E-F
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.80	48.41	52012.76	Fiedler	Rusenschloss
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.77	48.40	52700.00	Radiometric	Das GeissenklosterleIV
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	22.54	46.91	55031.63	Fiedler	Valea Sesii
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.84	44.88	55400.00	Fiedler	Baume Moula-Guercy V-VII ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.77	48.41	55819.17	Fiedler	Brillenhohle7
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	22.26	44.59	56344.19	Fiedler	Pestera Climente
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	13.67	45.37	56344.19	Fiedler	Romualdo Cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-7.64	39.66	56475.44	Fiedler	Foz do Enxarrique

Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	3.90	43.94	57200.00	Radiometric	La Roquette II [Conquerac]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.57	50.87	57400.00	Fiedler	Raj cave 6
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	19.05	47.75	57656.74	Fiedler	Remete cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.77	48.41	58181.76	Fiedler	Brillenhohle8
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	10.45	48.82	58313.02	Fiedler	Große Ofnethöhle V
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.43	45.09	58444.27	Fiedler	Gr. de Preletang [Presles]
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.03	50.50	58444.27	Fiedler	Princesse Pauline
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	28.52	44.42	58575.53	Fiedler	Pestera la Adam16
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	28.52	44.42	58706.78	Fiedler	Pestera la Adam26
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	6.65	50.23	59363.06	Fiedler	Buchenloch
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	12.44	43.19	59363.06	Fiedler	Monte Cucco
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	11.83	48.93	59625.57	Fiedler	Große Schulerloch C
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.16	48.58	59888.08	Fiedler	Steinheim upper level
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	40.00	44.90	60000.00	Radiometric	Dakhovskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	22.37	47.20	60000.00	Radiometric	Igrita cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
NOW	*Ursus spelaeus*	39.92	43.56	60000.00	NOW	Navalishinskaja cave lower

NOW	*Ursus spelaeus*	12.00	42.50	60000.00	NOW	Torre del Pagliaccetto
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	6.24	43.44	60019.34	Fiedler	Trou du Renard
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.65	48.12	60413.10	Fiedler	Budospest
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.84	44.88	60500.00	Fiedler	Baume Moula-Guercy IV ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	13.70	45.72	60544.36	Fiedler	GabrovizzaII
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.07	45.04	60675.61	Fiedler	Chàtillon-Saint-Jean, Dròme
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.16	48.58	61200.64	Fiedler	Steinheim middle level
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	20.30	48.50	61331.89	Fiedler	Horvolgy
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-3.95	43.28	61594.40	Fiedler	Castillo22
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	3.87	43.80	61594.40	Fiedler	Hortus Grotte

Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	11.25	45.42	61725.66	Fiedler	Zoppenga 1
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	47.44	47.02	61856.91	Fiedler	Singil
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	6.00	47.25	62250.68	Fiedler	Baume de Gonvillars (Becanson)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	-3.33	40.87	62250.68	Fiedler	Cueva del Congosto, Guadalajara
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	0.83	42.00	62250.68	Fiedler	Grotta Cola
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	23.15	40.37	62250.68	Fiedler	Petralona (Chalkidiki)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.67	49.40	62500.00	Radiometric	Barova cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	16.90	50.23	62500.00	Radiometric	Jaskinia Niedwiedzia
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	8.13	50.42	62500.00	Radiometric	Wildenscheuer cave st. I-II
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	0.63	43.21	64088.25	Fiedler	Montmaurin
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	14.97	48.84	64800.00	Radiometric	Herdengelhoehle
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
NOW	*Ursus spelaeus*	27.36	47.86	70000.00	NOW	Starye Duruitory l. 3-4
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	14.37	40.91	70519.77	Fiedler	Quisisana, Capri
Raia et al. 2009; Carotenuto et al. 2010	*Ursus spelaeus*	19.77	50.22	70600.00	Radiometric	Jaskinia Nietoperzowa

Raia et al. 2009; Carotenuto et al. 2010	*Ursus thibetanus*	2.71	43.33	68000.00	Radiometric	Grotte d'Aldene, Couche K (Herault)
PALEODB_EAST	*Ursus thibetanus*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
PALEODB_EAST	*Ursus thibetanus*	109.72	28.32	68500.00	PALEODB	Luosixuan cave, bed 1, Jishou county
PALEODB_EAST	*Ursus thibetanus*	109.72	28.32	68500.00	PALEODB	Luosixuan cave, bed 3, Jishou county
NOW	*Viverra tangalunga*	118.00	4.00	10000.00	NOW	Madai
PALEODB_EAST	*Viverra zibetha*	110.22	33.13	68500.00	PALEODB	Huanglong Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes corsac*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes corsac*	33.77	45.00	70000.00	Radiometric	Chokurcha I cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	19.92	50.08	12000.00	Radiometric	Mamutowa Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.90	43.60	12392.50	Radiometric	Kopacina
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	60.00	59.35	12800.00	Radiometric	Kakva-4
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	31.50	49.65	15950.00	Radiometric	Mezherich
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	33.00	67.00	16000.00	Radiometric	Okladnikov cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	59.00	62.20	16130.00	Radiometric	Medvezhaya cave (greyish-brown "B" loamy soil)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.05	43.11	16270.00	Radiometric	Cueva de Eralla
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	14.50	45.32	16780.00	Radiometric	Zupanov Spodmol
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	23.90	37.92	16932.50	Radiometric	Vraona cave (Attiki)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.10	43.18	17050.00	Radiometric	Cueva de Urtiaga
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	27.21	48.19	17200.00	Radiometric	Cosauti
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.10	43.18	17950.00	Radiometric	Cueva de Aitzbitarte
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	0.88	45.23	18500.00	Radiometric	A. Combe Sauniere [Sarliac-sur-l'Isle]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	60.22	60.42	19140.00	Radiometric	Shaitanskaya, Shaitanskaya cave, 1 (stratum 2)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	19.50	50.53	19250.00	Radiometric	Deszczowa Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.37	44.80	20167.00	Radiometric	Le Piage [Fajoles]C-E

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	8.32	44.20	20470.00	Radiometric	Arene Candide
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	20.53	48.02	21344.00	Radiometric	Balla cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.84	44.89	21442.00	Radiometric	Abri Moula [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-3.84	43.36	21500.00	Radiometric	Cueva Morin
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	15.88	48.24	21591.00	Radiometric	Langmannersdorf A
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	25.48	45.54	22000.00	Radiometric	Gura Cheii-Rasnov
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	32.50	51.60	22050.00	Radiometric	Mezinskaja
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	27.04	48.24	22100.00	Radiometric	Ciuntu
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-4.84	43.42	22280.00	Radiometric	La Riera23
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	28.50	47.50	22600.00	Radiometric	Climauti II S
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	17.89	48.61	22630.00	Radiometric	Moravany-Lopata II
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.20	43.06	22827.00	Radiometric	Gr. d'Enlene [Montesquieu-Avantes]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	36.00	51.10	23000.00	Radiometric	Avdeevskaja
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	5.02	50.43	23000.00	Radiometric	Goyet Cave 3
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	42.50	42.00	23000.00	Radiometric	Gvardzhilas-Klde
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	35.50	48.50	23000.00	Radiometric	Jamburg
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	31.28	49.45	23000.00	Radiometric	Kanev
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.75	49.33	23000.00	Radiometric	Ochoz cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.67	49.25	23000.00	Radiometric	Pekarna cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	42.50	41.70	23000.00	Radiometric	Sakazhija
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	32.50	50.50	23000.00	Radiometric	Zhuravka
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	17.96	40.15	23151.00	Radiometric	Cavallo
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	8.13	50.42	23300.00	Radiometric	Wildenscheuer cave st. III
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	2.34	43.31	24025.00	Radiometric	Canecaude I [Villardonel]

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.00	44.93	24045.00	Radiometric	Abri Pataud3
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	40.17	43.50	24500.00	Radiometric	Akhshtyrskaja cave, Akhshatyr
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	27.28	48.27	24854.00	Radiometric	Molodova V [Kosoutsy]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	18.90	47.67	25000.00	Radiometric	Pilisszanto 1
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.63	43.01	25695.00	Radiometric	Tuto de Camalhot [St-Jean de Verges]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.21	44.41	26500.00	Radiometric	Les Pecheurs [Casteljau]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	0.86	46.70	26728.00	Radiometric	Fontenioux [St Pierre de Maille]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.69	48.87	26730.00	Radiometric	Pavlov I
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.67	50.48	26775.00	Radiometric	Gr. du Spy
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]G-I
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.37	44.80	27088.00	Radiometric	Le Piage [Fajoles]K
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	17.00	51.50	27450.00	Radiometric	Krems-Wachtberg
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.75	42.16	27712.00	Radiometric	L'Arbreda
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.64	48.87	27734.00	Radiometric	Dolni Vestonice I
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-3.48	53.23	27815.00	Radiometric	Pontnewydd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.15	48.55	27876.00	Radiometric	Bockstein-Torle
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	15.58	41.68	27952.00	Radiometric	Gr. Paglicci
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.31	43.93	28073.00	Radiometric	La Baume Longue [Dions]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	0.72	46.38	28313.00	Radiometric	L'Ermitage [Lussac-les-Chateaux]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.00	44.93	28516.00	Radiometric	Abri Pataud4
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.01	43.23	28936.00	Radiometric	Amalda Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-3.66	50.49	29176.00	Radiometric	Tornewton Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-8.46	39.64	29358.00	Radiometric	Caldeirao Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.06	44.98	29500.00	Radiometric	Abri du Facteur

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.00	44.93	29900.00	Radiometric	Abri Pataud5
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-9.22	38.90	30100.00	Radiometric	Pego do Diabo
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.54	43.95	30119.00	Radiometric	La Salpetriere [Remoulins]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-3.50	50.46	30185.00	Radiometric	Kent's Cavern
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-0.16	43.11	30778.00	Radiometric	Grotte de Courau (Grotte Saucet) [St-Pe-de-Bigorre]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	0.94	44.96	30782.00	Radiometric	La FerrassieI1
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	25.42	42.94	30901.00	Radiometric	Bacho Kiro6a/
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.73	48.84	30939.00	Radiometric	Milovice I
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.52	45.07	31109.00	Radiometric	Jaurens [Nespouls]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	7.44	46.68	31300.00	Radiometric	Schnurenloch
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	5.72	50.59	31333.00	Radiometric	Trou Walou
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	5.48	46.48	31400.00	Radiometric	Gr. de La Baume [Gigny sur Suran]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.20	48.56	32122.00	Radiometric	Vogelherd Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	15.40	48.32	32200.00	Radiometric	Willendorf II
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	0.30	45.50	32659.00	Radiometric	La Quina Y-Z [Villebois la Valette]1
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-8.97	38.49	32878.00	Radiometric	Figueira Brava Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	3.87	45.06	32903.00	Radiometric	Les Rivaux, Loc. 1 [Espaly-St-Marcel]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	20.59	44.29	33800.00	Radiometric	Risovaca
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.47	45.00	33800.00	Radiometric	Sirejol [Gignac]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	3.77	47.60	33825.00	Radiometric	Grotte du Renne, Arcy-sur-Cure
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.04	46.29	33850.00	Radiometric	Velica Pecina j
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.90	45.57	34276.00	Radiometric	Abri FumaneD3b
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	60.22	60.42	34310.00	Radiometric	Shaitanskaya, 1 (stratum 3)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.17	48.55	34365.00	Radiometric	Hohlenstein-Stadel [IV]

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-0.51	45.75	34700.00	Radiometric	Roche a Pierrot [St.-Cesaire]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	20.63	48.12	35127.00	Radiometric	Szeleta Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	2.88	43.34	35900.00	Radiometric	Gr. Tournal (or Grande Grotte de Bize) [Bize-Minervois]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	2.61	42.27	35968.00	Radiometric	Ermitons Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.97	50.21	36176.00	Radiometric	Trou MagriteM2
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	25.42	42.94	36184.00	Radiometric	Bacho Kiro11a
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.88	51.29	36197.00	Radiometric	Picken's Hole, Layer 3
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.75	42.16	36260.00	Radiometric	Mollet Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.90	45.57	36500.00	Radiometric	Abri FumaneA2
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-0.27	44.79	36986.00	Radiometric	Camiac[-et-St-Denis]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	15.59	48.41	37404.00	Radiometric	Krems-Hundssteig
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	20.37	43.53	38000.00	Radiometric	Smolucka Pecina
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-1.20	43.37	38896.00	Radiometric	Isturitz [Isturits]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	37.80	45.00	39000.00	Radiometric	Ilskaja 1&2
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	18.66	47.72	40600.00	Radiometric	Tokod
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	5.05	50.49	41569.00	Radiometric	Sclayn Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-8.58	52.22	41631.00	Radiometric	Castlepook Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-4.50	51.76	41954.00	Radiometric	Coygan Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-3.95	43.28	42947.00	Radiometric	Castillo18C
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.87	51.32	43244.00	Radiometric	Banwell Bone Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	43.50	42.50	44150.00	Radiometric	Kudaro 1, l.3
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.84	44.89	44900.00	Radiometric	Gr. Neron [Soyons]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	44.51	40.50	47800.00	Radiometric	Erevanskaja cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	23.02	45.13	48350.00	Radiometric	Pestera Cioarei

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.77	51.28	48554.00	Radiometric	Soldier's Hole
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	20.47	47.97	50000.00	Radiometric	Subalyuk1
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	57.57	59.85	51356.48	Fiedler	Kamen' Pisany
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	56.00	60.80	51356.48	Fiedler	Ushminskaya cave (stratum 1-2)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	60.00	59.35	51356.48	Fiedler	Zhiliche Sokola, 2
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	18.89	47.39	51400.00	Radiometric	Erd
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-1.20	53.26	51600.00	Radiometric	Pin Hole Cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	20.41	48.07	52000.00	Radiometric	Istallosko cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	9.80	48.41	52012.76	Fiedler	Rusenschloss
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.75	49.41	54143.00	Radiometric	Kulna Cave7a
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-0.40	42.02	54740.00	Radiometric	Los Moros I [Gabasa]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	60.50	61.27	54769.12	Fiedler	Burmantovo1, 2
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	60.03	60.24	54800.00	Fiedler	Cheremukhovo 1 (1-4)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.40	50.62	55031.63	Fiedler	Teufelsbrücke 2-3a
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	22.54	46.91	55031.63	Fiedler	Valea Sesii
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	5.00	50.43	55162.89	Fiedler	Grotte Scladina5
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	58.21	61.80	55294.14	Fiedler	Kaninskaya cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.84	44.88	55400.00	Fiedler	Baume Moula-Guercy V-VII ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.07	45.00	55800.00	Radiometric	Le Moustier
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.40	50.62	55950.42	Fiedler	Teufelsbrücke 3
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	22.26	44.59	56344.19	Fiedler	Pestera Climente
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	8.63	47.70	56869.21	Fiedler	Schweizerbild 5
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	3.90	43.94	57200.00	Radiometric	La Roquette II [Conquerac]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	20.57	50.87	57400.00	Fiedler	Raj cave 6

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	19.05	47.75	57656.74	Fiedler	Remete cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	39.00	45.00	58181.76	Fiedler	Mezmaiskaya Cave 2
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.45	48.82	58313.02	Fiedler	Große Ofnethöhle V
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.05	48.77	58706.78	Fiedler	Mauern Weinberghoehlen F
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	18.72	47.72	58838.04	Fiedler	Dorog
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	13.51	41.22	59100.55	Fiedler	Gr. di Sant'Agostino
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.45	48.82	59100.55	Fiedler	Große Ofnethöhle IV
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	13.67	45.73	59231.80	Fiedler	Grotta Pocala
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-4.10	43.40	59363.06	Fiedler	Cueva de Altamira Sol
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	12.44	43.19	59363.06	Fiedler	Monte Cucco
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	2.75	51.28	59494.32	Fiedler	Gough's cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.15	48.55	59756.83	Fiedler	Bocksteinschmiede h/Höhle=IIIb
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	9.72	48.37	59756.83	Fiedler	Kogelstein
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.15	48.55	59888.08	Fiedler	Bocksteinschmiede g=IV
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	40.85	44.20	60000.00	Radiometric	Barakaevskaya stoyanka
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	22.37	47.20	60000.00	Radiometric	Igrita cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	33.87	45.25	60000.00	Radiometric	Mamat-Koba
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.15	48.55	60019.34	Fiedler	Bocksteinschmiede f/h
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	5.11	45.83	60150.59	Fiedler	Carriere Fournier, Chatillon-Saint-Jean (Drome)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	5.00	50.43	60150.59	Fiedler	Grotte Scladina1A
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	9.22	48.80	60150.59	Fiedler	Villa Seckendorff-Bad Cannstatt
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-1.34	43.08	60413.10	Fiedler	Cueva de Abauntz
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.84	44.88	60500.00	Fiedler	Baume Moula-Guercy IV ~ Soyons (Ardeche)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	13.70	45.72	60544.36	Fiedler	GabrovizzaII

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.33	45.32	60544.36	Fiedler	Grotta Maggiore
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	8.63	47.70	60544.36	Fiedler	Schweizerbild 4
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	25.42	42.94	60675.61	Fiedler	Bacho Kiro13
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.81	46.58	60675.61	Fiedler	Gr. Velars Etrigny
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.20	45.37	60675.61	Fiedler	Grotta del Cerè
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.42	50.64	60675.61	Fiedler	Roter Berg
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	5.21	50.59	60675.61	Fiedler	Trou du Docteur
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	4.97	50.21	60675.61	Fiedler	Trou Reuviau-a-Furfooz
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.10	43.18	60806.87	Fiedler	Cueva de Ermittia
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	13.71	45.71	60806.87	Fiedler	Grotta Tilde
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	21.52	40.19	60938.12	Fiedler	Dafnero (Haliakmon basin)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.20	45.65	61069.38	Fiedler	Covoli di Velo
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.95	45.61	61069.38	Fiedler	Grotte di Veja A
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.59	45.31	61200.64	Fiedler	Riparo Tagliente
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.70	49.27	61200.64	Fiedler	Sveduv Stul 12
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.51	44.08	61331.89	Fiedler	Abìmes de la Fage, Corrèze
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-9.37	39.36	61331.89	Fiedler	Furninha
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	20.30	48.50	61331.89	Fiedler	Horvolgy
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	28.52	44.42	61331.89	Fiedler	Pestera la Adam29
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	18.22	40.22	61331.89	Fiedler	Sternatia
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	13.73	45.73	61594.40	Fiedler	Grotta San Leonardo
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	0.50	44.01	61700.00	Fiedler	Gr. de la Nauterie I [La Romieu]
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.59	45.30	61725.66	Fiedler	Riparo Mezzena
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	22.50	41.05	61856.91	Fiedler	Agios Georgios

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	13.70	45.90	61856.91	Fiedler	Grotta Azzurra
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	13.75	45.67	61856.91	Fiedler	Grotta Benussi
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	0.15	45.63	61988.17	Fiedler	Artenac 10
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	13.73	45.73	61988.17	Fiedler	Bristie 1
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-2.28	40.95	61988.17	Fiedler	Los Casares B (Guadalajara)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	39.00	45.00	61988.17	Fiedler	Mezmaiskaya Cave 2A
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	0.37	43.11	61988.17	Fiedler	Montousse I (Haute Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	1.22	44.81	62000.00	Radiometric	Combe Grenal [Domme, Dordogne]50
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	2.75	42.80	62250.68	Fiedler	Caune de L'Arago, Complexe Sommital (Pyrennes)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.36	45.28	62250.68	Fiedler	Grotta Perin
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	18.30	40.11	62250.68	Fiedler	San Sidero
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	12.20	41.92	62250.68	Fiedler	Torre In Pietra (Lower Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	12.40	41.78	62250.68	Fiedler	Vitinia (Upper Beds) (Roma province)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	24.00	41.31	62250.68	Fiedler	Volax (E. Macedonia)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	16.90	50.23	62500.00	Radiometric	Jaskinia Niedwiedzia
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	9.77	48.40	62500.00	Radiometric	Sirgenstein cave
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	15.87	45.84	62500.00	Radiometric	Veternica cave i
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	39.00	45.00	62513.19	Fiedler	Mezmaiskaya Cave 1–2
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	2.75	42.80	62644.44	Fiedler	Caune de L'Arago CM III (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-0.71	40.90	62644.44	Fiedler	Cueva de los Huesos
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-3.81	40.91	62775.70	Fiedler	Pinilla del Valle, Madrid
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	-3.25	41.00	62906.95	Fiedler	Los Torrejones
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	47.00	43.30	63038.21	Fiedler	Alkhast
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	22.58	37.00	63038.21	Fiedler	Apidima Cave B

Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	22.58	37.00	63038.21	Fiedler	Apidima Cave C
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	43.00	45.60	63038.21	Fiedler	Zejukovo, Nal'chik
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	10.16	44.00	63431.98	Fiedler	Montignoso
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	12.20	41.92	63563.23	Fiedler	Torre In Pietra (Upper Beds)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	9.51	48.53	64088.25	Fiedler	Heppenloch
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	39.00	45.00	64088.25	Fiedler	Mezmaiskaya Cave 2B
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	11.07	51.30	64219.51	Fiedler	Bilzingsleben II
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	14.97	48.84	64800.00	Radiometric	Herdengelhoehle
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	2.75	42.80	65663.32	Fiedler	Caune de L'Arago CM I (Pyrenees)
Raia et al. 2009; Carotenuto et al. 2010	*Vulpes vulpes*	18.43	40.10	71044.79	Fiedler	Grotta Romanelli

locality	normalized age (years)	NA Sigma	met hod	lab code	calibration curve	calibrated age (BP)	calibrated age CI95	calibrated age CI95
Buran Kaya III	10041	45	AMS	OxA-25670	IntCal13	11597.74	11270.10	11939.90
Buran Kaya III	10010	60	AMS	GrA-50461	IntCal13	11600.00	11241.85	11958.15
Kemmelberg	10000	200	AMS	OxA-0111	IntCal13	11605.00	10632.20	12577.80
Devil's Wood Pit	10025	55	AMS	OxA-8020	IntCal13	11606.50	11255.48	11957.53
Butzsee-Altfriesack	10020	60	AMS	OxA-8841	IntCal13	11608.50	11247.98	11969.03
Grotte de la Princesse Pauline	10010	70	AMS	LYON-1841	IntCal13	11609.00	11226.15	11991.85
Kartstein	10020	75	AMS	OxA-9031	IntCal13	11622.00	11224.90	12019.10
Cham-Grindel III	10000	100	AMS	AA-43085	IntCal13	11626.00	11165.25	12086.75
De Zijp	10020	80	AMS	OxA-5804	IntCal13	11628.50	11221.43	12035.58
Filador	10020	80	AMS	AA-8647.T.461	IntCal13	11628.50	11221.43	12035.58
Grotta Arene Candide	10065	55	AMS	OxA-10998	IntCal13	11634.50	11268.28	12000.73
El Valle	10120	280	AMS	Gx-24639	IntCal13	11640.35	10544.68	12736.33

Buran Kaya III	10050	70	AMS	GifA-11219/SacA-25135	IntCal13	11641.00	11248.65	12033.35
Abric Agut	10060	65	AMS	OxA-10074	IntCal13	11643.50	11258.28	12028.73
Abric Agut	10085	60	AMS	OxA-10050	IntCal13	11655.00	11270.25	12039.75
Jean-Pierre II	10050	100	AMS	LYON-23/OxA-	IntCal13	11704.14	11209.80	12227.20
Gare de Couze	10140	50	AMS	GrA-45453	IntCal13	11715.00	11356.85	12073.15
Guilanya	10195	255	AMS	Ua-34298	IntCal13	11726.91	10709.55	12744.45
Flixton II	10155	55	AMS	OxA-2395-14	IntCal13	11732.50	11355.83	12109.18
Chelm's Combe Shelter	10150	40	AMS	OxA-17829	IntCal13	11733.50	11418.58	12048.43
Grazzo de l'Aspiou	10020	120	AMS	OxA-0516	IntCal13	11735.27	11126.95	12354.05
Flixton II	10090	90	AMS	OxA-6318	IntCal13	11762.79	11243.15	12349.85
Broken Cavern	10180	900	AMS	OxA-4374	IntCal13	11784.50	8711.73	14857.28
Flixton II	10150	80	AMS	OxA-6319	IntCal13	11820.00	11279.45	12360.55
Chelm's Combe Shelter	10140	100	AMS	OxA-1782	IntCal13	11821.50	11255.78	12387.23
Flixecourt	10150	90	AMS	OxA-6328	IntCal13	11823.50	11270.13	12376.88
Entrefoces	10170	90	AMS	LYON-103	IntCal13	11832.00	11276.25	12387.75
Belloy-sur-Somme, Plaisance	10110	130	AMS	OxA-722	IntCal13	11854.00	11205.15	12502.85
Boila	10190	90	AMS	OxA-5243	IntCal13	11862.25	11285.28	12488.73
Geldrop 3-1	10190	60	AMS	GrA-15181	IntCal13	11874.95	11413.15	12356.85
Aveline's Hole	10210	80	AMS	OxA-5682	IntCal13	11877.74	11340.23	12412.78
La Madeleine	10190	100	AMS	GifA-95457	IntCal13	11887.50	11276.18	12498.83
Chelm's Combe Shelter	10190	130	AMS	BM-2318	IntCal13	11892.00	11239.35	12544.65
Gough's Old Cave	10190	120	AMS	OxA-1120	IntCal13	11892.00	11253.60	12530.40
Bad Breisig	10220	60	AMS	GrA-17716	IntCal13	11899.50	11427.83	12371.18
Chelm's Combe Shelter	10230	110	AMS	OxA-1784	IntCal13	11908.50	11280.08	12536.93
Chelm's Combe Shelter	10220	130	AMS	BM-2431	IntCal13	11929.50	11255.48	12603.53
Balma del Gai	10260	90	AMS	GifA-95617	IntCal13	11942.00	11358.70	12525.30
Closeau	10240	150	AMS	LYON-1555	IntCal13	11945.50	11239.18	12651.83
Belloy-sur-Somme, Plaisance	10260	160	AMS	OxA-724	IntCal13	11952.00	11237.60	12666.40
Ealing	10320	150	AMS	OxA-803	IntCal13	11975.00	11274.85	12675.15
El Castillo	10310	120	AMS	OxA-970	IntCal13	11976.50	11305.33	12647.68
La Fru	10310	90	AMS	UtC-1736	IntCal13	11992.50	11431.53	12553.48
Kastelhohle-Nord	10380	140	AMS	OxA-1392	IntCal13	11997.50	11311.13	12683.88
Broken Cavern	10370	900	AMS	Oxa-4375	IntCal13	12003.00	8934.50	15071.50
Klisoura Cave 7	10420	150	AMS	OxA-503	IntCal13	12022.48	11339.93	12705.08
Klithi	10420	150	AMS	OxA-542	IntCal13	12022.48	11339.93	12705.08
Khummi	10345	100	AMS	AA-13391	IntCal13	12037.00	11435.65	12638.35

Chelm's Combe Shelter	10370	110	AMS	OxA-1785	IntCal13	12048.00	11433.35	12662.65
El Miron, Burial area	10270	50	AMS	GX-24467	IntCal13	12049.78	11711.83	12389.18
Goncharka I	10280	70	AMS	AA-25438	IntCal13	12054.48	11586.78	12508.23
Goncharka I	10280	70	AMS	AA-25439	IntCal13	12054.48	11586.78	12508.23
Diablets	10320	40	AMS	Beta-127570	IntCal13	12128.46	11839.18	12400.83
Cativera	10370	100	AMS	AA-23369	IntCal13	12130.26	11608.55	12655.45
El Sidron	10340	70	AMS	GX-30242	IntCal13	12140.00	11737.20	12542.80
Cava Pompi di Pofi	10350	60	AMS	UtC-11552	IntCal13	12161.50	11789.58	12533.43
Golyi Mys IV	10340	50	AMS	AA-36280	IntCal13	12167.66	11837.30	12510.70
Cogola	10380	70	AMS	UtC-9286	IntCal13	12184.50	11789.78	12579.23
Gross Lieskow	10420	100	AMS	LZ-1353	IntCal13	12192.33	11711.35	12674.65
Cuina Turcului	10400	90	AMS	GifA-96261	IntCal13	12198.50	11738.23	12658.78
Chelm's Combe Shelter	10600	200	AMS	OxA-1781	IntCal13	12208.00	11362.50	13053.50
La Madeleine	10620	200	AMS	OxA-2026	IntCal13	12224.00	11376.60	13071.40
Akrotiri-Aetokremnos	10420	85	AMS	Beta-41000/ETH-7188	IntCal13	12224.50	11787.03	12661.98
El Castillo	10510	100	AMS	GifA-95136	IntCal13	12273.00	11844.55	12701.45
Closeau	10410	50	AMS	LYON-788	IntCal13	12281.00	12010.25	12551.75
Gross Lieskow	10520	100	AMS	LZ-1351	IntCal13	12291.79	11848.63	12705.38
Boila	10560	110	AMS	OxA-5245	IntCal13	12318.42	11852.18	12742.83
Baciki	10480	80	AMS	GrA-17642	IntCal13	12324.01	11968.78	12682.23
Gromatukha	10450	60	AMS	AA-38108	IntCal13	12328.00	12017.35	12638.65
Akrotiri-Aetokremnos	10485	80	AMS	Beta-41406/ETH-7331	IntCal13	12334.00	11984.40	12683.60
Butzsee	10480	75	AMS	OxA-8742	IntCal13	12338.00	11996.95	12679.05
Abeilles 4	10580	115	AMS	LYON-949	IntCal13	12339.95	11854.00	12780.00
Kopytowa	10480	60	AMS	Poz-28515	IntCal13	12355.00	12047.20	12662.80
Geldrop 3-4	10500	70	AMS	GrA-15177	IntCal13	12357.00	12032.10	12681.90
Dzierzyslaw 35	10510	70	AMS	LuS-7422	IntCal13	12363.00	12041.90	12684.10
Chelm's Combe Shelter	10480	45	AMS	OxA-17831	IntCal13	12365.00	12100.90	12629.10
Cimetiere	10520	60	AMS	Beta-244004	IntCal13	12384.50	12088.58	12680.43
Cheremuski	10570	80	AMS	AA-20937	IntCal13	12388.00	12067.85	12708.15
Elaiochori	10600	110	AMS	OxA-0811	IntCal13	12390.50	11994.83	12786.18
Akrotiri-Aetokremnos	10575	80	AMS	Beta-41408/ETH-7332	IntCal13	12391.00	12071.80	12710.20
Igue du Gral	10520	55	AMS	Ly-16390	IntCal13	12391.00	12106.95	12675.05

Arquian	10600	100	AMS	OxA-3173	IntCal13	12396.00	12028.35	12763.65
Can Manel	10540	60	AMS	Beta-179899	IntCal13	12398.50	12110.18	12686.83
Geldrop II	10610	100	AMS	OxA-2563	IntCal13	12406.00	12038.35	12773.65
En Tourettes	10800	250	AMS	ETH-30797	IntCal13	12419.95	11438.65	13401.35
Buran Kaya III	10580	60	AMS	Ki-6259	IntCal13	12426.50	12155.28	12697.73
Devil's Wood Pit	10700	160	AMS	OxA-0518	IntCal13	12443.37	11822.68	13064.33
Grotta Arene Candide	10585	55	AMS	OxA-11000	IntCal13	12453.25	12180.35	12696.65
Jean-Pierre II	10555	45	AMS	LYON-3995(GrA)	IntCal13	12458.99	12193.15	12680.85
Closeau	10650	75	AMS	LYON-206 OxA-	IntCal13	12463.11	12173.18	12736.83
Gross Lieskow	10660	80	AMS	LZ-1349 or 1348?	IntCal13	12467.00	12164.90	12769.10
Cativera	10660	120	AMS	AA-23370	IntCal13	12495.00	12020.00	12970.00
Cogola	10640	60	AMS	UtC-9287	IntCal13	12548.53	12258.78	12719.23
Fariseu	10610	40	AMS	Beta-213130	IntCal13	12556.50	12417.33	12695.68
El Castillo	10720	100	AMS	GifA-96077	IntCal13	12564.00	12151.70	12976.30
Grotta all Onda	10655	55	AMS	OxA-11001	IntCal13	12566.00	12413.05	12718.95
Igue du Gral	10650	50	AMS	Ly-16389	IntCal13	12566.50	12419.73	12713.28
Cheimadio SS94-2	10655	45	AMS	OxA-17828	IntCal13	12573.42	12430.05	12710.95
Kamennaya Balka II	10900	400	AMS	OxA-699	IntCal13	12583.50	11213.13	13953.88
El Castillo	10740	100	AMS	GifA-96078	IntCal13	12586.00	12172.75	12999.25
Broken Cavern	10720	90	AMS	AAR-4539	IntCal13	12589.04	12190.50	12946.50
Castle Hill	10790	130	AMS	OxA-4387	IntCal13	12597.00	12118.20	13075.80
Grotta Arene Candide	10720	55	AMS	OxA-11002	IntCal13	12615.20	12438.88	12753.13
Buran Kaya III	10730	60	AMS	Ki-6268	IntCal13	12624.64	12436.15	12785.85
Feltwell	10810	120	AMS	OxA-3614	IntCal13	12629.94	12179.15	13070.85
Azzura di Paina	10760	100	AMS	UtC-2698	IntCal13	12636.67	12198.08	13023.93
Ekain	10830	150	AMS	GifA-95376	IntCal13	12637.00	12098.35	13175.65
Grotta Arene Candide	10735	55	AMS	OxA-11003	IntCal13	12640.50	12445.88	12776.13
Berlaars	10730	40	AMS	KIA-4937	IntCal13	12646.50	12561.48	12731.53
El Miron, Burial area	10740	40	AMS	Gx-27521a	IntCal13	12651.00	12565.50	12736.50
Grotta Arene Candide	10740	90	AMS	Beta-53981	IntCal13	12667.75	12258.88	12974.13
Alt Duvenstedt LA 121	10770	60	AMS	AAR-2245-2	IntCal13	12683.00	12544.30	12821.70
Chernigovka	10770	70	AMS	AA-20936	IntCal13	12685.77	12438.18	12902.83
Closeau	10755	90	AMS	LYON-563	IntCal13	12685.92	12389.73	12987.28
Akrotiri-Aetokremnos	10770	90	AMS	Beta-41002/ETH-7189	IntCal13	12707.00	12408.70	13005.30
Conty, Le Marais	10790	80	AMS	Beta-99256	IntCal13	12714.50	12435.68	12993.33

Balcarka, Balcarova	10810	45	AMS	OxA-18494	IntCal13	12715.00	12618.10	12811.90
Aline and Gwendoline Cave	10798	72	AMS	UBA-20194	IntCal13	12743.69	12449.25	12979.75
Closeau	10840	110	AMS	OxA-6337 (LYON-312)	IntCal13	12745.00	12414.40	13075.60
Closeau	10840	100	AMS	LYON-312	IntCal13	12747.00	12431.60	13062.40
Alt Duvenstedt LA 120b	10810	80	AMS	AAR-2245-1	IntCal13	12749.70	12442.88	13017.13
d'Gennly	10860	40	AMS	Beta-127573	IntCal13	12763.00	12683.20	12842.80
Freden-Gut Esbeck	10870	119	AMS	AA-10952	IntCal13	12766.50	12418.33	13114.68
Gross Lieskow	10870	105	AMS	LZ-1347	IntCal13	12766.66	12439.48	13081.53
Galeria da Cisterna, Gruta Nascente do Almonda	10820	60	AMS	GrA-9722	IntCal13	12768.50	12573.28	12963.73
Devil's Wood Pit	10910	150	AMS	OxA-0517	IntCal13	12769.99	12249.33	13255.68
Bad Breisig	10840	60	AMS	GrA-17493	IntCal13	12781.50	12583.43	12979.58
Anavatis quarry SS94-16	10870	40	AMS	IAAA-80842	IntCal13	12782.50	12688.93	12876.08
Algar de Joao Ramos	10850	50	AMS	OxA-29358	IntCal13	12798.00	12650.75	12945.25
Gorham's Cave	10880	40	AMS	Beta-185343	IntCal13	12798.00	12693.50	12902.50
Gasya	10875	90	AMS	AA-13393	IntCal13	12811.00	12556.40	13065.60
Filador	10864	60	AMS	OxA-8650	IntCal13	12816.00	12633.60	12998.40
Closeau	10885	85	AMS	LYON-564	IntCal13	12816.50	12569.98	13063.03
Chelm's Combe Shelter	10910	110	AMS	OxA-1783	IntCal13	12818.11	12453.83	13121.18
Dobryn Duzy III	10870	50	AMS	GrA-13868	IntCal13	12821.50	12669.03	12973.98
Doetichem-Dichteren	10870	50	AMS	GrA-13686	IntCal13	12821.50	12669.03	12973.98
Doetichem-Dichteren 8	10880	50	AMS	GrA-13387	IntCal13	12830.50	12678.98	12982.03
Hangest-sur-Somme, Le Marais	10920	90	AMS	LYON-85	IntCal13	12831.50	12582.13	13080.88
Hangest-sur-Somme, Le Marais	10920	90	AMS	OxA-4935 (LYON-85)	IntCal13	12831.50	12582.13	13080.88
Kendrick's Cave, Great Orme's Head	10915	35	AMS	SUERC-31564 (GU-21513)	IntCal13	12832.50	12711.38	12953.63
Korhaan zone 4	10880	60	AMS	Poz-28516	IntCal13	12833.00	12651.55	13014.45
Filador	10880	60	AMS	OxA-8659	IntCal13	12833.00	12651.55	13014.45
Bondi Cave	10920	40	AMS	Beta-239226	IntCal13	12845.00	12709.15	12980.85
Lapa do Suao	10900	70	AMS	Gx-27592	IntCal13	12847.00	12643.70	13050.30
Broken Cavern	10950	950	AMS	OxA-3888	IntCal13	12848.50	9618.03	16078.98
Ekain	10960	150	AMS	GifA-96114	IntCal13	12854.00	12423.65	13284.35
La Fru	10950	110	AMS	LYON-925	IntCal13	12864.00	12569.50	13158.50
Doetichem-Dichteren 8	10930	50	AMS	GrA-13388	IntCal13	12864.00	12704.40	13023.60
Guilanya	10940	50	AMS	Beta-210729	IntCal13	12869.50	12707.53	13031.48
Gross Lieskow	10960	80	AMS	LZ-1352	IntCal13	12878.50	12673.78	13083.23

Cha das Lameiras	10960	60	AMS	GrA-17073	IntCal13	12881.50	12705.28	13057.73
Andernach-Martinsberg	10970	60	AMS	GrA-16521	IntCal13	12885.00	12708.30	13061.70
Filador	11000	55	AMS	OxA-8660	IntCal13	12892.50	12720.08	13064.93
Korhaan zone 4	11010	50	AMS	Poz-28517	IntCal13	12894.50	12726.83	13062.18
Forcas I	11015	45	AMS	GrA-32955	IntCal13	12895.50	12732.58	13058.43
Faurelie	11010	60	AMS	Lyon-5368(SacA-12061)	IntCal13	12897.00	12719.35	13074.65
Kent's Bank Cave	11025	45	AMS	0xA-23786	IntCal13	12898.00	12734.60	13061.40
Klausenische	11035	50	AMS	KIA-33951	IntCal13	12902.50	12733.88	13071.13
Ceska Lesnice, Nizka Lesnice	11030	60	AMS	GrA-17077	IntCal13	12903.50	12724.43	13082.58
Kulna	11045	50	AMS	OxA-25283	IntCal13	12905.50	12735.93	13075.08
Kulna	11070	50	AMS	OxA-25286	IntCal13	12914.50	12743.03	13085.98
Gross Lieskow	11000	110	AMS	LZ-1350	IntCal13	12914.50	12600.53	13228.48
La Grange	11074	65	AMS	LTL-1159A	IntCal13	12929.00	12731.40	13126.60
Clot de l'Hospital	11115	50	AMS	OxA-16421	IntCal13	12942.50	12760.58	13124.43
Guilanya	11110	40	AMS	Beta-247706	IntCal13	12944.50	12794.88	13094.13
Grand Canton, Marolles-sur-Seine	11030	105	AMS	OxA-3671	IntCal13	12958.00	12672.05	13243.95
Alt Duvenstedt LA 121	11060	110	AMS	AAR-2246	IntCal13	12977.00	12683.45	13270.55
Guilanya	11095	195	AMS	Ua-34297	IntCal13	12981.50	12430.03	13532.98
Closeau	11105	95	AMS	LYON-569 (OxA)	IntCal13	12994.50	12718.53	13270.48
Cativera	11135	80	AMS	AA-23372	IntCal13	12999.00	12735.85	13262.15
Closeau	11120	100	AMS	LYON-568 (OxA)	IntCal13	13003.50	12718.98	13288.03
Andernach-Martinsberg 3	11160	70	AMS	GrA-16993	IntCal13	13006.00	12751.40	13260.60
Andernach-Martinsberg 3	11160	70	AMS	GrA-16994	IntCal13	13006.00	12751.40	13260.60
Fastov, Fastiv	11180	70	AMS	Ly-on5367(SacA-12060)	IntCal13	13015.50	12758.53	13272.48
Closeau	11165	90	AMS	LYON-562 (OxA)	IntCal13	13018.50	12735.88	13301.13
Kulna	11185	50	AMS	OxA-25292	IntCal13	13023.00	12819.70	13226.30
Krucza Skala	11210	80	AMS	Poz-1141	IntCal13	13038.00	12757.75	13318.25
El Miron, Burial area	11205	55	AMS	OxA-22088	IntCal13	13041.50	12821.58	13261.43
Kettig	11210	60	AMS	GrA-14762	IntCal13	13043.50	12814.08	13272.93
Hassleberga	11180	95	AMS	Ua-3293	IntCal13	13045.00	12736.25	13353.75
Closeau	11170	105	AMS	LYON-567	IntCal13	13055.50	12728.23	13382.78
Conduché	11210	90	AMS	OxA-2847	IntCal13	13063.00	12748.55	13377.45
Carry-le Rouet, Abri du Rouet	11170	120	AMS	GifA-93086	IntCal13	13068.50	12717.48	13419.53
Closeau	11205	100	AMS	LYON-565 (OxA))	IntCal13	13071.00	12739.45	13402.55

Closeau	11240	80	AMS	AA-21677 (LYON-358)	IntCal13	13079.50	12783.58	13375.43
La Greppia II	11240	80	AMS	LTL-1465A	IntCal13	13079.50	12783.58	13375.43
Closeau	11240	90	AMS	LYON-566 (OxA)	IntCal13	13083.00	12760.00	13406.00
Cathole	11230	100	AMS	AA-23371	IntCal13	13083.50	12746.73	13420.28
Carry-le Rouet, Abri du Rouet	11240	100	AMS	GifA-93083	IntCal13	13088.00	12749.80	13426.20
Korhaan zone 4	11240	120	AMS	Poz-28518	IntCal13	13093.00	12733.90	13452.10
Clos Mailloux	11265	90	AMS	LYON-561 (OxA)	IntCal13	13099.00	12776.00	13422.00
Kinsey Cave	11270	110	AMS	OxA-2456	IntCal13	13100.50	12749.48	13451.53
Closeau, locus 4	11275	85	AMS	LYON-570 (OxA)	IntCal13	13113.50	12808.08	13418.93
King Arthur's Cave	11250	130	AMS	OxA-8997	IntCal13	13116.25	12730.28	13521.73
Blenien	11279	77	AMS	Ua-44710	IntCal13	13116.50	12829.13	13403.88
El Sidron	11289	79	AMS	GX-30241	IntCal13	13124.00	12832.35	13415.65
Ekain	11310	90	AMS	GifA-96080	IntCal13	13133.50	12823.33	13443.68
Kettig	11314	50	AMS	Hd-18123	IntCal13	13180.50	13041.33	13319.68
Broken Cavern	11380	120	AMS	OxA-3887	IntCal13	13185.50	12807.88	13563.13
Andernach-Martinsberg	11300	220	AMS	H-85/91	IntCal13	13192.00	12591.60	13792.40
Buraca Grande - 9A	11390	110	AMS	GifA-96307	IntCal13	13196.00	12837.85	13554.15
Balma de la Griera	11350	70	AMS	Beta-244009	IntCal13	13223.00	13011.15	13434.85
Andernach-Martinsberg 2	11370	160	AMS	OxA-998	IntCal13	13234.00	12742.85	13725.15
Braunert	11400	45	AMS	OxA-13283	IntCal13	13255.00	13093.50	13416.50
Conty, Le Marais	11410	80	AMS	OxA-6148	IntCal13	13265.96	13040.80	13524.20
La Fru	11420	60	AMS	GrA-25062	IntCal13	13268.00	13082.75	13453.25
Berelekh	11450	140	AMS	Beta-190085	IntCal13	13275.00	12817.10	13732.90
Cherry Garden	11430	100	AMS	OxA-2159	IntCal13	13280.50	12999.78	13561.23
Abri du Moulin	11450	95	AMS	LYON-914	IntCal13	13297.50	13031.03	13563.98
Kino Elite	11465	75	AMS	OxA-11154	IntCal13	13314.50	13083.18	13545.83
Gough's Cave	11480	90	AMS	OxA-2234	IntCal13	13321.00	13070.20	13571.80
Dzudzuana Cave	11500	75	AMS	RTA-3282	IntCal13	13327.50	13096.18	13558.83
Gabo	11510	80	AMS	GrA-12116	IntCal13	13332.00	13093.55	13570.45
kalavan 1	11520	50	AMS	UGAMS-03414	IntCal13	13345.37	13168.25	13534.75
Kohlerhohle	11525	60	AMS	ETH-39760	IntCal13	13348.00	13144.70	13551.30
Ferrassie	11540	55	AMS	OxA-X-2294-15	IntCal13	13361.00	13171.00	13551.00
Kozarnika	11490	120	AMS	GifA-98346	IntCal13	13364.50	12999.23	13729.78
Giganti Cave	11560	55	AMS	LYON-4715(OxA)	IntCal13	13382.00	13205.30	13558.70
Kinsey Cave	11555	50	AMS	OxA-16339	IntCal13	13385.00	13218.75	13551.25
Kukrek	11550	130	AMS	Ua-2625	IntCal13	13396.00	13021.70	13770.30

Abri du Mannlefelsen,	11520	100	AMS	LYON-913	IntCal13	13397.00	13076.85	13717.15
Denton Pinch	11560	40	AMS	GrA-37870	IntCal13	13407.00	13273.05	13540.95
Kozarnika	11550	100	AMS	GifA-98345	IntCal13	13409.00	13087.90	13730.10
En Vignes	11555	100	AMS	UZ-3798	IntCal13	13411.00	13089.90	13732.10
Endingen VI	11555	100	AMS	ETH-13585	IntCal13	13411.00	13089.90	13732.10
Conty, Le Marais	11560	90	AMS	OxA-6150 (LYON-259)	IntCal13	13413.00	13104.25	13721.75
Klanjceva pec	11560	110	AMS	AAR-2785	IntCal13	13413.00	13080.50	13745.50
Bonn-Oberkassel	11570	100	AMS	OxA-4790	IntCal13	13417.00	13095.90	13738.10
Chernye kosti rockshelter - Tchernye kosti	11580	100	AMS	OxA-2242	IntCal13	13420.50	13098.93	13742.08
Kastlhanghohle	11590	90	AMS	OxA-5756	IntCal13	13427.00	13119.20	13734.80
Conty, Le Marais	11620	90	AMS	OxA-6149 (LYON-258)	IntCal13	13444.00	13142.85	13745.15
Hangest-sur-Somme, Le Marais	11630	90	AMS	LYON-86	IntCal13	13450.00	13150.75	13749.25
Hangest-sur-Somme, Le Marais	11630	90	AMS	OxA-4936 / Ly-86	IntCal13	13450.00	13150.75	13749.25
Conty, Le Marais	11640	80	AMS	GifA-99526	IntCal13	13471.50	13200.28	13742.73
Bonn-Oberkassel	11620	60	AMS	KIA-4163	IntCal13	13487.00	13267.55	13706.45
Closeau	11640	70	AMS	GrA-18762 (LYON-1553)	IntCal13	13487.50	13242.88	13732.13
Berroberría	11600	130	AMS	OxA-978	IntCal13	13493.00	13073.10	13912.90
Bois Ragot	11640	55	AMS	OxA-2754	IntCal13	13499.50	13290.03	13708.98
Cueto de la Mina	11650	190	AMS	OxA-996	IntCal13	13501.00	12863.55	14138.45
Hangest-sur-Somme, Le Marais	11660	110	AMS	OxA-4432 (LYON-22)	IntCal13	13502.46	13126.70	13907.30
Hangest III.1	11660	110	AMS	LYON-22 /OxA-	IntCal13	13502.46	13126.70	13907.30
Cueto de la Mina	11630	120	AMS	OxA-969	IntCal13	13504.07	13098.35	13910.65
El Miron, Burial area	11650	50	AMS	GX-24468	IntCal13	13504.50	13304.53	13704.48
Atxoste	11690	80	AMS	GrA-23107	IntCal13	13518.00	13272.90	13763.10
Donderen	11700	90	AMS	GrA-16243	IntCal13	13520.00	13236.90	13803.10
Kent's Cavern, Black Band	11650	130	AMS	OxA-2155	IntCal13	13533.50	13096.03	13970.98
Continenza	11725	65	AMS	LYON-1663/OxA	IntCal13	13540.00	13322.45	13757.55
Kettig	11720	60	AMS	GrA-14171	IntCal13	13540.50	13331.03	13749.98
Atxoste	11730	80	AMS	GrA-19870	IntCal13	13548.00	13297.20	13798.80
Gough's Cave	11700	100	AMS	OxA-2236	IntCal13	13560.00	13198.05	13921.95
Atxoste	11760	70	AMS	GrA-22866	IntCal13	13567.00	13341.85	13792.15
Galeria Complex	11755	80	AMS	OxA-11129	IntCal13	13572.00	13312.65	13831.35
Ahrenshoft LA 73	11750	60	AMS	KIA-3606 (a)	IntCal13	13574.50	13386.88	13762.13

Kulna	11770	55	AMS	OxA-25285	IntCal13	13597.00	13429.80	13764.20
Borneck Mitte	11770	55	AMS	KIA-33950	IntCal13	13597.00	13429.80	13764.20
Hort de la Boquera	11775	45	AMS	OxA-23645	IntCal13	13603.50	13453.88	13753.13
El Miron, Burial area	11785	55	AMS	OxA-22087	IntCal13	13606.50	13441.68	13771.33
La Fragua	11790	60	AMS	GrA-25054	IntCal13	13610.00	13433.30	13786.70
Atxoste	11800	60	AMS	GrA-22900	IntCal13	13621.00	13441.45	13800.55
Berelekh	11800	60	AMS	Beta-269441	IntCal13	13621.00	13441.45	13800.55
Kulna	11820	50	AMS	OxA-25284	IntCal13	13625.00	13468.25	13781.75
Abauntz	11760	90	AMS	OxA-5116	IntCal13	13628.00	13301.20	13954.80
Kendrick's Cave, Great Orme's Head	11760	90	AMS	OxA-7002	IntCal13	13628.00	13301.20	13954.80
Bleiwiesen	11782	81	AMS	Ua-44712	IntCal13	13639.00	13332.15	13945.85
Horster Egge	11850	45	AMS	OxA-23646	IntCal13	13642.50	13487.18	13797.83
Bonn-Oberkassel	11780	90	AMS	OxA-4791	IntCal13	13643.50	13312.43	13974.58
Alt Duvenstedt LA 120b	11780	110	AMS	AAR-2244	IntCal13	13659.50	13277.13	14041.88
Berelekh	11830	60	AMS	Beta-239447	IntCal13	13665.47	13459.70	13912.30
Berelekh	11830	60	AMS	Beta-269440	IntCal13	13665.47	13459.70	13912.30
Ekain	11760	180	AMS	GifA-95309	IntCal13	13667.00	13087.50	14246.50
Andernach-Martinsberg 2	11800	160	AMS	OxA-997	IntCal13	13671.50	13127.63	14215.38
Andernach-Martinsberg 2	11820	70	AMS	GrA-16990	IntCal13	13692.50	13435.53	13949.48
Gough's Cave	11820	120	AMS	OxA-2795	IntCal13	13694.50	13285.53	14103.48
Gonnersdorf	11830	110	AMS	OxA-2069	IntCal13	13697.00	13307.50	14086.50
La Fru	11840	60	AMS	GrA-25080	IntCal13	13698.50	13465.28	13931.73
Berelekh	11840	60	AMS	Beta-269443	IntCal13	13698.50	13465.28	13931.73
Faurelie	11850	70	AMS	Lyon-5366(SacA-12059)	IntCal13	13718.00	13454.85	13981.15
Gough's Cave	11870	110	AMS	OxA-2797	IntCal13	13726.00	13332.70	14119.30
Baume Flandin	11865	70	AMS	LYON-672	IntCal13	13730.50	13463.08	13997.93
Berelekh	11890	60	AMS	Beta-271418	IntCal13	13738.50	13485.33	13991.68
Berelekh	11890	60	AMS	Beta-271415	IntCal13	13738.50	13485.33	13991.68
Byci skala	11890	60	AMS	GrA-29911	IntCal13	13738.50	13485.33	13991.68
Kent's Cavern	11880	120	AMS	OxA-1203	IntCal13	13739.50	13320.08	14158.93
Birseck-Ermitage	11900	55	AMS	ETH-43307	IntCal13	13741.00	13495.90	13986.10
Jean-Pierre II	11900	60	AMS	LYON-3846(SacA-6542)	IntCal13	13747.00	13489.55	14004.45
Andernach-Martinsberg 2	11890	120	AMS	OxA-1924	IntCal13	13748.50	13326.23	14170.78
Condover	11880	130	AMS	OxA-1591	IntCal13	13751.50	13304.53	14198.48

Clotilde	11879	85	AMS	LTL-1215A	IntCal13	13753.00	13443.30	14062.70
Kendrick's Cave, Great Orme's Head	11880	90	AMS	OxA-7003	IntCal13	13755.00	13432.00	14078.00
Conty, Le Marais	11890	90	AMS	OxA-6151 (LYON-260)	IntCal13	13763.50	13440.03	14086.98
Irlich	11910	70	AMS	OxA-9847	IntCal13	13765.50	13481.93	14049.08
Kendrick's Cave, Great Orme's Head	11905	50	AMS	OxA-17089	IntCal13	13768.00	13558.05	13977.95
Gasselte	11905	80	AMS	AA-20934	IntCal13	13770.00	13466.95	14073.05
Berroberría	11900	130	AMS	OxA-949	IntCal13	13771.50	13315.98	14227.03
La Garenne Grand Abri	11920	90	AMS	ETH-26100	IntCal13	13786.00	13460.15	14111.85
Gough's New Cave	11900	140	AMS	OxA-843	IntCal13	13788.50	13300.68	14276.33
El Miron, Burial area	11950	70	AMS	GX-23417	IntCal13	13792.50	13499.43	14085.58
Kendrick's Cave, Great Orme's Head	11930	90	AMS	OxA-7004	IntCal13	13792.50	13465.23	14119.78
Borneck C.	11940	50	AMS	KIA-33949	IntCal13	13795.00	13572.70	14017.30
Douattes	11945	85	AMS	LYON-1417	IntCal13	13799.00	13478.85	14119.15
Berelekh	11940	60	AMS	Beta-271420	IntCal13	13805.50	13560.88	14050.13
Andernach-Martinsberg 2	11960	70	AMS	GrA-16989	IntCal13	13808.93	13504.90	14093.10
La Fru	11950	60	AMS	GrA-25052	IntCal13	13812.50	13565.98	14059.03
Ketrosy	11960	90	AMS	GrA-12396	IntCal13	13813.00	13479.55	14146.45
Continenza	11983	80	AMS	LTL-1250a	IntCal13	13820.00	13502.70	14137.30
Berelekh	11970	60	AMS	Beta-269442	IntCal13	13824.50	13574.18	14074.83
Irikaitz	11965	65	AMS	OxA-9848	IntCal13	13826.00	13566.65	14085.35
La Arenosa	11990	50	AMS	Ly-3727/GrA	IntCal13	13828.50	13596.23	14060.78
Gough's Cave	11990	90	AMS	OxA-2235	IntCal13	13835.00	13493.00	14177.00
Berelekh	11990	60	AMS	Beta-271416	IntCal13	13836.50	13583.33	14089.68
Jean-Pierre	12000	50	AMS	LYON-3996 (GrA)	IntCal13	13837.00	13605.20	14068.80
Krucza Skala	11980	70	AMS	Poz-1139	IntCal13	13838.00	13567.25	14108.75
Clusantin	12004	60	AMS	LTL-430A	IntCal13	13844.50	13589.43	14099.58
Forcas I	12010	60	AMS	GrA-33987	IntCal13	13848.00	13592.45	14103.55
Buran Kaya III	11900	150	AMS	OxA-4126	IntCal13	13848.00	13284.65	14411.35
Haye aux Mureaux	12000	70	AMS	Beta-265097	IntCal13	13850.00	13576.40	14123.60
Buran Kaya III	11950	130	AMS	OxA-4127	IntCal13	13851.50	13356.08	14346.93
Ahrensburg Pinnberg	12030	60	AMS	AAR-2784	IntCal13	13862.50	13606.48	14118.53
Fourtrouse	11970	120	AMS	OxA-1493	IntCal13	13864.50	13435.58	14293.43
Andernach-Martinsberg 2	12040	70	AMS	GrA-16991	IntCal13	13876.00	13593.85	14158.15
Church Hole Cave	12020	100	AMS	OxA-3717	IntCal13	13879.50	13495.23	14263.78
Khryashchy	12010	105	AMS	AA-20932	IntCal13	13879.50	13484.78	14274.23
Andernach-Martinsberg 2	12050	70	AMS	GrA-16987	IntCal13	13884.00	13599.00	14169.00

Adzhi-Koba, Adji-Koba	12050	75	AMS	AA-59608	IntCal13	13890.00	13591.70	14188.30
Golyi Mys IV	12055	75	AMS	AA-25437	IntCal13	13894.50	13593.83	14195.18
Faurelie	12070	70	AMS	Lyon-5370(SacA-12063)	IntCal13	13904.50	13615.23	14193.78
Fuchskirche I	12030	52	AMS	KIA-12927	IntCal13	13912.00	13723.90	14100.10
Berelekh	12050	60	AMS	Beta-271419	IntCal13	13914.68	13651.60	14137.40
Kastlhange	12060	90	AMS	OxA-5755	IntCal13	13928.00	13579.35	14276.65
Cova Eiros	12060	50	AMS	Beta-308859	IntCal13	13932.00	13745.80	14118.20
Atxoste	12070	60	AMS	GrA-19554	IntCal13	13946.00	13734.15	14157.85
Closeau	12050	100	AMS	LYON-313	IntCal13	13947.80	13511.88	14364.13
Closeau, locus 4	12050	100	AMS	OxA-6338 (LYON-313)	IntCal13	13947.80	13511.88	14364.13
Chinchon I	12085	55	AMS	OxA-25078	IntCal13	13953.50	13749.73	14157.28
Bonn-Oberkassel	12110	45	AMS	KIA-4161	IntCal13	13961.50	13771.03	14151.98
Beregovo II	12090	60	AMS	Beta-269446	IntCal13	13963.00	13745.45	14180.55
Berelekh	12100	60	AMS	Beta-269470	IntCal13	13972.00	13749.70	14194.30
Douattes Est	12100	60	AMS	LYON-1453	IntCal13	13972.00	13749.70	14194.30
Buxu	12090	70	AMS	GrA-2481	IntCal13	13976.00	13727.10	14224.90
Chiostraccio Cave	12120	55	AMS	OxA-25079	IntCal13	13982.50	13763.53	14201.48
Closeau, locus 4	12090	90	AMS	OxA-5680 (LYON-166)	IntCal13	13997.50	13593.28	14401.73
Kendrick's Cave, Great Orme's Head	12090	90	AMS	OxA-6144	IntCal13	13997.50	13593.28	14401.73
Ahrenshoft LA 58	12130	60	AMS	KIA-3833	IntCal13	14001.50	13761.63	14241.38
Fronton ouest	12158	50	AMS	KIA-12925	IntCal13	14010.50	13782.98	14238.03
La Paloma	11990	140	AMS	OxA-951	IntCal13	14021.50	13387.38	14655.63
Guilanya	12180	50	AMS	Beta-185066	IntCal13	14033.50	13794.58	14272.43
Abri Fritsch	12160	60	AMS	LYON-640/GrA-9705	IntCal13	14035.00	13772.80	14297.20
Abric d'En Vidal	12160	60	AMS	GrA-9705/LYON-640	IntCal13	14035.00	13772.80	14297.20
Irlich	12110	90	AMS	UtC-9221	IntCal13	14045.00	13603.25	14486.75
Berelekh	12200	40	AMS	Beta-216796	IntCal13	14055.50	13857.43	14253.58
Bavans	12170	60	AMS	GrA-23129	IntCal13	14056.50	13777.68	14335.33
Buttenloch	12040	120	AMS	OxA-4981	IntCal13	14059.00	13487.10	14630.90
La Fru	12200	50	AMS	GrA-34354	IntCal13	14068.00	13810.55	14325.45
Beraud	12070	110	AMS	AA-43086	IntCal13	14070.00	13513.30	14626.70
Etiolles, Les Coudrays	11900	250	AMS	OxA-174	IntCal13	14071.50	13059.28	15083.73
Dzierzyslaw 1	12150	70	AMS	Poz-7318	IntCal13	14079.50	13760.78	14398.23

Kastelhohle	12215	45	AMS	ETH-45026	IntCal13	14086.50	13855.18	14317.83
Berelekh	12180	60	AMS	Beta-269444	IntCal13	14089.00	13782.15	14395.85
Gouvia-Tzavros	12050	130	AMS	GifA-92346	IntCal13	14092.50	13480.23	14704.78
Gougeac	12030	150	AMS	OxA-588	IntCal13	14111.50	13413.73	14809.28
Castelseras	12030	150	AMS	OxA-4388	IntCal13	14111.50	13413.73	14809.28
Andernach-Martinsberg 2	11950	250	AMS	OxA-984	IntCal13	14120.00	13109.20	15130.80
Condover	12080	130	AMS	OxA-1457	IntCal13	14130.50	13495.43	14765.58
Ahrenshoft LA 73	12200	60	AMS	KIA-3605	IntCal13	14138.50	13792.23	14484.78
La Fru	12110	110	AMS	OxA-5264 (LYON-134)	IntCal13	14143.50	13585.38	14701.63
Church Hole Cave	12110	120	AMS	OxA-4108	IntCal13	14149.13	13521.33	14763.68
Kesslerloch	12225	45	AMS	KIA-33350	IntCal13	14158.15	13939.53	14377.48
Fuchskirche I	12232	50	AMS	KIA-12926	IntCal13	14170.50	13859.38	14481.63
Bonn-Muffendorf	12210	60	AMS	KIA-4162	IntCal13	14170.50	13798.58	14542.43
Dietfurt	12210	60	AMS	KIA-3837	IntCal13	14170.50	13798.58	14542.43
Koczukówka I	12140	110	AMS	AAR-1036	IntCal13	14180.50	13597.68	14763.33
Berelekh	12190	70	AMS	Beta-269473	IntCal13	14203.00	13780.25	14625.75
Berelekh	12220	60	AMS	Beta-269469	IntCal13	14213.50	13806.43	14620.58
Bange	12080	180	AMS	OxA-538	IntCal13	14214.00	13361.85	15066.15
Chenelaz, Grotte de la Chenelaz	12190	80	AMS	LYON-383	IntCal13	14228.50	13770.13	14686.88
Aveline's Hole	12100	180	AMS	OxA-801	IntCal13	14236.00	13390.50	15081.50
Aveline's Hole	12100	180	AMS	OxA-0801	IntCal13	14236.00	13390.50	15081.50
Buttenloch	12180	90	AMS	UtC-12577	IntCal13	14238.00	13752.55	14723.45
La Chora	12240	55	AMS	LYON-2738	IntCal13	14240.50	13851.48	14629.53
Eloutteville	12150	120	AMS	GifA-95544	IntCal13	14246.50	13594.33	14898.68
Harvincourt Hav.1	12230	70	AMS	Beta-265098	IntCal13	14249.00	13796.80	14701.20
Gough's Cave	12245	55	AMS	OxA-18067	IntCal13	14250.00	13859.55	14640.45
Isturitz	12245	60	AMS	OxA-19837	IntCal13	14255.00	13838.90	14671.10
Bonn-Oberkassel	12180	110	AMS	OxA-4792	IntCal13	14257.00	13617.65	14896.35
Hort de la Boquera	12250	60	AMS	OxA-13595	IntCal13	14262.50	13845.93	14679.08
Closeau, locus 46	12248	66	AMS	AA-41882	IntCal13	14263.00	13817.45	14708.55
Atxoste	12200	90	AMS	GrfA-19502	IntCal13	14264.50	13764.33	14764.68
Komarovo	12260	60	AMS	Poz-6621	IntCal13	14278.50	13860.98	14696.03
Can Manel	12260	60	AMS	Beta-184713	IntCal13	14278.50	13860.98	14696.03
Douattes	12255	55	AMS	LYON-1416	IntCal13	14283.63	13878.75	14660.25
Gough's New Cave	12170	130	AMS	OxA-1890	IntCal13	14300.00	13593.20	15006.80
Bange	12200	160	AMS	OxA-540	IntCal13	14317.00	13519.95	15114.05

Andernach-Martinsberg 2	12270	50	AMS	OxA-V-2218-39	IntCal13	14324.00	13990.55	14657.45
Clusantin	12256	85	AMS	LTL-1216A	IntCal13	14343.50	13794.88	14892.13
Church Hole Cave	12250	90	AMS	OxA-3718	IntCal13	14354.00	13787.80	14920.20
Afontova Gora 2, Old Excavation CL C3	12280	80	AMS	AA-68662	IntCal13	14363.00	13816.75	14909.25
Church Hole	12240	150	AMS	OxA-735	IntCal13	14363.50	13603.03	15123.98
Church Hole Cave	12240	150	AMS	OxA-0735	IntCal13	14363.50	13603.03	15123.98
La Fru	12260	90	AMS	GrA-22098	IntCal13	14367.00	13792.25	14941.75
Guerny	12310	40	AMS	Beta-247708	IntCal13	14368.00	14070.65	14665.35
Kiik-Koba	12240	100	AMS	OxA-6840	IntCal13	14371.00	13774.40	14967.60
Kent's Cavern, Black Band	12240	100	AMS	OxA-8002	IntCal13	14371.00	13774.40	14967.60
Douattes	12255	95	AMS	Ly-1416	IntCal13	14376.00	13786.05	14965.95
Grotte de Bange	12300	60	AMS	LYON-915	IntCal13	14381.00	13995.30	14766.70
Bâme de Courtemaîche	12300	60	AMS	GrA-13409	IntCal13	14381.00	13995.30	14766.70
King Arthur's Cave	12250	100	AMS	OxA-6844	IntCal13	14383.50	13779.78	14987.23
Etiolles, Les Coudrays	12250	100	AMS	OxA-5995/LYON-202	IntCal13	14383.50	13779.78	14987.23
Gough's New Cave	12260	160	AMS	OxA-591	IntCal13	14388.50	13602.38	15174.63
Cueva del Hoyo de la Mina, Hoyo Mina	12255	100	AMS	Ua-19443	IntCal13	14389.00	13781.95	14996.05
Balma del Gai	12240	110	AMS	GifA-95630	IntCal13	14391.50	13762.13	15020.88
Kinsey Cave	12315	55	AMS	OxA-16337	IntCal13	14394.50	14028.28	14760.73
Etiolles, Les Coudrays	12315	55	AMS	OxA-12019	IntCal13	14394.50	14028.28	14760.73
Can Garriga	12310	60	AMS	Beta-184712	IntCal13	14399.00	14007.60	14790.40
Kent's Cavern Vestibule	12250	110	AMS	OxA-5692	IntCal13	14400.50	13768.28	15032.73
Kiskevely	12290	90	AMS	OxA-5861	IntCal13	14402.50	13807.33	14997.68
Bonn-Oberkassel	12270	100	AMS	OxA-4793	IntCal13	14403.00	13788.35	15017.65
Cogola	12340	40	AMS	Beta-392008	IntCal13	14408.00	14104.00	14712.00
Kesslerloch	12335	45	AMS	KIA-33351	IntCal13	14409.50	14085.08	14733.93
King Arthur's Cave	12300	100	AMS	OxA-6838	IntCal13	14424.50	13800.83	15048.18
Gough's Cave	12300	100	AMS	OxA-2237	IntCal13	14424.50	13800.83	15048.18
Andernach-Martinsberg 2	12300	200	AMS	OxA-985	IntCal13	14431.00	13524.70	15337.30
Gouch's Cave	12300	180	AMS	OxA-1071	IntCal13	14433.00	13600.80	15265.20
Beny-sur-Mer	12290	120	AMS	AA-13088	IntCal13	14433.50	13776.58	15090.43
Conty	12300	120	AMS	OxA-6257/LYON-286	IntCal13	14440.00	13781.65	15098.35
Irlich	12310	120	AMS	OxA-9736	IntCal13	14445.50	13785.73	15105.28
Etrembieres, site du Veyrier	12300	130	AMS	ETH-3937	IntCal13	14446.50	13769.63	15123.38

Etiolles, Les Coudrays	12315	75	AMS	OxA-8757	IntCal13	14457.00	13963.95	14950.05
Condover	12330	120	AMS	OxA-1456	IntCal13	14457.50	13793.93	15121.08
Kent's Cavern, Black Band	12320	130	AMS	OxA-1789	IntCal13	14461.00	13779.85	15142.15
Abauntz	12340	60	AMS	Beta-67949	IntCal13	14464.50	14046.98	14882.03
Abauntz	12340	60	AMS	CAMS-9918	IntCal13	14464.50	14046.98	14882.03
Grotte de l'Abbaye	12340	60	AMS	LYON-1844	IntCal13	14464.50	14046.98	14882.03
Gough's New Cave	12360	170	AMS	OxA-465	IntCal13	14479.87	13653.73	15292.28
Closeau, locus 46	12350	60	AMS	GrA-11664 (LYON-789)	IntCal13	14483.00	14059.30	14906.70
Klausenhohlen (Obere Klause)	12350	130	AMS	OxA-5719	IntCal13	14483.00	13793.30	15172.70
Continenza	12353	60	AMS	LTL-6188a	IntCal13	14489.50	14063.43	14915.58
Gromatukha	12340	70	AMS	MTC-05936	IntCal13	14490.50	14015.98	14965.03
Gough's New Cave	12340	150	AMS	OxA-0589	IntCal13	14494.50	13765.38	15223.63
Badanj	12380	110	AMS	OxA-2197	IntCal13	14495.50	13852.83	15138.18
Gough's Cave	12380	110	AMS	OxA-2796	IntCal13	14495.50	13852.83	15138.18
Closeau, locus 46	12360	60	AMS	GrA-11665 (LYON-790)	IntCal13	14502.50	14072.63	14932.38
Golyi Mys IV	12360	60	AMS	AA-32281	IntCal13	14502.50	14072.63	14932.38
Aveline's Hole	12380	130	AMS	OxA-1121	IntCal13	14503.50	13805.73	15201.28
Closeau, locus 46	12350	70	AMS	GrA-18816	IntCal13	14505.50	14027.18	14983.83
Grotte de l'Abbaye	12350	70	AMS	LYON-1842	IntCal13	14505.50	14027.18	14983.83
Aschenstein	12366	61	AMS	KIA-33772	IntCal13	14515.00	14077.05	14952.95
Gough's New Cave	12370	150	AMS	OxA-0590	IntCal13	14515.50	13781.63	15249.38
Oelknitz	12350	85	AMS	Bln-1726	IntCal13	14516.50	13982.13	15050.88
Kastelhohle-Nord	12395	45	AMS	ETH-45025	IntCal13	14517.50	14147.48	14887.53
Gough's New Cave	12400	110	AMS	OxA-1200	IntCal13	14521.00	13882.60	15159.40
Gough's Cave	12380	160	AMS	OxA-463	IntCal13	14529.50	13774.73	15284.28
Goyet	12380	60	AMS	KIA-22275	IntCal13	14535.00	14096.10	14973.90
Continenza	12381	60	AMS	LTL-1249a	IntCal13	14536.50	14097.13	14975.88
Condover	12400	160	AMS	OxA-1455	IntCal13	14544.50	13784.03	15304.98
Gromatukha	12380	70	AMS	MTC-05937	IntCal13	14548.00	14066.35	15029.65
Gonfreville-l'Orcher	12385	65	AMS	OxA-15296	IntCal13	14550.00	14087.35	15012.65
Grotte de l'Abbaye	12390	60	AMS	LYON-1849	IntCal13	14550.00	14106.35	14993.65
Klappholz LA 63	12440	140	AMS	OxA-5720	IntCal13	14554.50	13825.38	15283.63
Beraud	12390	90	AMS	Beta-147639	IntCal13	14555.50	14015.43	15095.58
Berelekh	12410	50	AMS	Beta-243745	IntCal13	14559.00	14149.55	14968.45
Gough's Cave	12400	100	AMS	OxA-3452	IntCal13	14562.50	13995.83	15129.18
Afontova Gora 2	12400	60	AMS	GrA-5555	IntCal13	14563.00	14115.55	15010.45

Gough's New Cave	12415	50	AMS	OxA-17832	IntCal13	14565.50	14153.68	14977.33
Berelekh	12400	80	AMS	Beta-269445	IntCal13	14568.50	14057.88	15079.13
El Castillo	12390	190	AMS	GifA-95375	IntCal13	14569.50	13633.28	15505.73
Kendrick's Cave, Great Orme's Head	12410	100	AMS	OxA-6146	IntCal13	14573.50	14007.78	15139.23
Hohlefelsgrotte	12410	90	AMS	OxA-5752	IntCal13	14574.50	14037.28	15111.73
Lapa do Suao	12410	80	AMS	Gx-27590	IntCal13	14579.00	14069.80	15088.20
Dietfurt Burghohle	12420	60	AMS	KIA-3838	IntCal13	14586.50	14133.83	15039.18
Campalou	12470	140	AMS	LYON-2214/GrA-23731	IntCal13	14592.00	13862.40	15321.60
Closeau, locus 4	12423	67	AMS	AA-41881	IntCal13	14592.50	14119.88	15065.13
Kent's Cavern, Black Band	12430	80	AMS	OxA-7994	IntCal13	14597.00	14090.65	15103.35
Forcas I	12440	50	AMS	GrA-32957	IntCal13	14601.00	14176.35	15025.65
Gough's Cave	12440	55	AMS	OxA-18066	IntCal13	14604.50	14163.23	15045.78
Gough's New Cave	12440	55	AMS	OxA-13585	IntCal13	14604.50	14163.23	15045.78
Käsloch, Kasloch	12450	45	AMS	ETH-39771	IntCal13	14610.00	14201.50	15018.50
Jean-Pierre II	12448	54	AMS	LYON-3919 (OxA)	IntCal13	14612.50	14173.13	15051.88
Geissenklosterle	12450	120	AMS	OxA-5158	IntCal13	14616.50	13989.98	15243.03
Burgtonna	12450	110	AMS	ETH-7613	IntCal13	14617.00	14020.40	15213.60
Blenien	12452	83	AMS	Ua-44711	IntCal13	14617.50	14104.03	15130.98
Kulna	12455	55	AMS	OxA-25295	IntCal13	14619.50	14176.33	15062.68
Jean-Pierre II	12455	51	AMS	LYON-3920 (OxA)	IntCal13	14619.50	14188.68	15050.33
Kohlerhohle	12460	45	AMS	ETH-43309	IntCal13	14623.50	14212.63	15034.38
Jean Thomas I	12460	60	AMS	LYON-3957 (SacA-6543)	IntCal13	14624.50	14168.03	15080.98
Chenelaz, Grotte de la Chenelaz	12460	65	AMS	OxA-8027/LYON-703	IntCal13	14624.50	14155.68	15093.33
Dzierzyslaw 35	12300	400	AMS	Ki-8851	IntCal13	14627.00	13121.25	16132.75
Kohlerhohle	12465	40	AMS	ETH-39762	IntCal13	14629.50	14238.58	15020.43
Brighton, Black Rock	12470	63	AMS	OxA-11054	IntCal13	14632.50	14168.43	15096.58
Gough's New Cave	12470	55	AMS	OxA-17846	IntCal13	14634.00	14191.30	15076.70
Bois Ragot	12475	75	AMS	OxA-10332/LYO?-1371	IntCal13	14637.50	14143.98	15131.03
Brohltal	12470	110	AMS	OxA-4588	IntCal13	14638.50	14041.43	15235.58
Fees	12475	80	AMS	OxA-6426	IntCal13	14639.00	14131.70	15146.30
Cendres	12470	100	AMS	Beta-142284	IntCal13	14639.00	14072.80	15205.20
Closeau	12480	70	AMS	LYON-1551 (GrA-18815)	IntCal13	14641.00	14159.35	15122.65

Krucza Skala	12480	60	AMS	Poz-27261	IntCal13	14642.00	14186.00	15098.00
Grotte aux Ours	12480	80	AMS	OxA-7282	IntCal13	14644.00	14135.75	15152.25
Collubil	12480	80	AMS	LYON-598	IntCal13	14644.00	14135.75	15152.25
Aveline's Hole	12480	130	AMS	OxA-1122	IntCal13	14645.50	13991.43	15299.58
Castlepook	12480	130	AMS	OxA-3602	IntCal13	14645.50	13991.43	15299.58
Boila	12480	120	AMS	OxA-5241	IntCal13	14646.50	14021.88	15271.13
Gough's Cave	12485	50	AMS	OxA-17848	IntCal13	14651.00	14223.50	15078.50
Gough's Cave	12470	160	AMS	OxA-464	IntCal13	14652.00	13815.05	15488.95
Gough's Cave	12490	55	AMS	OxA-18065	IntCal13	14653.50	14211.28	15095.73
Gough's Cave	12490	120	AMS	OxA-3412	IntCal13	14656.00	14030.90	15281.10
Gare de Couze	12490	50	AMS	GrA-43937	IntCal13	14657.00	14230.45	15083.55
Gough's Cave	12495	50	AMS	OxA-12104	IntCal13	14663.00	14237.40	15088.60
Abri Gay	12505	65	AMS	LYON-1454	IntCal13	14664.50	14195.68	15133.33
High Furlong	12400	300	AMS	OxA-150	IntCal13	14665.50	13397.73	15933.28
Kesslerloch	12502	52	AMS	KIA-11826	IntCal13	14668.50	14238.63	15098.38
Gouberville-Lande du Nau	12500	50	AMS	OxA-17845	IntCal13	14668.50	14244.33	15092.68
Felsstalle	12505	80	AMS	OxA-6428	IntCal13	14669.50	14156.03	15182.98
El Pendo	12470	170	AMS	OxA-995	IntCal13	14673.00	13805.65	15540.35
Closeau	12510	80	AMS	LYON-1550 (GrA-18860)	IntCal13	14674.50	14160.08	15188.93
Kashtanka 1	12505	45	AMS	ETH-39769	IntCal13	14679.00	14273.35	15084.65
Krucza Skala	12520	70	AMS	Poz-1138	IntCal13	14681.50	14194.63	15168.38
Jean-Pierre II	12520	60	AMS	LYON-3847(SacA-6929)	IntCal13	14682.00	14228.85	15135.15
Gough's Cave	12515	50	AMS	OxA-16378	IntCal13	14685.00	14265.10	15104.90
Gough's Cave	12520	55	AMS	OxA-18068	IntCal13	14686.00	14249.95	15122.05
Gough's New Cave	12500	160	AMS	OxA-592	IntCal13	14687.50	13832.03	15542.98
La Paloma	12500	140	AMS	OxA-950	IntCal13	14688.50	13979.33	15397.68
Ekain	12520	100	AMS	GifA-96089	IntCal13	14689.50	14119.98	15259.03
Carry-le Rouet, Abri du Rouet	12520	130	AMS	GifA-93082	IntCal13	14704.50	14032.38	15376.63
Climente II	12535	55	AMS	OxA-22042	IntCal13	14704.50	14271.78	15137.23
Kinsey Cave	12535	55	AMS	OxA-16338	IntCal13	14704.50	14271.78	15137.23
Gough's Cave	12535	55	AMS	OxA-18064	IntCal13	14704.50	14271.78	15137.23
Hohle Fels, Hohler Fels	12520	130	AMS	OxA-4975	IntCal13	14704.50	14032.38	15376.63
Brillenhohle	12535	50	AMS	OxA-23414	IntCal13	14708.00	14292.85	15123.15
Oelknitz	12545	80	AMS	Bln-1565	IntCal13	14709.50	14189.38	15229.63
Bourrouilla	12540	50	AMS	OxA-19696	IntCal13	14714.00	14300.75	15127.25

Gorham's Cave	12540	50	AMS	Beta-196777	IntCal13	14714.00	14300.75	15127.25
Douattes	12480	260	AMS	Ly-435	IntCal13	14720.00	13547.70	15892.30
Afontova Gora 2, Old Excavation CL C3	12560	70	AMS	AA-59609	IntCal13	14727.50	14239.68	15215.33
Kulna	12555	60	AMS	OxA-25290	IntCal13	14727.50	14276.73	15178.28
Bonn-Oberkassel	12560	55	AMS	OxA-28150	IntCal13	14737.00	14306.65	15167.35
Bois Ragot	12560	50	AMS	OxA-12079	IntCal13	14745.50	14340.33	15150.68
Bois Ragot	12585	75	AMS	OxA-10333/LYON-1372	IntCal13	14754.50	14250.53	15258.48
Aveline's Hole	12565	50	AMS	OxA-17722	IntCal13	14757.00	14357.05	15156.95
Cabones	12565	50	AMS	OxA-12021	IntCal13	14757.00	14357.05	15156.95
Gough's Old Cave	12530	150	AMS	OxA-0587	IntCal13	14765.50	13981.28	15549.73
Gough's Cave	12600	80	AMS	OxA-18035	IntCal13	14768.00	14248.35	15287.65
Gough's Cave	12550	130	AMS	OxA-4107	IntCal13	14772.50	14065.23	15479.78
Etrechy	12590	60	AMS	GrA-9703	IntCal13	14775.00	14330.40	15219.60
Abri Suard, La Chaise	12590	60	AMS	LYON-637(GrA-9703)	IntCal13	14775.00	14330.40	15219.60
Buxu	12600	70	AMS	GrA-2462	IntCal13	14776.50	14291.53	15261.48
Gough's Cave	12570	120	AMS	OxA-3414	IntCal13	14782.00	14112.25	15451.75
Gough's Cave	12585	55	AMS	OxA-16292	IntCal13	14784.00	14368.85	15199.15
Kulna	12585	55	AMS	OxA-25302	IntCal13	14784.00	14368.85	15199.15
Forcas I	12600	60	AMS	GrA-33986	IntCal13	14794.50	14356.08	15232.93
Bois Ragot	12615	70	AMS	OxA-10263/LYON-1369	IntCal13	14794.50	14312.38	15276.63
Kulna	12600	60	AMS	OxA-25288	IntCal13	14794.50	14356.08	15232.93
Goyet 3	12620	90	AMS	GrA-3238	IntCal13	14797.00	14231.75	15362.25
La Pila	12580	190	AMS	GrA-90033	IntCal13	14797.50	13830.88	15764.13
La Peyzie	12580	190	AMS	GifA-90033	IntCal13	14797.50	13830.88	15764.13
Gough's New Cave	12570	45	AMS	OxA-17833	IntCal13	14806.50	14464.98	15148.03
Ahrenshoft LA 73	12550	1170	AMS	KIA-3606	IntCal13	14817.61	11009.85	18597.15
Golubki 3	12610	60	AMS	AA-36279	IntCal13	14827.00	14409.00	15245.00
Climautsi II, Klimautsy II, Klimauts II, Climautsy II, Climauti	12590	50	AMS	OxA-24990	IntCal13	14831.50	14472.88	15190.13
Climente II	12590	50	AMS	OxA-22990	IntCal13	14831.50	14472.88	15190.13
Gough's Cave	12590	50	AMS	OxA-17849	IntCal13	14831.50	14472.88	15190.13
La Fru	12600	120	AMS	LYON-29/OxA-4408	IntCal13	14839.00	14137.90	15540.10
Espagnac	12605	55	AMS	OxA-26676	IntCal13	14844.00	14464.00	15224.00

El Castillo	12620	110	AMS	GifA-96079	IntCal13	14853.50	14174.73	15532.28
Kulna	12620	60	AMS	OxA-25291	IntCal13	14854.50	14452.18	15256.83
Bouron	12610	55	AMS	OxA-19698	IntCal13	14856.00	14480.75	15231.25
Bois Laiterie	12625	117	AMS	GX-20433	IntCal13	14865.00	14162.95	15567.05
Douattes Est	12660	80	AMS	LYON-1853	IntCal13	14869.00	14332.25	15405.75
Gare de Couze	12630	120	AMS	GrA-45456	IntCal13	14874.00	14159.60	15588.40
Bois Ragot	12645	65	AMS	OxA-10262/LYON-1368	IntCal13	14887.00	14476.60	15297.40
Gough's Cave	12650	120	AMS	OxA-3411	IntCal13	14900.50	14175.18	15625.83
Bois Laiterie	12665	96	AMS	GX-20434	IntCal13	14906.50	14265.73	15547.28
Grand Canton, Marolles-sur-Seine	12650	130	AMS	OxA-3139	IntCal13	14909.50	14152.83	15666.18
La Boja	12605	45	AMS	VERA-5363	IntCal13	14923.50	14651.33	15195.68
Gough's Cave	12670	120	AMS	OxA-4106	IntCal13	14925.00	14190.65	15659.35
Koldrab	12680	110	AMS	OxA-5973	IntCal13	14932.00	14229.95	15634.05
Grichet	12620	50	AMS	OxA-13284	IntCal13	14933.00	14636.60	15229.40
Andernach Martinsberg 1	12500	500	AMS	OxA-999	IntCal13	14948.00	13088.85	16807.15
Bois Ragot	12630	50	AMS	OxA-12080	IntCal13	14955.50	14668.13	15242.88
Gorham's Cave	12640	50	AMS	Beta-184047	IntCal13	14970.00	14685.95	15254.05
Condover	12700	160	AMS	OxA-1021	IntCal13	14980.00	14122.15	15837.85
Borshchevo 2	12720	140	AMS	GrA-9249	IntCal13	14986.50	14184.23	15788.78
Bois Ragot	12685	70	AMS	OxA-10331/LYON-1370	IntCal13	14990.00	14577.70	15402.30
Bois Laiterie	12720	100	AMS	OxA-10334/LYON-1373	IntCal13	14991.50	14326.03	15656.98
Gonnersdorf	12730	130	AMS	OxA-5728	IntCal13	14993.00	14219.70	15766.30
Dobranichevka - Dobranitchevka Dobranichivka	12700	200	AMS	OxA-700	IntCal13	15000.50	14012.98	15988.03
Golyi Mys IV	12680	65	AMS	AA-36278	IntCal13	15007.00	14662.15	15351.85
Andernach-Martinsberg	12675	55	AMS	OxA-V-2223.37	IntCal13	15010.00	14715.50	15304.50
La Fru	12740	110	AMS	LYON-133/OxA-5263	IntCal13	15011.50	14309.93	15713.08
Douattes	12680	60	AMS	GrA-9725	IntCal13	15012.00	14695.65	15328.35
Douattes	12680	60	AMS	LYON-647	IntCal13	15012.00	14695.65	15328.35
Geissenklosterle	12750	130	AMS	OxA-6253	IntCal13	15018.50	14242.83	15794.18
La Paloma	12750	130	AMS	OxA-975	IntCal13	15018.50	14242.83	15794.18
Bienkowice	12700	55	AMS	OxA-28078	IntCal13	15047.00	14758.20	15335.80
Cote 229	12770	120	AMS	Gif A-93014	IntCal13	15048.50	14311.78	15785.23

La Fru	12770	110	AMS	LYON-132/OxA-5262	IntCal13	15065.50	14381.98	15749.03
Gonnersdorf	12790	120	AMS	OxA-5730	IntCal13	15082.00	14350.50	15813.50
Gough's Cave	12800	170	AMS	OxA-466	IntCal13	15100.50	14183.28	16017.73
Fuchskirche I	12721	65	AMS	KIA-12928	IntCal13	15105.00	14739.25	15470.75
Etiolles, Les Coudrays	12800	220	AMS	OxA-173	IntCal13	15119.50	14057.88	16181.13
Andernach-Martinsberg	12820	130	AMS	OxA-1127	IntCal13	15130.00	14356.70	15903.30
Dotrzyma 1	12740	70	AMS	LYON-1850	IntCal13	15152.50	14745.43	15559.58
Buttenloch	12750	80	AMS	UtC-12575	IntCal13	15164.50	14708.98	15620.03
Goyet 3	12770	90	AMS	GrA-3237	IntCal13	15191.00	14689.40	15692.60
Kesslerloch	12770	90	AMS	OxA-5748	IntCal13	15191.00	14689.40	15692.60
La Fru	12810	110	AMS	LYON-131/OxA-5261	IntCal13	15197.00	14589.00	15805.00
Etiolles, Les Coudrays	12900	220	AMS	OxA-175	IntCal13	15223.50	14157.13	16289.88
El Castillo	12910	180	AMS	GifA-95172	IntCal13	15232.00	14276.30	16187.70
El Castillo	12910	180	AMS	GifA-91172	IntCal13	15232.00	14276.30	16187.70
Goyet 3	12775	50	AMS	OxA-12121	IntCal13	15253.50	15015.53	15491.48
Andernach-Martinsberg	12930	180	AMS	OxA-1125	IntCal13	15256.50	14306.03	16206.98
Kesselt-Op de Schans ODS2	12774	54	AMS	KIA-11825	IntCal13	15260.00	14983.55	15536.45
Goyet 3	12775	55	AMS	OxA-V-2223-48	IntCal13	15261.00	14977.90	15544.10
Hollenberg-Hohle 3	12798	70	AMS	Erll-13570	IntCal13	15277.00	14904.60	15649.40
Kohlerhohle	12790	45	AMS	ETH-39761	IntCal13	15278.00	15071.85	15484.15
Champreveyres	12805	75	AMS	OxA-20701	IntCal13	15278.00	14874.25	15681.75
Andernach-Martinsberg	12890	140	AMS	OxA-1126	IntCal13	15293.00	14556.75	16029.25
La Paloma	12860	430	AMS	OxA-973	IntCal13	15296.00	13544.20	17047.80
Gare de Couze	12800	60	AMS	GrA-45461	IntCal13	15301.50	15000.83	15602.18
Chiostraccio Cave	12800	50	AMS	Beta-293673	IntCal13	15311.50	15064.03	15558.98
Douattes	12860	100	AMS	Ly-2210/GrA-23536	IntCal13	15324.00	14814.80	15833.20
Champ-Parel	12815	65	AMS	OxA-20700	IntCal13	15326.50	15001.13	15651.88
Coimbre	12840	70	AMS	Beta-271250	IntCal13	15365.50	15025.88	15705.13
Coleoptere	12870	95	AMS	OxA-3635	IntCal13	15366.50	14906.23	15826.78
Holing	12846	63	AMS	Erl-13569	IntCal13	15380.50	15075.08	15685.93
Gonnersdorf	12910	130	AMS	OxA-5729	IntCal13	15384.50	14746.58	16022.43
Abri Stendel	12860	75	AMS	OxA-10471	IntCal13	15390.00	15039.45	15740.55
Isturitz, Grande Salle	12860	55	AMS	OxA-19834	IntCal13	15393.00	15116.55	15669.45
Butte d'Arvigny	12870	80	AMS	UtC-12574	IntCal13	15399.00	15030.40	15767.60

Douattes Ouest	12870	80	AMS	LYON-1852(GrA-20633)	IntCal13	15399.00	15030.40	15767.60
Konczyce Wielkie	12870	70	AMS	GrA-13696	IntCal13	15407.50	15081.18	15733.83
Bourrouilla	12880	50	AMS	OxA-19697	IntCal13	15410.50	15147.83	15673.18
El Castillo	12930	130	AMS	OxA-972	IntCal13	15414.00	14784.15	16043.85
Etang	12990	300	AMS	OxA-138	IntCal13	15421.00	14040.65	16801.35
Gough's Cave	12940	140	AMS	OxA-3413	IntCal13	15422.50	14749.43	16095.58
Adaouste	12890	60	AMS	KIA-36055	IntCal13	15427.00	15132.50	15721.50
Kesslerloch	12897	53	AMS	KIA-11829	IntCal13	15430.50	15156.43	15704.58
Grotte de Bange	12900	60	AMS	LYON-905	IntCal13	15436.00	15141.50	15730.50
Bange	12900	60	AMS	GrA-13441	IntCal13	15436.00	15141.50	15730.50
Bange	12900	60	AMS	GrA-13969	IntCal13	15436.00	15141.50	15730.50
Etiolles, Les Coudrays	13000	300	AMS	OxA-139	IntCal13	15437.00	14051.90	16822.10
Andernach-Martinsberg	12950	140	AMS	OxA-1130	IntCal13	15437.50	14766.33	16108.68
Bycgawa-Zadebie	12910	60	AMS	GrA-29910	IntCal13	15445.00	15150.50	15739.50
Ferrassie	12950	130	AMS	OxA-X-2403-18	IntCal13	15448.50	14826.73	16070.28
Golyi Mys IV	12925	65	AMS	AA-36277	IntCal13	15462.50	15151.38	15773.63
Duruthy	12930	60	AMS	Poz-15983	IntCal13	15465.50	15169.58	15761.43
El Castillo	13060	200	AMS	GifA-91004	IntCal13	15511.00	14549.60	16472.40
Krucza Skala	12970	60	AMS	Poz-27245	IntCal13	15513.50	15215.68	15811.33
El Miron, Burial area	12970	70	AMS	GX-22132	IntCal13	15519.00	15180.80	15857.20
Abri Sandron	12970	70	AMS	OxA-10494	IntCal13	15519.00	15180.80	15857.20
Abri Gay	12980	70	AMS	LYON-639/GrA-9720)	IntCal13	15532.00	15191.90	15872.10
Abri Gay	12980	70	AMS	GrA-9720	IntCal13	15532.00	15191.90	15872.10
Gonnersdorf	12990	55	AMS	OxA-V-2223-42	IntCal13	15535.50	15252.88	15818.13
Coimbre	12990	60	AMS	Beta-297104	IntCal13	15538.50	15236.88	15840.13
Faurelie	12980	80	AMS	Lyon-5369(SacA-12062)	IntCal13	15541.50	15161.98	15921.03
Gonnersdorf	13010	55	AMS	OxA-V-2222-31	IntCal13	15561.50	15274.13	15848.88
Andernach-Martinsberg	13015	50	AMS	OxA-V-2218-38	IntCal13	15563.50	15293.23	15833.78
Andernach Martinsberg 1	13025	50	AMS	OxA-18409	IntCal13	15576.00	15302.40	15849.60
Isturitz	13035	45	AMS	GrA-45329	IntCal13	15583.50	15325.58	15841.43
Buttental	13020	130	AMS	OxA-4602	IntCal13	15602.00	15039.60	16164.40
El Pendo	13050	150	AMS	OxA-976	IntCal13	15610.00	14964.95	16255.05
Kesslerloch	13052	53	AMS	KIA-11827	IntCal13	15614.00	15317.60	15910.40
La Fru	13040	140	AMS	GifA-92351	IntCal13	15617.50	15017.58	16217.43

Buraca Grande - 9A	13050	100	AMS	OxA-5522	IntCal13	15630.00	15170.20	16089.80
Gonnersdorf	13060	60	AMS	OxA-15295	IntCal13	15630.50	15305.13	15955.88
Gonnersdorf	13075	55	AMS	OxA-V-2223-43	IntCal13	15644.50	15332.43	15956.58
Hollenberg-Hohle 3	13077	71	AMS	Erl-13572	IntCal13	15656.00	15290.25	16021.75
Bora Gran	13080	90	AMS	Ox BGA-2153 or ?2513?	IntCal13	15662.50	15232.63	16092.38
Gonnersdorf	13095	55	AMS	OxA-V-2223-41	IntCal13	15669.00	15352.65	15985.35
Isturitz, Grande Salle	13095	55	AMS	OxA-19833	IntCal13	15669.00	15352.65	15985.35
Abri Stendel	13105	70	AMS	OxA-10470	IntCal13	15684.50	15318.28	16050.73
Andernach-Martinsberg	13090	130	AMS	OxA-1129	IntCal13	15685.50	15130.23	16240.78
Kniegrotte	13090	130	AMS	OxA-4853	IntCal13	15685.50	15130.23	16240.78
Jean-Pierre II	13105	75	AMS	OxA-8032/LYON-711	IntCal13	15686.00	15304.10	16067.90
Andernach-Martinsberg	13110	50	AMS	OxA-V-2218-40	IntCal13	15694.00	15402.35	15985.65
Hollenberg-Hohle 3	13114	71	AMS	Erl-13571	IntCal13	15694.00	15323.50	16064.50
Andernach-Martinsberg	13110	80	AMS	GrA-16985	IntCal13	15695.00	15295.05	16094.95
Buttental	13100	140	AMS	OxA-4982	IntCal13	15697.50	15112.78	16282.23
Espalugue	13120	55	AMS	OxA-28086	IntCal13	15702.50	15388.53	16016.48
Kesslerloch	13120	90	AMS	OxA-5746	IntCal13	15711.50	15274.98	16148.03
Kniegrotte	13120	130	AMS	OxA-4845	IntCal13	15714.50	15155.43	16273.58
Altamira	13130	120	AMS	GifA-96067	IntCal13	15721.00	15189.00	16253.00
Kniegrotte	13130	120	AMS	OxA-4849	IntCal13	15721.00	15189.00	16253.00
Cendres	13220	503	AMS	Beta-287551	IntCal13	15722.50	13682.38	17762.63
Geissenklosterle	13130	100	AMS	OxA-6254	IntCal13	15725.00	15253.80	16196.20
Andernach-Martinsberg	13135	55	AMS	OxA-V-2216-43	IntCal13	15729.50	15425.03	16033.98
Fontaine-des-Demoiselles	13140	120	AMS	GifA-96327	IntCal13	15732.50	15200.03	16264.98
Kniegrotte	13150	130	AMS	OxA-4848	IntCal13	15744.00	15179.70	16308.30
La Garenne Grand Abri	13150	110	AMS	OxA-8163/LYON-702	IntCal13	15744.50	15243.38	16245.63
Kniegrotte	13160	140	AMS	OxA-4850	IntCal13	15765.00	15164.60	16365.40
Andernach-Martinsberg	13180	70	AMS	GrA-16980	IntCal13	15785.00	15421.15	16148.85
Andernach-Martinsberg	13180	70	AMS	GrA-16986	IntCal13	15785.00	15421.15	16148.85
Gonnersdorf	13165	55	AMS	OxA-V-2223-40	IntCal13	15792.50	15516.53	16068.48
Badanj	13200	100	AMS	OxA-5859	IntCal13	15795.50	15322.88	16268.13
Kniegrotte	13190	130	AMS	OxA-4846	IntCal13	15796.00	15223.15	16368.85
Dzierzyslaw 35	13180	60	AMS	Poz-10135	IntCal13	15811.50	15513.68	16109.33
Bedburg-Koningshoven	13220	100	AMS	LYON-423	IntCal13	15816.00	15341.00	16291.00
Andernach-Martinsberg	13200	140	AMS	OxA-1128	IntCal13	15822.00	15202.60	16441.40

Bad Kosen-Lengefeld	13200	150	AMS	OxA-2196	IntCal13	15830.50	15175.48	16485.53
Coupe-Gorge Montmaurin, Goupe-Gorge	13230	90	AMS	OxA-6667	IntCal13	15830.50	15392.08	16268.93
Hohle Fels, Hohler Fels	13240	110	AMS	OxA-4956	IntCal13	15843.50	15332.88	16354.13
Hohle Fels, Hohler Fels	13240	110	AMS	OxA-4596	IntCal13	15843.50	15332.88	16354.13
Geissenklosterle	13230	130	AMS	OxA-4854	IntCal13	15856.00	15267.00	16445.00
Gromatukha	13240	85	AMS	AA-20939	IntCal13	15860.50	15456.28	16264.73
Khummi	13260	116	AMS	AA-13392	IntCal13	15881.00	15335.70	16426.30
Coimbre	13230	60	AMS	Beta-297105	IntCal13	15897.50	15620.58	16174.43
Colombier	13280	110	AMS	UtC-1737	IntCal13	15903.00	15374.80	16431.20
Abrigo de Buendia	13240	55	AMS	OxA-29341	IntCal13	15914.50	15661.33	16167.68
Covaciella	13290	140	AMS	GifA-95370	IntCal13	15938.50	15299.63	16577.38
Andernach Martinsberg 1	13270	180	AMS	OxA-10651	IntCal13	15956.50	15165.63	16747.38
Gonnersdorf	13270	55	AMS	OxA-V-2223-39	IntCal13	15956.50	15708.08	16204.93
Kniegrotte	13310	110	AMS	OxA-4832	IntCal13	15958.00	15435.50	16480.50
Cendres	13280	50	AMS	Beta-287550	IntCal13	15968.50	15739.08	16197.93
Groltta Grande, Scario, trench F	13310	100	AMS	AA-20940	IntCal13	15979.50	15525.88	16433.13
Hohle Fels, Hohler Fels	13350	140	AMS	OxA-4977	IntCal13	16018.50	15355.88	16681.13
Cendres	13350	50	AMS	Beta-287538	IntCal13	16044.00	15816.95	16271.05
Etxauri	13370	60	AMS	Beta-284730	IntCal13	16065.50	15801.88	16329.13
Laa 2	13370	70	AMS	Poz-52969	IntCal13	16070.00	15766.00	16374.00
Dzierzyslaw 35	13370	80	AMS	GdA-193	IntCal13	16084.50	15734.43	16434.58
Courbet	13380	120	AMS	GifA-97311	IntCal13	16095.00	15561.10	16628.90
Kosautsy - Cosautsi - Cosaoutsy	13380	80	AMS	GrA-9565	IntCal13	16099.00	15745.60	16452.40
Cendres	13400	50	AMS	Beta-287552	IntCal13	16107.50	15887.58	16327.43
Felsstalle	13390	90	AMS	OxA-6427	IntCal13	16118.00	15721.85	16514.15
Abrigo de Buendia	13410	55	AMS	OxA-28279	IntCal13	16120.00	15877.75	16362.25
Cosquer	13460	330	AMS	GifA-95365	IntCal13	16146.00	14752.35	17539.65
La Garma	13410	120	AMS	AA-45581	IntCal13	16152.00	15615.25	16688.75
Courbet	13410	240	AMS	GifA-90169	IntCal13	16164.00	15150.35	17177.65
Kesslerloch	13430	100	AMS	OxA-5747	IntCal13	16175.50	15733.28	16617.73
Kalamakia Cave	13450	40	AMS	UGAMS-03486	IntCal13	16181.00	16010.95	16351.05
Grappin	13450	50	AMS	Ly-4865/GrA	IntCal13	16185.50	15964.63	16406.38
La Fru	13455	75	AMS	LYON-708 OxA-8029	IntCal13	16197.00	15851.20	16542.80
Isturitz, Grande Salle	13455	55	AMS	OxA-19835	IntCal13	16198.50	15948.18	16448.83
Abrigo de Buendia	13480	50	AMS	Beta-246576	IntCal13	16236.50	16008.03	16464.98
El Castillo	13510	190	AMS	GifA-98159	IntCal13	16254.50	15382.88	17126.13

Andernach Martinsberg 1	13500	90	AMS	OxA-10492	IntCal13	16270.50	15852.03	16688.98
Kosautsy - Cosautsi - Cosaoutsy	13510	70	AMS	GrA-13289	IntCal13	16280.50	15959.88	16601.13
Courbet	13490	260	AMS	GifA-90170	IntCal13	16284.00	15178.20	17389.80
Abauntz	13500	160	AMS	OxA-5983	IntCal13	16292.50	15573.83	17011.18
Abrigo de Buendia	13540	60	AMS	Beta-246577	IntCal13	16322.00	16044.60	16599.40
El Castillo	13520	120	AMS	GifA-95109	IntCal13	16333.50	15772.53	16894.48
El Castillo	13520	120	AMS	GifA-95227	IntCal13	16333.50	15772.53	16894.48
El Castillo	13520	130	AMS	GifA-96068	IntCal13	16336.50	15740.38	16932.63
Kniegrotte	13520	130	AMS	OxA-4852	IntCal13	16336.50	15740.38	16932.63
Bonn-Oberkassel	13560	55	AMS	OxA-28147	IntCal13	16345.00	16085.65	16604.35
Altamira	13570	190	AMS	GifA-91178	IntCal13	16368.50	15521.58	17215.43
El Vellon	13570	70	AMS	Beta-245813	IntCal13	16374.00	16046.25	16701.75
El Castillo	13570	130	AMS	GifA-95108	IntCal13	16394.50	15798.38	16990.63
El Castillo	13570	130	AMS	GifA-95226	IntCal13	16394.50	15798.38	16990.63
Isturitz	13605	65	AMS	OxA-19838	IntCal13	16424.00	16106.70	16741.30
Gonnersdorf	13610	80	AMS	OxA-10201	IntCal13	16448.00	16061.35	16834.65
La Garma	13610	100	AMS	OxA-8722	IntCal13	16457.50	15982.03	16932.98
Espalugue	13630	60	AMS	OxA-28087	IntCal13	16459.50	16163.58	16755.43
Grappin	13640	60	AMS	Ly-3878/GrA	IntCal13	16474.50	16176.68	16772.33
Etiolles, Les Coudrays	13625	105	AMS	LYON-1894	IntCal13	16475.50	15983.88	16967.13
Cova Fosca	13660	50	AMS	Beta-187224	IntCal13	16495.00	16238.50	16751.50
Cova Gran de Santa Linya	13660	50	AMS	Beta-187424	IntCal13	16495.00	16238.50	16751.50
Klithi	13640	100	AMS	OxA-2331	IntCal13	16497.00	16026.75	16967.25
Laa 2	13665	60	AMS	OxA-26673	IntCal13	16512.50	16208.03	16816.98
El Miron, Burial area	13660	70	AMS	GX-22703	IntCal13	16516.00	16164.50	16867.50
Dzierzyslaw 35	13700	350	AMS	Ki-8951	IntCal13	16520.00	15164.35	17875.65
Bedeilhac	13660	100	AMS	LYON-428	IntCal13	16522.00	16052.70	16991.30
Kesslerloch	13670	100	AMS	OxA-5750	IntCal13	16533.50	16064.68	17002.33
Kamennaya Balka II	13660	180	AMS	OxA-778	IntCal13	16540.50	15748.68	17332.33
Bedeilhac	13680	155	AMS	LYON-425	IntCal13	16543.00	15852.35	17233.65
Asprochaliko	14000	600	AMS	OxA-776	IntCal13	16556.00	14308.30	18803.70
Cendres	13690	120	AMS	Beta-118022	IntCal13	16557.50	16017.43	17097.58
El Castillo	13710	140	AMS	GifA-98152	IntCal13	16584.00	15962.70	17205.30
El Miron, Burial area	13710	70	AMS	GX-32381	IntCal13	16584.50	16226.83	16942.18
Covaciella	13710	180	AMS	GifA-95362	IntCal13	16600.00	15805.80	17394.20
Bedeilhac	13725	100	AMS	LYON-427	IntCal13	16600.00	16131.65	17068.35
Käsloch, Kasloch	13760	45	AMS	ETH-39770	IntCal13	16633.50	16363.23	16903.78

Etxeberri, Etcheberri'ko Karbia, Etxeberriko Kharbea	13770	60	AMS	Beta-284731	IntCal13	16649.50	16323.18	16975.83
Bistricioara Lutarie Shore (Mal)	13768	79	AMS	Erl-11856	IntCal13	16653.50	16262.58	17044.43
Abrigo de Buendia	13790	50	AMS	Beta-246578	IntCal13	16673.00	16383.25	16962.75
kalavan 1	13800	60	AMS	Poz-19664	IntCal13	16684.50	16357.23	17011.78
Abri Gay	13795	100	AMS	LYON-1543	IntCal13	16692.00	16224.60	17159.40
La Garenne-Blanchard	13780	150	AMS	GifA-102581	IntCal13	16702.50	16027.53	17377.48
Cougnac	13810	210	AMS	GifA-92500	IntCal13	16704.50	15827.18	17581.83
Gonnersdorf	13810	90	AMS	OxA-10200	IntCal13	16705.50	16272.78	17138.23
La Fru	13810	110	AMS	LYON-89/OxA-4937	IntCal13	16716.00	16207.75	17224.25
Afontova Gora 2	13810	35	AMS	UCIAMS-79661	IntCal13	16718.00	16505.20	16930.80
Gorham's Cave	13820	50	AMS	Beta-196780	IntCal13	16718.00	16437.75	16998.25
La Garma	13810	160	AMS	AA-45585	IntCal13	16734.50	16030.08	17438.93
Dzrucula	13830	100	AMS	RTA-3278	IntCal13	16736.00	16263.85	17208.15
Boila	13810	130	AMS	OxA-5246	IntCal13	16736.50	16132.78	17340.23
Carriot	13820	120	AMS	GifA-93081	IntCal13	16747.50	16184.63	17310.38
Kesslerloch	13858	55	AMS	KIA-11828	IntCal13	16772.50	16480.38	17064.63
Afontova Gora 2	13870	80	AMS	AA-68664	IntCal13	16774.50	16369.33	17179.68
La Garma	13860	100	AMS	OxA-7181	IntCal13	16783.00	16293.75	17272.25
Kaminnaia, Kaminnaya	13850	140	AMS	AA-38042	IntCal13	16785.00	16147.55	17422.45
Gorham's Cave	13870	40	AMS	Beta-181896	IntCal13	16795.50	16568.93	17022.08
Chaves (Cendres according to Villaverde 1995)	13890	80	AMS	LYON-3291 (Pozà	IntCal13	16802.50	16395.43	17209.58
Eliseevichi 1 - Yeliseevitichi 1	13905	55	AMS	KIA-18760	IntCal13	16838.00	16551.10	17124.90
Isturitz, Saint-Martin	13910	70	AMS	OxA-19830	IntCal13	16842.00	16487.65	17196.35
El Castillo	13900	130	AMS	GifA-98155	IntCal13	16845.50	16245.58	17445.43
Kamienczyk	13920	130	AMS	AA-38044	IntCal13	16866.50	16267.53	17465.48
Altamira	13940	170	AMS	GifA-91179	IntCal13	16879.50	16152.28	17606.73
Klithi	13940	130	AMS	OxA-2834	IntCal13	16886.00	16286.55	17485.45
Chiliomodi	13940	140	AMS	GifA-95230	IntCal13	16887.50	16258.13	17516.88
Klithi	13940	110	AMS	OxA-3941	IntCal13	16888.50	16347.48	17429.53
Campalou	13940	70	AMS	LYON-2212/GrA-23940	IntCal13	16892.00	16532.90	17251.10
Afontova Gora 2, Old Excavation CL C3	13970	80	AMS	AA-68663	IntCal13	16948.50	16531.93	17365.08
Isteiner Klotz	13980	65	AMS	OxA-26679	IntCal13	16961.50	16611.43	17311.58
Eliseevichi 1 - Yeliseevitichi 1	14100	400	AMS	GIN-4139	IntCal13	16966.00	15439.35	18492.65

Dobranichevka - Dobranitchevka Dobranichivka	13990	90	AMS	OxA-12108	IntCal13	16970.50	16515.93	17425.08
Coimbre	14000	60	AMS	Beta-367727	IntCal13	16991.50	16662.33	17320.68
La Fru	14060	130	AMS	LYON-130	IntCal13	17022.50	16426.38	17618.63
La Fru	14060	130	AMS	OxA-5260/LYON-130	IntCal13	17022.50	16426.38	17618.63
Cosquer	14050	180	AMS	GifA-96101	IntCal13	17030.00	16254.80	17805.20
Klithi	14060	200	AMS	OxA-750	IntCal13	17030.50	16198.78	17862.23
La Garma	14050	110	AMS	OxA-8721	IntCal13	17031.50	16515.18	17547.83
Bondi Cave	14050	90	AMS	SacA-12065	IntCal13	17043.00	16600.30	17485.70
La Garenne Grand Abri	14070	100	AMS	ETH-26103	IntCal13	17063.00	16587.05	17538.95
El Castillo	14090	150	AMS	GifA-98151	IntCal13	17065.50	16385.78	17745.23
kalavan 1	14060	70	AMS	Poz-19665	IntCal13	17073.50	16709.18	17437.83
Altamira inner vestibule	14070	70	AMS	GrA-27777	IntCal13	17090.50	16732.83	17448.18
Barjac-Issirac	14110	150	AMS	GifA-95074	IntCal13	17097.00	16413.95	17780.05
Gontsy, Gintsy	14110	120	AMS	OxA-6729	IntCal13	17102.00	16560.50	17643.50
Isturitz, Saint-Martin	14075	60	AMS	OxA-19832	IntCal13	17114.00	16805.25	17422.75
Gontsy, Gintsy	14120	90	AMS	OxA-7387	IntCal13	17135.50	16709.43	17561.58
Campagnol des Neiges	14100	70	AMS	LYON-2211/GrA-23730	IntCal13	17136.50	16795.93	17477.08
Kent's Cavern	14140	110	AMS	OxA-2845	IntCal13	17146.00	16646.30	17645.70
Isturitz, Grande Salle	14110	60	AMS	OxA-19831	IntCal13	17165.00	16872.40	17457.60
Kesslerloch	14150	100	AMS	OxA-5749	IntCal13	17167.00	16710.05	17623.95
Klithi	14200	200	AMS	OxA-749	IntCal13	17167.50	16349.08	17985.93
Gontsy, Hontsy	14180	110	AMS	OxA-6601	IntCal13	17202.50	16709.93	17695.08
Afontova Gora 2	14140	60	AMS	GrA-5553	IntCal13	17208.00	16929.65	17486.35
Espalugue	14145	65	AMS	OxA-26675	IntCal13	17209.00	16911.65	17506.35
Dzierzyslaw 35	14150	70	AMS	Poz-10136	IntCal13	17209.50	16890.78	17528.23
Arlanpe	14150	60	AMS	Beta-287336	IntCal13	17221.00	16946.45	17495.55
Combe Saunière	14260	200	AMS	OxA-768	IntCal13	17240.00	16420.15	18059.85
Altamira	14250	180	AMS	GifA-91330	IntCal13	17244.50	16505.88	17983.13
Afontova Gora 2	14180	60	AMS	GrA-5554	IntCal13	17256.00	16984.30	17527.70
Grappin	14180	50	AMS	Ly-4668/GrA	IntCal13	17259.50	17024.38	17494.63
Afontova Gora 2	14200	60	AMS	GrA-5556	IntCal13	17279.50	17009.23	17549.78
Granne	14200	50	AMS	Ly-4866	IntCal13	17281.50	17048.28	17514.73
Cougnac	14290	180	AMS	GifA-89250	IntCal13	17298.50	16565.58	18031.43
Eliseevichi 1 - Yeliseevitichi 1	14240	120	AMS	GIN-5475	IntCal13	17303.00	16772.90	17833.10

Boila	14310	200	AMS	Beta-109187	IntCal13	17321.50	16509.73	18133.28
Gontsy, Gintsy	14250	110	AMS	OxA-5934	IntCal13	17331.00	16846.50	17815.50
Klithi	14290	140	AMS	OXA-2970	IntCal13	17334.50	16746.93	17922.08
Croze a Gondran	14260	70	AMS	Ly-638/GrA-9704	IntCal13	17345.50	17041.03	17649.98
Altamira	14330	190	AMS	GifA-91181	IntCal13	17352.00	16581.55	18122.45
Gontsy, Gintsy	14350	300	AMS	GIN-2595	IntCal13	17359.50	16214.28	18504.73
Gontsy, Gintsy	14280	100	AMS	OxA-8409	IntCal13	17386.00	16953.75	17818.25
Abrigo de Buendia	14315	55	AMS	OxA-28280	IntCal13	17414.00	17164.15	17663.85
Kesslerloch	14330	110	AMS	OxA-10238	IntCal13	17433.50	16977.03	17889.98
Bondi Cave	14330	90	AMS	SacA-12064	IntCal13	17445.00	17048.85	17841.15
Kostenki (Kostienki) 14 (Markina Gora)	14355	120	AMS	AA-4798	IntCal13	17451.00	16969.35	17932.65
Kamennaya Balka II	14340	70	AMS	GrA-21567	IntCal13	17458.00	17134.05	17781.95
Altamira	14410	200	AMS	GifA-91249	IntCal13	17465.00	16653.70	18276.30
Dobiegniewo 4	14355	90	AMS	GrA-22472	IntCal13	17471.00	17078.65	17863.35
Calsos	14370	90	AMS	OxA-8031	IntCal13	17487.00	17097.50	17876.50
Ekain	14440	230	AMS	GifA-96115	IntCal13	17488.00	16576.00	18400.00
Gonnersdorf	14380	100	AMS	OxA-10239	IntCal13	17490.00	17072.00	17908.00
Abrigo de Buendia	14380	90	AMS	UtC-4006	IntCal13	17496.50	17108.43	17884.58
Gontsy, Gintsy	14400	110	AMS	OxA-5933	IntCal13	17503.50	17059.38	17947.63
La Cimante	14390	70	AMS	GrA-9713/LYON-644	IntCal13	17522.50	17201.88	17843.13
Gontsy, Gintsy	14420	100	AMS	OxA-7609	IntCal13	17530.00	17119.60	17940.40
Altamira	14480	250	AMS	GifA-90057	IntCal13	17531.50	16553.48	18509.53
Igue du Gral	14460	130	AMS	Ly-16388	IntCal13	17566.00	17059.65	18072.35
Altamira	14520	260	AMS	GifA-90047	IntCal13	17570.00	16570.60	18569.40
Baborów 12	14800	1150	AMS	OxA-1212	IntCal13	17573.00	13782.50	21363.50
Kniegrotte	14470	140	AMS	OxA-4851	IntCal13	17582.00	17037.65	18126.35
Forbes Quarry	14440	70	AMS	GrA-25979	IntCal13	17582.50	17278.98	17886.03
Dufaure	14640	320	AMS	AA-3029	IntCal13	17655.50	16495.08	18815.93
Abrigo de Buendia	14500	60	AMS	Beta-246579	IntCal13	17673.00	17436.45	17909.55
Abrigo 6 del Humo	14500	50	AMS	Beta-377746	IntCal13	17677.00	17469.90	17884.10
Cendres	14510	50	AMS	Beta-287539	IntCal13	17686.50	17480.83	17892.18
Abrigo de Buendia	14515	55	AMS	OxA-28278	IntCal13	17689.00	17469.55	17908.45
Gontsy, Gintsy	14550	150	AMS	OxA-5932	IntCal13	17691.00	17099.15	18282.85
Grappin	14520	50	AMS	Ly-4871/GrA	IntCal13	17695.50	17490.78	17900.23
Abrigo de Buendia	14530	50	AMS	Beta-246580	IntCal13	17704.00	17500.70	17907.30

Klithi	14570	130	AMS	OxA-3732	IntCal13	17720.50	17199.43	18241.58
Laa 2	14570	65	AMS	OxA-26672	IntCal13	17735.50	17493.73	17977.28
La Paloma	14600	160	AMS	OxA-974	IntCal13	17741.00	17122.55	18359.45
Gontsy, Gintsy	14600	200	AMS	OxA-717	IntCal13	17743.50	16984.93	18502.08
Gontsy, Hontsy	14590	120	AMS	OxA-6602	IntCal13	17750.50	17271.23	18229.78
Abrigo de Buendia	14595	55	AMS	OxA-28275	IntCal13	17761.50	17551.08	17971.93
Karain B	14600	100	AMS	OxA-8406	IntCal13	17774.50	17404.48	18144.53
El Miron, Burial area	14620	80	AMS	GX-22347	IntCal13	17791.50	17495.58	18087.43
Abrigo de Buendia	14635	55	AMS	OxA-28276	IntCal13	17803.00	17593.05	18012.95
Bignalats	14635	70	AMS	OxA-28121	IntCal13	17804.50	17540.88	18068.13
Gonnersdorf	14620	100	AMS	OxA-8368	IntCal13	17805.50	17430.73	18180.28
Isturitz	14640	50	AMS	GrA-45332 IST 3-53	IntCal13	17808.00	17614.20	18001.80
Altamira	14650	140	AMS	GifA-96059	IntCal13	17810.50	17268.53	18352.48
Chufín	14700	250	AMS	OxA-715	IntCal13	17816.50	16915.43	18717.58
Abrigo de Buendia	14660	60	AMS	OxA-29342	IntCal13	17832.00	17601.15	18062.85
Altamira	14710	200	AMS	GifA-91254	IntCal13	17861.00	17118.10	18603.90
Gontsy, Gintsy	14670	110	AMS	OxA-6142	IntCal13	17871.50	17452.08	18290.93
Kamenka B	14670	105	AMS	AA-4797	IntCal13	17872.00	17468.25	18275.75
Abrigo de Buendia	14690	80	AMS	Beta-246581	IntCal13	17883.50	17564.78	18202.23
Brinzeni I, Brynzeny 1	14700	130	AMS	OxA-4120	IntCal13	17898.00	17414.45	18381.55
Kamennaya Balka II	14730	70	AMS	GrA-1791	IntCal13	17928.50	17639.23	18217.78
Combe Saunière	14770	200	AMS	OxA-770	IntCal13	17929.50	17192.78	18666.23
Combe Saunière	14800	240	AMS	OxA-769	IntCal13	17933.50	17091.33	18775.68
Isturitz	14750	50	AMS	Gra-45328	IntCal13	17939.00	17736.65	18141.35
El Castillo	14740	140	AMS	GifA-98156	IntCal13	17948.50	17427.43	18469.58
Dzierzyslaw 35	14850	280	AMS	Ki-8997	IntCal13	17962.00	17017.70	18906.30
Kamennaya Balka II	14760	90	AMS	GrA-21494	IntCal13	17964.00	17606.80	18321.20
El Miron, Burial area	14760	70	AMS	OxA-22091	IntCal13	17966.00	17672.45	18259.55
Cova Gran de Santa Linya	14760	70	AMS	Beta-259273	IntCal13	17966.00	17672.45	18259.55
El Miron, Burial area	14795	75	AMS	OxA-22092	IntCal13	18002.50	17695.18	18309.83
Gruta Nova da Columbeira	14800	120	AMS	KN-5597	IntCal13	18011.50	17553.13	18469.88
Altamira	14800	150	AMS	GifA-96060	IntCal13	18013.50	17466.78	18560.23
Brno-Bohunice B2002	14820	120	AMS	GrA-20002	IntCal13	18035.00	17576.15	18493.85
Altamira	14820	130	AMS	GifA-96071	IntCal13	18035.00	17543.85	18526.15
El Pendo	14830	170	AMS	OxA-977	IntCal13	18039.00	17433.85	18644.15
La Garenne Grand Abri	14840	100	AMS	ETH-29157	IntCal13	18053.00	17662.55	18443.45

Kamennaya Balka II	14850	80	AMS	GrA-964	IntCal13	18063.50	17750.48	18376.53
Kamennaya Balka II	14850	80	AMS	GrA-21568	IntCal13	18063.50	17750.48	18376.53
Abrigo de Buendia	14830	50	AMS	Beta-246582	IntCal13	18064.50	17864.53	18264.48
Cendres	14850	100	AMS	Beta-118023	IntCal13	18065.00	17674.55	18455.45
Abrigo de Buendia	14840	50	AMS	Beta-212776	IntCal13	18075.00	17874.55	18275.45
Abrigo de Buendia	14845	55	AMS	OxA-28777	IntCal13	18081.00	17864.40	18297.60
El Miron, Burial area	14850	60	AMS	GX-27114	IntCal13	18085.00	17854.15	18315.85
Grappin	14850	50	AMS	Ly-4869/GrA	IntCal13	18085.00	17884.55	18285.45
Altamira III	14910	60	AMS	GrA-32766	IntCal13	18140.00	17910.10	18369.90
Grappin	14940	50	AMS	Ly-4867/GrA	IntCal13	18163.50	17959.73	18367.28
El Mentidero	14930	70	AMS	OxA-22089	IntCal13	18169.50	17902.08	18436.93
Combe Saunière	14990	220	AMS	OxA-481	IntCal13	18173.50	17455.78	18891.23
Cougnac	15000	200	AMS	GifA-90019	IntCal13	18191.50	17525.08	18857.93
Abrigo de Buendia	14960	60	AMS	OxA-29343	IntCal13	18192.50	17951.68	18433.33
Kamennaya Balka II	14950	80	AMS	GrA-17964	IntCal13	18196.50	17893.93	18499.08
Kesslerloch	15020	180	AMS	OxA-10298	IntCal13	18218.00	17607.15	18828.85
La Garenne Grand Abri	14980	100	AMS	ETH-29154	IntCal13	18226.00	17865.00	18587.00
Barma Grande	14990	80	AMS	Beta-63510 CAMS-7641	IntCal13	18235.00	17927.20	18542.80
Kamennaya Balka II	15000	90	AMS	GrA-21497	IntCal13	18244.00	17909.60	18578.40
Altamira inner vestibule	15050	180	AMS	GifA-96062	IntCal13	18246.00	17638.00	18854.00
La Garenne-Blanchard	15010	90	AMS	ETH-28494	IntCal13	18252.00	17917.60	18586.40
Gvardjilas-Klde, Gwardzilas Klde	15010	110	AMS	OxA-7856	IntCal13	18256.00	17864.60	18647.40
Isturitz	15020	70	AMS	OxA-28083	IntCal13	18258.00	17973.95	18542.05
La Garenne Grand Abri	15020	100	AMS	ETH-29158	IntCal13	18263.50	17901.08	18625.93
La Garenne-Blanchard	15050	90	AMS	ETH-28493	IntCal13	18287.50	17948.83	18626.18
Chimeneas	15070	140	AMS	GifA-95194	IntCal13	18299.00	17825.90	18772.10
Alonse	15069	90	AMS	GrA-21536	IntCal13	18305.00	17963.95	18646.05
Combe Saunière	15120	200	AMS	OxA-756	IntCal13	18306.50	17650.53	18962.48
La Garenne Grand Abri	15070	100	AMS	ETH-29156	IntCal13	18310.00	17941.40	18678.60
La Garenne Grand Abri	15080	100	AMS	ETH-29155	IntCal13	18318.50	17948.48	18688.53
Kovrizhka-3, Kovrijka III	15100	90	AMS	AA-59603	IntCal13	18333.50	17988.18	18678.83
Arlanpe	15100	60	AMS	Beta-316472	IntCal13	18334.50	18082.28	18586.73
Lapa do Suao	15110	90	AMS	Gx-27593	IntCal13	18342.50	17996.23	18688.78
Kamennaya Balka II	15120	110	AMS	GrA-21619	IntCal13	18351.00	17956.75	18745.25
Cova Gran de Santa Linya	15120	70	AMS	Beta-265984	IntCal13	18352.00	18067.95	18636.05
Isturitz	15130	110	AMS	OxA-19836	IntCal13	18358.50	17963.78	18753.23

El Miron, Burial area	15120	40	AMS	UGAMS-7799	IntCal13	18375.50	18201.18	18549.83
Combe Saunière	15190	200	AMS	OxA-751	IntCal13	18390.00	17725.00	19055.00
Combe Saunière	15200	200	AMS	OxA-754	IntCal13	18407.50	17737.28	19077.73
El Miron, Burial area	15220	100	AMS	GX-23416	IntCal13	18438.00	18075.10	18800.90
Klithi	15220	200	AMS	OxA-1091	IntCal13	18439.00	17764.50	19113.50
El Miron, Burial area	15220	300	AMS	GX-23393	IntCal13	18471.00	17464.95	19477.05
Laczki	15290	150	AMS	GifA-95047	IntCal13	18496.00	17994.40	18997.60
Grappin	15260	70	AMS	Ly-3877/GrA	IntCal13	18516.00	18269.00	18763.00
Grappin	15335	115	AMS	Ly-3162/Poz	IntCal13	18547.00	18156.55	18937.45
Igue du Gral	15350	120	AMS	LYON-3086 Poz-	IntCal13	18561.50	18155.38	18967.63
Grappin	15335	100	AMS	LYON-3161 (Poz)	IntCal13	18567.00	18233.55	18900.45
Fontareches	15325	70	AMS	OxA-23046	IntCal13	18577.00	18337.60	18816.40
Kamennaya Balka II	15360	80	AMS	GrA-21708	IntCal13	18608.00	18340.10	18875.90
El Miron, Burial area	15370	80	AMS	GX-32654	IntCal13	18616.00	18349.05	18882.95
Altamira inner vestibule	15420	70	AMS	GrA-30329	IntCal13	18668.00	18438.10	18897.90
Ciemna, sector CO	15460	75	AMS	OxA-27869	IntCal13	18705.00	18466.55	18943.45
Altamira	15440	200	AMS	GifA-91185	IntCal13	18718.50	18000.78	19436.23
Klithi	15460	260	AMS	OxA-2328	IntCal13	18737.00	17877.25	19596.75
Combe Saunière	15480	210	AMS	OxA-459	IntCal13	18753.50	18010.13	19496.88
Altamira inner vestibule	15580	70	AMS	GrA-30326	IntCal13	18836.50	18609.93	19063.08
Kamennaya Balka II	15590	80	AMS	GrA-17937	IntCal13	18866.00	18592.40	19139.60
Kamennaya Balka II	15590	80	AMS	GrA-17957	IntCal13	18866.00	18592.40	19139.60
Klithi	15580	380	AMS	OxA-2329	IntCal13	18874.50	17622.88	20126.13
Cosquer	15570	150	AMS	GifA-92446	IntCal13	18880.50	18339.48	19421.53
Kamennaya Balka II	15610	80	AMS	GrA-17349	IntCal13	18886.50	18609.58	19163.43
Kamennaya Balka II	15610	80	AMS	GrA-18349	IntCal13	18886.50	18609.58	19163.43
El Miron, Burial area	15610	90	AMS	OxA-22093	IntCal13	18890.00	18583.15	19196.85
Cendres	15630	60	AMS	Beta-287540	IntCal13	18894.50	18692.63	19096.38
Fanciulli	15615	100	AMS	LTL-13785A	IntCal13	18897.00	18558.80	19235.20
Klithi	15600	160	AMS	OxA-1155	IntCal13	18911.00	18341.00	19481.00
Brno-Videnska street (Konevova ul.)	15650	70	AMS	GdA-459	IntCal13	18926.00	18679.95	19172.05
Cha das Lameiras	15630	120	AMS	LYON-1293	IntCal13	18941.50	18504.98	19378.03
Coimbre	15710	60	AMS	Beta-340005	IntCal13	18982.00	18764.45	19199.55
El Miron, Burial area	15740	40	AMS	MAMS-7217	IntCal13	19000.00	18840.40	19159.60
Kamennaya Balka II	15760	100	AMS	GrA-21711	IntCal13	19082.50	18705.83	19459.18
Combe Saunière	15750	230	AMS	OxA-410	IntCal13	19092.50	18295.93	19889.08

Karain B	15860	100	AMS	OxA-8407	IntCal13	19167.50	18794.63	19540.38
Kamennaya Balka II	15900	90	AMS	GrA-21479	IntCal13	19199.50	18851.33	19547.68
Cipolliane, Shelter C	15960	80	AMS	Beta-171353	IntCal13	19248.50	18926.93	19570.08
Altamira II	15910	230	AMS	I-12012	IntCal13	19257.00	18478.00	20036.00
Klithi	15950	120	AMS	OxA-2332	IntCal13	19257.00	18819.05	19694.95
Gvard	15960	120	AMS	OxA-7855	IntCal13	19269.00	18827.25	19710.75
Klithi	15960	130	AMS	OxA-2330	IntCal13	19284.50	18806.18	19762.83
La Celle	16020	80	AMS	OxA-12053	IntCal13	19299.50	18975.08	19623.93
Cendres	16030	60	AMS	Beta-287541	IntCal13	19315.00	19052.80	19577.20
Klithi	15960	200	AMS	OxA-1746	IntCal13	19315.50	18626.28	20004.73
Bois des Brousses	16060	80	AMS	OxA-22040	IntCal13	19347.00	19015.45	19678.55
El Miron, Burial area	16050	40	AMS	UG-3364r	IntCal13	19364.50	19184.48	19544.53
Cap Blanc	16050	130	AMS	GifA-10084(SacA-19715)	IntCal13	19389.00	18883.60	19894.40
El Miron, Burial area	16080	40	AMS	UG-3366r	IntCal13	19393.00	19215.35	19570.65
Kosarnika	16050	170	AMS	GrA-4209	IntCal13	19398.50	18788.13	20008.88
Gandil	16070	160	AMS	GifA-93238	IntCal13	19413.00	18824.00	20002.00
Cova Beneito	16140	140	AMS	Ua-32243	IntCal13	19472.00	18929.55	20014.45
Klithi	16140	150	AMS	OxA-2972	IntCal13	19475.00	18908.80	20041.20
Kogelstein	16205	55	AMS	ETH-43310	IntCal13	19549.50	19297.28	19801.73
Klithi	16250	170	AMS	OxA-2327	IntCal13	19597.00	18949.10	20244.90
Goyet 3	16320	140	AMS	OxA-6592	IntCal13	19667.00	19114.10	20219.90
Fontfaures	16338	153	AMS	Erl-8928	IntCal13	19691.00	19083.95	20298.05
Klithi	16300	400	AMS	OxA-136	IntCal13	19738.00	18414.65	21061.35
Klithi	16300	400	AMS	OxA-137	IntCal13	19738.00	18414.65	21061.35
Cierro	16360	55	AMS	OxA-27871	IntCal13	19758.50	19532.88	19984.13
Laa 2	16380	80	AMS	OxA-27395	IntCal13	19775.50	19478.63	20072.38
Cosquer	16390	260	AMS	GifA-92423	IntCal13	19783.00	18862.45	20703.55
Gorham's Cave	16420	60	AMS	Beta-181893	IntCal13	19810.50	19569.68	20051.33
Coimbre	16440	70	AMS	Beta-367726	IntCal13	19832.00	19560.30	20103.70
Bois de la Vente	16440	80	AMS	OxA-22941	IntCal13	19838.00	19535.90	20140.10
El Miron, Burial area	16460	50	AMS	GX-28209	IntCal13	19843.50	19626.43	20060.58
Altamira	16480	210	AMS	GifA-96061	IntCal13	19850.50	19061.53	20639.48
Kharyaska-2	16460	170	AMS	SNU03-366	IntCal13	19853.50	19203.23	20503.78
Klithi	16490	220	AMS	OxA-1092	IntCal13	19864.50	19042.28	20686.73
El Miron, Burial area	16520	40	AMS	UGA-10628	IntCal13	19916.00	19740.25	20091.75
Fontgrasse	16518	133	AMS	Erl-8926	IntCal13	19952.00	19445.65	20458.35

Etxeberri, Etcheberri'ko Karbia, Etxeberriko Kharbea	16570	60	AMS	Beta-284733	IntCal13	19975.50	19715.68	20235.33
La Boja	16580	70	AMS	VERA-5788	IntCal13	19989.50	19684.08	20294.93
Gandil	16580	160	AMS	GifA-96350	IntCal13	20006.50	19415.13	20597.88
El Miron, Burial area	16600	90	AMS	GX-30398	IntCal13	20026.00	19639.35	20412.65
El Miron, Burial area	16600	40	AMS	UG-3365r	IntCal13	20030.00	19869.45	20190.55
Brinzeni I, Brynzeny 1	16600	160	AMS	OxA-4123	IntCal13	20035.00	19448.85	20621.15
Klithi	16650	190	AMS	OxA-2971	IntCal13	20090.50	19384.18	20796.83
Gandil	16700	160	AMS	GifA-96351	IntCal13	20154.50	19557.43	20751.58
Kalavan 2	16740	130	AMS	UG-2296	IntCal13	20171.50	19663.73	20679.28
Cova Gran de Santa Linya	16800	80	AMS	Beta-233606	IntCal13	20273.50	19968.08	20578.93
Fontgrasse	16838	143	AMS	Erl-8925	IntCal13	20302.50	19745.33	20859.68
Grappin	16840	110	AMS	LYON-3160 (Poz)	IntCal13	20322.00	19906.85	20737.15
El Castillo	16850	220	AMS	OxA-971	IntCal13	20364.00	19547.00	21181.00
Balma de la Griera	16890	200	AMS	GrA-6486	IntCal13	20388.00	19624.20	21151.80
Geissenklosterle	16940	180	AMS	OxA-5156	IntCal13	20438.50	19737.88	21139.13
El Miron, Burial area	16960	80	AMS	GX-25858	IntCal13	20449.50	20116.53	20782.48
Cueva Major Atapuerca	16980	80	AMS	Beta-209452	IntCal13	20473.00	20137.65	20808.35
Gandil	16950	360	AMS	GifA-92385	IntCal13	20477.50	19161.28	21793.73
La Boja	16990	70	AMS	VERA-5364a	IntCal13	20484.50	20186.68	20782.33
El Castillo	16980	180	AMS	GifA-98153	IntCal13	20505.50	19801.08	21209.93
Gandil	16980	170	AMS	GifA-96416	IntCal13	20506.00	19851.45	21160.55
El Miron, Burial area	17050	60	AMS	GX-25857	IntCal13	20565.00	20310.40	20819.60
Arlanpe	17070	80	AMS	Beta-238178	IntCal13	20583.00	20249.55	20916.45
Coimbre	17110	80	AMS	Beta-297106	IntCal13	20636.00	20308.25	20963.75
Fontgrasse	17100	144	AMS	Erl-8927	IntCal13	20655.50	20072.68	21238.33
Fontgrasse	17100	144	AMS	Erl-8937	IntCal13	20655.50	20072.68	21238.33
Arlanpe	17160	70	AMS	Beta-231389	IntCal13	20706.50	20428.63	20984.38
Kosautsy - Cosautsi - Cosaoutsy	17130	180	AMS	GrA-5217	IntCal13	20716.50	20010.18	21422.83
Altamira inner vestibule	17200	90	AMS	GrA-32760	IntCal13	20760.00	20395.20	21124.80
El Miron, Burial area	17230	40	AMS	UG-15182	IntCal13	20776.50	20600.28	20952.73
El Miron, Burial area	17240	40	AMS	UG-15180	IntCal13	20787.50	20610.33	20964.68
Balma del Gai	17200	180	AMS	GrA-95072	IntCal13	20796.00	20075.90	21516.10
Cendres	17230	130	AMS	Beta-118024	IntCal13	20815.00	20269.70	21360.30
Kostenki (Kostienki) 14 (Markina Gora)	17200	210	AMS	OxA-6436	IntCal13	20815.50	19998.98	21632.03
Arka Herzsanet	17260	70	AMS	Beta-261388	IntCal13	20828.00	20537.30	21118.70

Gandil	17290	180	AMS	GifA-97307	IntCal13	20902.00	20166.70	21637.30
Gandil	17290	180	AMS	GifA-96305	IntCal13	20902.00	20166.70	21637.30
El Miron, Burial area	17400	80	AMS	GX-29439	IntCal13	21017.00	20649.35	21384.65
Dzerava skala	17400	180	AMS	Poz-7064	IntCal13	21047.50	20315.53	21779.48
La Boja	17430	70	AMS	VERA-5364b	IntCal13	21050.50	20718.48	21382.53
El Miron, Burial area	17400	270	AMS	GX-31194	IntCal13	21057.00	20044.30	22069.70
Gandil	17480	180	AMS	GifA-96417	IntCal13	21135.00	20432.00	21838.00
El Miron, Burial area	17620	40	AMS	UG-15181	IntCal13	21295.50	21077.48	21513.53
Cap Blanc	17640	160	AMS	GifA-10083(SacA-19714)	IntCal13	21296.00	20662.35	21929.65
Baume de Fontbe	17645	110	AMS	Ly-3290/GrA	IntCal13	21335.50	20855.28	21815.73
Combe Saunière	17700	290	AMS	OXA-488	IntCal13	21355.50	20314.78	22396.23
Gato-2	17700	70	AMS	GrA-42226	IntCal13	21414.00	21060.60	21767.40
Kurtak-4	17740	120	AMS	AA-68670	IntCal13	21425.00	20931.95	21918.05
Kosautsy - Cosautsi - Cosaoutsy	17780	90	AMS	GrA-7554	IntCal13	21480.00	21083.85	21876.15
Cosquer	17800	160	AMS	GifA-96075	IntCal13	21542.50	20866.58	22218.43
Kosautsy - Cosautsi - Cosaoutsy	17840	180	AMS	OxA-5257	IntCal13	21578.50	20843.68	22313.33
Kosautsy - Cosautsi - Cosaoutsy	17840	180	AMS	OxA-5236	IntCal13	21578.50	20843.68	22313.33
Blot 3	17850	80	AMS	LYON-1336	IntCal13	21582.50	21252.38	21912.63
Kosautsy - Cosautsi - Cosaoutsy	17900	200	AMS	OxA-5233	IntCal13	21614.50	20845.48	22383.53
Kosautsy - Cosautsi - Cosaoutsy	17900	180	AMS	OxA-5234	IntCal13	21634.00	20913.90	22354.10
Asprochaliko	18000	300	AMS	OxA-775	IntCal13	21697.00	20633.95	22760.05
Cosquer	18010	200	AMS	GifA-92419	IntCal13	21711.50	20973.83	22449.18
Gruta Nova da Columbeira	18000	185	AMS	KN-5596	IntCal13	21715.50	21011.08	22419.93
Kosautsy - Cosautsi - Cosaoutsy	18000	180	AMS	OxA-5237	IntCal13	21719.50	21027.43	22411.58
Kosautsy - Cosautsi - Cosaoutsy	18000	180	AMS	OxA-5235	IntCal13	21719.50	21027.43	22411.58
Kosautsy - Cosautsi - Cosaoutsy	18060	180	AMS	OxA-5238	IntCal13	21773.00	21098.50	22447.50
Bondi Cave	18010	140	AMS	SacA-12067	IntCal13	21782.50	21206.33	22358.68
Blot 3	18000	80	AMS	LYON-1337	IntCal13	21821.00	21459.05	22182.95
Kosautsy - Cosautsi - Cosaoutsy	18140	200	AMS	OxA-5247	IntCal13	21848.00	21130.75	22565.25
Abri Pataud	18040	80	AMS	GrA-37873	IntCal13	21876.00	21513.10	22238.90
Kosautsy - Cosautsi - Cosaoutsy	18140	165	AMS	AA-1231	IntCal13	21891.00	21306.75	22475.25
Fossellone	18160	240	AMS	UtC-11551	IntCal13	21891.50	21017.98	22765.03
Gato-2	18090	90	AMS	GrA-30683	IntCal13	21930.00	21542.40	22317.60
Ampelototos	18220	200	AMS	OxA-4894	IntCal13	21977.50	21269.28	22685.73
Kosautsy - Cosautsi - Cosaoutsy	18260	210	AMS	GrA-5218	IntCal13	22039.50	21287.58	22791.43
Gato Preto/Quartel dos Bombeiros	18260	130	AMS	GrA-22503	IntCal13	22050.50	21610.18	22490.83

Fuente del Pinar	18200	70	AMS	GX-27757	IntCal13	22076.50	21802.43	22350.58
Cobrante	18260	70	AMS	GrA-22439	IntCal13	22119.00	21851.10	22386.90
Aitzbitarte III Ext	18400	215	AMS	Ua-11150	IntCal13	22205.00	21455.45	22954.55
Kosautsy - Cosautsi - Cosaoutsy	18430	100	AMS	GrA-13291	IntCal13	22239.00	21897.00	22581.00
Gorham's Cave	18440	80	AMS	Beta-184042	IntCal13	22242.50	21957.03	22527.98
Chuntu rockshelter - Tchountou Ciuntu	18510	200	AMS	OxA-4125	IntCal13	22338.50	21648.33	23028.68
Altamira II	18540	320	AMS	GifA-90045	IntCal13	22361.00	21227.65	23494.35
Cosquer	18530	190	AMS	GifA-92492	IntCal13	22372.00	21722.20	23021.80
Kastelhohle-Nord	18530	150	AMS	OxA-9737	IntCal13	22388.00	21859.80	22916.20
Cobrante	18540	70	AMS	GrA-22438	IntCal13	22397.50	22183.28	22611.73
Kosautsy - Cosautsi - Cosaoutsy	18560	200	AMS	OxA-5256	IntCal13	22405.50	21724.83	23086.18
Bora Gran d'en Carreras	18600	140	AMS	LYON-4688	IntCal13	22445.00	21934.85	22955.15
Gato-2	18650	140	AMS	GrA-22505	IntCal13	22491.00	21983.70	22998.30
Amvrosievka	18620	220	AMS	OxA-4893	IntCal13	22518.50	21734.28	23302.73
Amvrosievka	18660	220	AMS	OxA-4895	IntCal13	22578.50	21804.73	23352.28
Amvrosievka	18700	240	AMS	OxA-4890	IntCal13	22615.00	21782.80	23447.20
Amvrosievka	18700	220	AMS	OxA-4892	IntCal13	22620.00	21847.65	23392.35
Cendres	18750	130	AMS	Beta-118027	IntCal13	22651.00	22236.80	23065.20
Altamira inner vestibule	18750	100	AMS	GrA-30324	IntCal13	22658.50	22341.68	22975.33
Cosquer	18760	220	AMS	GifA-92422	IntCal13	22671.50	21893.93	23449.08
Kosautsy - Cosautsi - Cosaoutsy	18780	200	AMS	OxA-5248	IntCal13	22683.00	21954.35	23411.65
Cosquer	18820	310	AMS	GifA-92417	IntCal13	22734.00	21671.90	23796.10
Gato-2	18850	100	AMS	GrA-30684	IntCal13	22741.00	22415.15	23066.85
Caldeirao	18840	200	AMS	OXA-2510	IntCal13	22743.00	22019.10	23466.90
Cosquer	18840	245	AMS	GifA-92416	IntCal13	22750.50	21906.43	23594.58
Amvrosievka	18860	220	AMS	OxA-4891	IntCal13	22761.00	21981.05	23540.95
Kosautsy - Cosautsi - Cosaoutsy	18860	200	AMS	OxA-5255	IntCal13	22768.50	22050.78	23486.23
Combe Saunière	18860	320	AMS	OxA-757	IntCal13	22779.00	21693.15	23864.85
Berelekh	18920	80	AMS	Beta-243743	IntCal13	22781.50	22488.43	23074.58
Krakow Spadzista	18950	90	AMS	Poz-51375	IntCal13	22821.50	22488.53	23154.48
Blot	18950	100	AMS	LYON-1335	IntCal13	22849.50	22472.83	23226.18
Kosautsy - Cosautsi - Cosaoutsy	18940	220	AMS	OxA-5249	IntCal13	22867.00	22109.85	23624.15
Grubgraben	18960	290	AMS	AA-1746	IntCal13	22897.00	21911.85	23882.15
Fariseu	19020	80	AMS	GrA-40167	IntCal13	22905.50	22557.33	23253.68
Karacharovo - Karatcharovo - Karacarovo	18960	180	AMS	OxA-8446	IntCal13	22927.50	22326.63	23528.38
Kosautsy - Cosautsi - Cosaoutsy	18980	220	AMS	OxA-5250	IntCal13	22936.50	22200.73	23672.28

Bordeneuve	19020	110	AMS	OxA-22315	IntCal13	22941.50	22497.38	23385.63
Kosautsy - Cosautsi - Cosaoutsy	18980	200	AMS	OxA-5254	IntCal13	22946.00	22284.80	23607.20
Antolinako Koba	19020	120	AMS	Beta-230284	IntCal13	22948.50	22480.63	23416.38
Fuente del Salín	19060	80	AMS	Beta-72393	IntCal13	22960.50	22595.23	23325.78
Altamira inner vestibule	19060	90	AMS	GrA-30325	IntCal13	22965.00	22566.00	23364.00
Kosautsy - Cosautsi - Cosaoutsy	19070	100	AMS	GrA-7557	IntCal13	22978.00	22549.55	23406.45
Bossats	19096	121	AMS	Erl-17854	IntCal13	23008.50	22524.48	23492.53
Kosautsy - Cosautsi - Cosaoutsy	19120	100	AMS	GrA-7555	IntCal13	23026.00	22596.60	23455.40
Kosautsy - Cosautsi - Cosaoutsy	19060	220	AMS	OxA-5251	IntCal13	23050.00	22317.55	23782.45
Kosautsy - Cosautsi - Cosaoutsy	19060	220	AMS	OxA-5252	IntCal13	23050.00	22317.55	23782.45
Kosautsy - Cosautsi - Cosaoutsy	19080	220	AMS	OxA-5253	IntCal13	23072.00	22338.60	23805.40
Finca Dona Martina	19180	90	AMS	VERA-5101bHS	IntCal13	23103.50	22723.98	23483.03
Kastelhohle-Nord	19200	150	AMS	OxA-9739	IntCal13	23117.00	22543.20	23690.80
El Buxú	19140	230	AMS	GifA-98154	IntCal13	23134.00	22371.15	23896.85
Brinzeni I, Brynzeny 1	19220	180	AMS	OxA-4118	IntCal13	23168.00	22503.95	23832.05
El Miron, Burial area	19230	50	AMS	UG-07216	IntCal13	23179.00	22948.15	23409.85
La Boja	19240	90	AMS	VERA-5365_2	IntCal13	23182.50	22825.78	23539.23
Cosquer	19200	240	AMS	GifA-92418	IntCal13	23189.00	22397.65	23980.35
Aitzbitarte III Ext	19230	200	AMS	Ua-24964	IntCal13	23190.00	22479.40	23900.60
Kiriaki (Parga)	19200	250	AMS	OxA-718	IntCal13	23191.00	22375.90	24006.10
Cabeco do Porto Marinho	19220	280	AMS	ICEN-691	IntCal13	23213.00	22315.25	24110.75
Balma Grande	19280	220	AMS	GifA-95073	IntCal13	23240.00	22477.15	24002.85
Cosquer	19290	340	AMS	GifA-98188	IntCal13	23268.00	22174.55	24361.45
Cosquer	19340	200	AMS	GifA-95135	IntCal13	23275.50	22545.43	24005.58
Bondi Cave	19360	120	AMS	Beta-2392225	IntCal13	23328.00	22864.40	23791.60
Aitzbitarte III Ext	19400	210	AMS	Ua-37960	IntCal13	23331.50	22569.13	24093.88
La Boja	19390	100	AMS	VERA-5365	IntCal13	23353.50	22954.98	23752.03
Azzura di Paina	19430	150	AMS	UtC-2043	IntCal13	23399.00	22837.55	23960.45
Kosautsy - Cosautsi - Cosaoutsy	19440	100	AMS	GrA-6746	IntCal13	23410.50	22999.63	23821.38
Cougnac	19500	270	AMS	GifA-91234	IntCal13	23457.00	22527.90	24386.10
Cosquer	19500	270	AMS	GifA-91324	IntCal13	23457.00	22527.90	24386.10
Cova Gran de Santa Linya	19500	90	AMS	Beta-195429	IntCal13	23470.50	23083.38	23857.63
Grotte des Gorges	19510	170	AMS	SacA-25148	IntCal13	23480.00	22863.45	24096.55
Combe Saunière	19490	350	AMS	OxA-752	IntCal13	23515.00	22399.70	24630.30
Asberg	19570	100	AMS	KIA-33773	IntCal13	23542.50	23125.93	23959.08
Kastelhohle-Nord	19620	140	AMS	OxA-9738	IntCal13	23590.50	23056.13	24124.88
Altamira inner vestibule	19630	80	AMS	GrA-32761	IntCal13	23655.50	23351.03	23959.98

Grotte du Renne, Arcy-sur-Cure	19680	160	AMS	OxA-6107 (LYON-599)	IntCal13	23660.50	23058.68	24262.33
Combe Saunière	19630	320	AMS	OxA-753	IntCal13	23689.50	22532.88	24846.13
Aitzbitarte III Ext	19715	235	AMS	Ua-18463	IntCal13	23695.00	22888.45	24501.55
Cosquer	19720	210	AMS	GifA-98186	IntCal13	23705.00	22964.00	24446.00
Cavallo	19685	75	AMS	OxA-21072	IntCal13	23716.50	23435.78	23997.23
Bistricioara-Lutarie III	19749	149	AMS	Erl-12851	IntCal13	23735.00	23168.80	24301.20
Aitzbitarte III Ext	19765	220	AMS	Ua-37959	IntCal13	23745.00	22980.25	24509.75
Abri Pataud	19700	350	AMS	OxA-688	IntCal13	23791.00	22530.35	25051.65
Cosquer	19740	340	AMS	GifA-98196	IntCal13	23819.00	22570.70	25067.30
Kozarnika	19770	270	AMS	GifA-10674	IntCal13	23847.50	22836.23	24858.78
Brinzeni I, Brynzeny 1	19780	260	AMS	OxA-4899	IntCal13	23858.00	22887.10	24828.90
Krakow Spadzista trench	19840	100	AMS	Poz-51334	IntCal13	23880.00	23512.35	24247.65
Kozarnika	19890	270	AMS	GifA-10673	IntCal13	24001.00	22975.00	25027.00
Caldeirao	19900	260	AMS	OxA-1939	IntCal13	24007.50	23009.53	25005.48
La Vina	19930	220	AMS	OxA-4092	IntCal13	24019.50	23145.03	24893.98
Coimbre	19980	70	AMS	Beta-322480	IntCal13	24033.50	23766.08	24300.93
Cueva Ambrosio	19950	210	AMS	GifA-95577	IntCal13	24044.00	23205.15	24882.85
Cueva Ambrosio	19950	210	AMS	Gif-A-95577	IntCal13	24044.00	23205.15	24882.85
Kastrelaki-Aetorraki	20000	80	AMS	Beta-132437	IntCal13	24051.00	23748.90	24353.10
Castlepook	19950	250	AMS	OxA-3604	IntCal13	24058.00	23081.40	25034.60
kalavan 1	20020	100	AMS	UGAMS-2296A	IntCal13	24066.00	23695.50	24436.50
Bajondillo	19990	480	AMS	MAD-2405	IntCal13	24093.00	22518.85	25667.15
Grotte XVI	20070	330	AMS	AA-2668	IntCal13	24202.00	23000.25	25403.75
Bondi Cave	20080	170	AMS	SacA-12066	IntCal13	24229.00	23549.75	24908.25
Brinzeni I, Brynzeny 1	20140	260	AMS	OxA-4898	IntCal13	24289.00	23324.75	25253.25
Krakow Spadzista, site C2	20200	350	AMS	OxA-635	IntCal13	24323.50	23077.58	25569.43
Cueva Ambrosio	20150	200	AMS	GifA-955767	IntCal13	24324.00	23538.35	25109.65
Cueva Ambrosio	20150	200	AMS	Gif-A-955767	IntCal13	24324.00	23538.35	25109.65
Azzura di Paina	20200	240	AMS	UtC-2697	IntCal13	24370.50	23481.78	25259.23
Abri Pataud	20400	600	AMS	OxA-580	IntCal13	24401.50	22592.23	26210.78
Grotte XVI	20230	270	AMS	AA-2669	IntCal13	24416.50	23429.93	25403.08
Grotte XVI	20280	220	AMS	AA-2992	IntCal13	24450.00	23616.85	25283.15
Abri Pataud	20400	450	AMS	OxA-373	IntCal13	24461.50	23029.38	25893.63
Castlepook	20300	210	AMS	OxA-3606	IntCal13	24470.50	23667.28	25273.73
Aitzbitarte III Ext	20290	260	AMS	Ua-11149	IntCal13	24480.50	23523.38	25437.63
Kostenki (Kostienki) 4 (Alexandrovskaya site)	20290	150	AMS	OxA-8310	IntCal13	24486.00	23866.60	25105.40

Kostenki (Kostienki) 14 (Markina Gora)	20315	200	AMS	AA-4800	IntCal13	24487.50	23714.68	25260.33
Brinzeni I, Brynzeny 1	20300	160	AMS	OxA-6999	IntCal13	24496.00	23845.25	25146.75
Grotte XVI	20410	380	AMS	AA-2991	IntCal13	24509.50	23231.28	25787.73
Castlepook	20360	220	AMS	OxA-4233	IntCal13	24546.00	23707.15	25384.85
Krakow Spadzista trench	20360	110	AMS	Poz-51333	IntCal13	24551.50	24057.03	25045.98
Cosquer	20370	260	AMS	GifA-92348	IntCal13	24557.50	23605.13	25509.88
Aitzbitarte III Ext	20405	130	AMS	Ua-11147	IntCal13	24604.50	24049.23	25159.78
Avdeikha	20640	630	AMS	OxA-370	IntCal13	24677.50	22761.83	26593.18
Aldingbourne Park	20510	150	AMS	Beta-203513	IntCal13	24705.00	24103.65	25306.35
Caldeirao	20530	270	AMS	OXA-2511	IntCal13	24711.00	23756.25	25665.75
La Baume	20640	110	AMS	VERA-5366HS	IntCal13	24848.00	24376.80	25319.20
Kostenki (Kostienki) 14 (Markina Gora)	20640	170	AMS	GrA-18230	IntCal13	24853.50	24182.33	25524.68
Kurtak-4	20690	240	AMS	AA-72146	IntCal13	24884.50	24036.63	25732.38
Chauvet	20790	340	AMS	GifA-98157	IntCal13	24912.50	23848.03	25976.98
Cueva del Higueral de Valleja	20780	80	AMS	OxA-12270	IntCal13	24996.00	24584.65	25407.35
High Lodge	20780	80	AMS	OxA-12370	IntCal13	24996.00	24584.65	25407.35
Krakow Spadzista trench	20770	120	AMS	Poz-51329	IntCal13	24997.00	24471.65	25522.35
Kostenki (Kostienki) 14 (Markina Gora)	20855	260	AMS	AA-4799	IntCal13	25008.00	24133.05	25882.95
Kostenki (Kostienki) 14 (Markina Gora)	20890	280	AMS	GrA-18231	IntCal13	25028.00	24113.15	25942.85
Blomkeberg	20810	140	AMS	LYON-1647	IntCal13	25030.00	24450.50	25609.50
La Boja	20830	110	AMS	VERA-5366_2	IntCal13	25051.50	24548.48	25554.53
La Cala	20900	150	AMS	OxA-7404	IntCal13	25110.00	24506.75	25713.25
Chuntu rockshelter - Tchountou Ciuntu	21000	220	AMS	OxA-4426	IntCal13	25159.50	24402.83	25916.18
Dzudzuana Cave	20980	150	AMS	RTT-3434	IntCal13	25175.50	24574.63	25776.38
Kostenki (Kostienki) 17 (Spitsynskaya site)	21020	180	AMS	OxA-7128	IntCal13	25196.00	24532.90	25859.10
La Boja	20980	120	AMS	VERA-5366	IntCal13	25206.50	24702.53	25710.48
Aveley	21100	400	AMS	OxA-623	IntCal13	25242.00	23997.50	26486.50
Bockstein-Torle	20990	120	AMS	KIA-8956	IntCal13	25243.00	24766.10	25719.90
Aitzbitarte III Ext	21130	290	AMS	Ua-1917	IntCal13	25244.50	24329.18	26159.83
La Boja	20980	110	AMS	VERA-5213	IntCal13	25276.50	24863.73	25689.28
Cosquer	21150	620	AMS	GifA-95372	IntCal13	25329.00	23441.35	27216.65
Dzudzuana Cave	21220	200	AMS	RTA-3433	IntCal13	25354.50	24671.93	26037.08
La Boja	21060	110	AMS	VERA-5213HS	IntCal13	25379.00	25001.85	25756.15

Balma a Collomb	21255	350	AMS	AA-8649	IntCal13	25403.50	24281.08	26525.93
Grotte du Renne, Arcy-sur-Cure	21150	160	AMS	OxA-21590	IntCal13	25405.00	24895.80	25914.20
Giurgiu - Malu Rosu	21140	120	AMS	GrA-5094	IntCal13	25449.50	25064.28	25834.73
Cellier	21230	180	AMS	Beta-142282	IntCal13	25469.00	24927.50	26010.50
Jaglisko 3a	21190	140	AMS	Poz-48868	IntCal13	25476.00	25046.60	25905.40
Kurtak-4	21270	160	AMS	AA-72147	IntCal13	25534.00	25066.60	26001.40
Blot	21330	210	AMS	LYON-1643	IntCal13	25546.00	24937.05	26154.95
La Garma 5	21650	790	AMS	AA-45566	IntCal13	25652.50	23530.68	27774.33
Kastritsa	21350	80	AMS	Beta-131047	IntCal13	25661.00	25424.45	25897.55
Bison, Meyrais	21541	155	AMS	Erl-11854	IntCal13	25789.00	25354.85	26223.15
Blot	21510	220	AMS	LYON-1644	IntCal13	25790.50	25135.48	26445.53
Bondi Cave	21550	120	AMS	Beta-270161	IntCal13	25817.00	25508.25	26125.75
Anecrial Lapa do Anecrial	21560	220	AMS	OxA-5526	IntCal13	25844.50	25191.38	26497.63
Combe Saunière	21640	400	AMS	OxA-758	IntCal13	25869.50	24538.08	27200.93
Abri Pataud	21588	280	AMS	OxA-21588	IntCal13	25905.50	25013.93	26797.08
Abri Pataud	21740	450	AMS	OxA-599	IntCal13	25931.50	24512.68	27350.33
Cova Gran de Santa Linya	21690	120	AMS	Beta-207576	IntCal13	25963.00	25636.20	26289.80
Labeko Koba	21660	300	AMS	Ua-3323	IntCal13	26020.00	25040.55	26999.45
Abri Pataud	21800	90	AMS	GrA-45013	IntCal13	26057.50	25806.23	26308.78
Kostenki (Kostienki) 8 (Telmanskaya site)	21900	450	AMS	GrA-9283	IntCal13	26058.00	24667.20	27448.80
Alecrim 6	21794	170	AMS	Wk-25514	IntCal13	26094.00	25599.05	26588.95
Buraca Escura	21820	200	AMS	OxA-5524	IntCal13	26165.00	25547.50	26782.50
Altamira inner vestibule	21910	90	AMS	GrA-32765	IntCal13	26167.00	25883.90	26450.10
Abri Pataud	21910	90	AMS	GrA-45133	IntCal13	26167.00	25883.90	26450.10
Altamira inner vestibule	21930	100	AMS	GrA-27739	IntCal13	26190.00	25878.40	26501.60
Bistricioara-Lutarie III	21950	90	AMS	DeA-3685,1,1	IntCal13	26200.00	25911.20	26488.80
El Castillo	21920	150	AMS	GX-25788	IntCal13	26214.00	25763.70	26664.30
La Passagère	22200	600	AMS	OxA-179	IntCal13	26229.50	24598.83	27860.18
Blot	21870	230	AMS	LYON-1648	IntCal13	26264.00	25517.30	27010.70
Jeneralka	21910	270	AMS	GrA-20004	IntCal13	26279.50	25421.18	27137.83
Kraków Spadzista, site B "Workshops''	21920	200	AMS	Poz-28809	IntCal13	26309.50	25646.88	26972.13
Dzudzuana Cave	21930	190	AMS	RTA-3435	IntCal13	26314.50	25680.38	26948.63
Krakow Spadzista trench	22090	110	AMS	Poz-51373	IntCal13	26347.00	25970.80	26723.20
Gruta Ibn Arnar	22350	990	AMS	KN-199/Hv-1350	IntCal13	26360.50	23755.13	28965.88
Combe Saunière	22100	440	AMS	OxA-486	IntCal13	26364.00	25160.35	27567.65

Banka Kopanica	22010	210	AMS	GrA-19909	IntCal13	26389.50	25705.03	27073.98
Ogof-yr-ychen, Jones' Bay	22350	620	AMS	Birm-340	IntCal13	26398.50	24698.48	28098.53
Blot	22030	230	AMS	LYON-1645	IntCal13	26407.50	25676.48	27138.53
Chulatovo II	22100	220	AMS	OxA-4774	IntCal13	26466.50	25763.03	27169.98
Blot 1	22210	150	AMS	GrA-17217/LYON-1339	IntCal13	26533.50	25979.18	27087.83
Blot	22190	220	AMS	LYON-1646	IntCal13	26540.00	25838.90	27241.10
Klisoura Cave 1, Klissoura Cave 1	22270	160	AMS	RTT-4788	IntCal13	26582.50	26002.53	27162.48
Krakow Spadzista, site D	22330	160	AMS	Poz-26226	IntCal13	26628.00	26044.70	27211.30
Banka-Horne farske role	22320	220	AMS	GrA-19910	IntCal13	26628.50	25928.83	27328.18
Brimfield	22330	230	AMS	OxA-4121	IntCal13	26634.50	25917.73	27351.28
Abri Pataud	22360	90	AMS	GrA-45132	IntCal13	26640.50	26219.18	27061.83
Aitzbitarte III Ext	22420	290	AMS	Ua-24965	IntCal13	26692.00	25870.25	27513.75
La Pente-des-Brosses	22500	600	AMS	OxA-180	IntCal13	26695.50	25143.68	28247.33
Jemielnica	22480	290	AMS	GrA-20003	IntCal13	26732.50	25909.33	27555.68
Cejkov I	22480	120	AMS	Beta-159856	IntCal13	26748.50	26260.68	27236.33
Brinzeni I, Brynzeny 1	22530	250	AMS	OxA-4119	IntCal13	26762.50	26009.63	27515.38
Aitzbitarte III Ext	22580	295	AMS	Ua-24963	IntCal13	26793.50	25960.83	27626.18
Aghitu-3 Cave	22630	300	AMS	KIA-43241	IntCal13	26822.00	25981.25	27662.75
Buraca Escura	22700	240	AMS	OxA-5523	IntCal13	26875.50	26136.88	27614.13
Fuente del Salín	22580	100	AMS	GX-27756	IntCal13	26878.00	26481.85	27274.15
Couffin	22750	390	AMS	GifA-92426	IntCal13	26893.50	25898.38	27888.63
Anston Cave	22640	120	AMS	Beta-233766	IntCal13	26917.00	26475.25	27358.75
Kostenki (Kostienki) 14 (Markina Gora)	22780	250	AMS	OxA-4114	IntCal13	26923.50	26169.68	27677.33
Esquicho-Grapaou	22840	280	AMS	GrA-35064	IntCal13	26951.50	26148.28	27754.73
Khotylevo 2	22720	150	AMS	OxA-27225	IntCal13	26960.50	26455.58	27465.43
Krakow Spadzista trench	22740	120	AMS	Poz-51374	IntCal13	26996.50	26567.58	27425.43
Krakow Spadzista, site C3	22770	160	AMS	Poz-31040	IntCal13	26998.50	26474.58	27522.43
Caldeirao	22900	380	AMS	OxA-1940	IntCal13	27020.00	26003.50	28036.50
Dolni Vestonice	22840	200	AMS	OxA-8292	IntCal13	27024.00	26406.50	27641.50
Krakow Zwierzyniec	22800	150	AMS	LuS-7421	IntCal13	27029.50	26534.08	27524.93
Gite Risso	22790	130	AMS	GrA-6037	IntCal13	27031.50	26584.53	27478.48
Aghitu-3 Cave	22900	180	AMS	KIA-43242	IntCal13	27093.00	26538.20	27647.80
Kostenki (Kostienki) 8 (Telmanskaya site)	23020	320	AMS	OxA-7109	IntCal13	27094.00	26190.55	27997.45

Chauvet	23000	1000	AMS	GifA-11127/SacA-24667	IntCal13	27104.50	24436.43	29772.58
Khotylevo 2	22900	150	AMS	OxA-27002	IntCal13	27113.50	26629.48	27597.53
Chauvet	22860	110	AMS	GrA-23146	IntCal13	27119.00	26748.50	27489.50
Caldeirao (cave)	23040	340	AMS	OxA-5521	IntCal13	27130.50	26163.88	28097.13
Khotylevo 2	23020	210	AMS	OxA-X-2500-11	IntCal13	27161.00	26561.55	27760.45
Kent's Cavern	23080	260	AMS	OxA-5696	IntCal13	27183.00	26468.60	27897.40
Kraków Spadzista, site B ''Workshops''	23020	180	AMS	Poz-242	IntCal13	27185.50	26654.93	27716.08
Cosquer	23080	640	AMS	GifA-95308	IntCal13	27264.50	25639.53	28889.48
Alberndorf I	23170	230	AMS	ETH-13041	IntCal13	27277.50	26649.08	27905.93
Khotylevo 1	23050	150	AMS	OxA-27223	IntCal13	27291.50	26892.98	27690.03
Grotte du Renne, Arcy-sur-Cure	23180	210	AMS	OxA-21568	IntCal13	27306.00	26743.60	27868.40
Krakow Spadzista, site E	23150	190	AMS	Poz-28733	IntCal13	27308.00	26808.30	27807.70
Abric Romani	23160	490	AMS	NzA-1818	IntCal13	27309.00	25980.90	28637.10
Abri Pataud	23200	500	AMS	OxA-685	IntCal13	27337.50	25988.98	28686.03
Horka	23210	510	AMS	VRI-676	IntCal13	27346.50	25978.98	28714.03
Aitzbitarte III Ext	23230	330	AMS	Ua-2243	IntCal13	27364.00	26396.90	28331.10
Flageolet I	23250	500	AMS	OxA-596	IntCal13	27373.50	26019.28	28727.73
Fuente del Salín	23190	900	AMS	GX-29438	IntCal13	27388.50	25054.83	29722.18
Abri Pataud	23180	670	AMS	OxA-163	IntCal13	27391.50	25661.08	29121.93
Khotylevo 2	23160	160	AMS	OxA-27224	IntCal13	27397.00	27027.45	27766.55
Aggsbach	23140	130	AMS	KIA-43238	IntCal13	27402.50	27096.13	27708.88
Dzudzuana Cave	23240	200	AMS	RTA-3823 (RTT?)	IntCal13	27432.50	26967.48	27897.53
Khotylevo 2	23240	160	AMS	OxA-27001	IntCal13	27457.00	27100.75	27813.25
Jarama VI	23380	500	AMS	Beta-56640	IntCal13	27478.50	26105.28	28851.73
Labeko Koba	23360	300	AMS	Ua-3035	IntCal13	27510.50	26634.13	28386.88
Eel Point	23370	110	AMS	OxA-11543	IntCal13	27570.00	27339.15	27800.85
Andornaktalya-Zugo-dulo, Adornak-Zugo-dulo	23410	170	AMS	OxA-11235	IntCal13	27596.50	27219.83	27973.18
Cejkov I	23440	120	AMS	Beta-159853	IntCal13	27615.00	27363.25	27866.75
Brinzeni I, Brynzeny 1	23400	220	AMS	OxA-7001	IntCal13	27617.00	27082.15	28151.85
Cuco	23400	250	AMS	GrA-32097	IntCal13	27628.50	26980.13	28276.88
Jaksice II	23460	150	AMS	Poz-42517	IntCal13	27637.00	27311.15	27962.85
Grotta Arene Candide	23440	190	AMS	OxA-10700	IntCal13	27637.50	27192.43	28082.58
Castle Hill	23470	300	AMS	OxA-4232	IntCal13	27642.00	26783.20	28500.80
Franchthi	23510	90	AMS	OxA-21069	IntCal13	27656.50	27464.13	27848.88

Khotylevo 2	23470	170	AMS	OxA-27000	IntCal13	27657.00	27270.35	28043.65
Kostenki (Kostienki) 14 (Markina Gora)	23600	440	AMS	GrA-5244	IntCal13	27708.50	26496.78	28920.23
Gargas	23590	100	AMS	LYON-3400 GrA	IntCal13	27715.50	27493.68	27937.33
Goyet 3	23580	130	AMS	KIA-22280	IntCal13	27728.50	27430.68	28026.33
Cougnac	23610	350	AMS	GifA-91183	IntCal13	27751.00	26791.50	28710.50
Jaksice II	23640	180	AMS	Poz-48869	IntCal13	27847.00	27377.70	28316.30
Cejkov I	23820	40	AMS	Beta-159852	IntCal13	27857.50	27755.38	27959.63
Ash Tree Cave	23760	110	AMS	Beta-303671	IntCal13	27882.50	27592.28	28172.73
Briquests	23680	200	AMS	OxA-8293	IntCal13	27894.50	27367.73	28421.28
Kent's Cavern	23680	300	AMS	OxA-4437	IntCal13	27900.50	27136.23	28664.78
Kraków Spadzista, site B ''Workshops''	23750	140	AMS	Poz-1248	IntCal13	27908.00	27523.25	28292.75
Gorham's Cave	23800	600	AMS	OxA-7979	IntCal13	27915.00	26242.05	29587.95
Kraków Spadzista, site C	23750	150	AMS	LuS-7418	IntCal13	27917.50	27503.78	28331.23
Kraków Spadzista, site B ''Workshops''	23750	150	AMS	LuS-7417	IntCal13	27917.50	27503.78	28331.23
Carane 3	23710	270	AMS	GifA-99245	IntCal13	27931.00	27235.60	28626.40
Ferrassie	23800	530	AMS	OxA-401	IntCal13	27941.50	26469.48	29413.53
Kraków Spadzista, site B ''Workshops''	23770	160	AMS	Poz-1251	IntCal13	27942.00	27499.30	28384.70
Esquicho-Grapaou	23755	285	AMS	LYON-889	IntCal13	27963.00	27241.00	28685.00
Kastritsa	23880	100	AMS	Beta-131046	IntCal13	27989.00	27691.65	28286.35
Aitzbitarte III Ext	23830	345	AMS	Ua-2628	IntCal13	28028.00	27169.20	28886.80
Aghitu-3 Cave	23880	150	AMS	KIA-43243	IntCal13	28029.00	27600.55	28457.45
Aghitu-3 Cave	23960	120	AMS	KIA-43240	IntCal13	28072.50	27707.23	28437.78
El Conde	23930	180	AMS	GX-25787	IntCal13	28080.50	27578.43	28582.58
Buraca Escura	23920	300	AMS	GifA-93048	IntCal13	28099.50	27353.28	28845.73
Eel Point	24000	140	AMS	OxA-11015	IntCal13	28117.00	27699.00	28535.00
Breitenbach B	23990	180	AMS	OxA-11964	IntCal13	28124.50	27623.38	28625.63
Gorham's Cave	24010	160	AMS	Beta-196775	IntCal13	28134.00	27673.25	28594.75
Kraków Spadzista, site B ''Workshops''	23980	280	AMS	Poz-225	IntCal13	28138.00	27432.15	28843.85
Korotkaya cave	24020	220	AMS	OxA-7000	IntCal13	28147.50	27566.58	28728.43
Kraków Spadzista, site B ''Workshops''	24000	300	AMS	Poz-268	IntCal13	28165.50	27411.68	28919.33
Castlepook	24000	300	AMS	OxA-4234	IntCal13	28165.50	27411.68	28919.33
El Castillo	24070	150	AMS	Beta-242617	IntCal13	28170.00	27724.45	28615.55
Cendres	24080	150	AMS	Beta-155606	IntCal13	28176.50	27730.48	28622.53

Ferrassie	24140	100	AMS	GrA-31939	IntCal13	28193.00	27841.50	28544.50
Cejkov I	24130	130	AMS	Beta-159855	IntCal13	28200.50	27787.73	28613.28
Bistricioara-Lutarie III	24153	112	AMS	DeA-3688,1,1	IntCal13	28208.00	27828.95	28587.05
Jaksice II	24140	180	AMS	Poz-51589	IntCal13	28222.00	27717.55	28726.45
Krakow Spadzista, site E	24200	140	AMS	Poz-27292	IntCal13	28247.00	27810.00	28684.00
Bilancino	24220	100	AMS	Beta-93272	IntCal13	28253.00	27893.90	28612.10
Cejkov I	24240	120	AMS	Beta-159854	IntCal13	28269.00	27867.15	28670.85
Kostenki (Kostienki) 14 (Markina Gora)	24030	440	AMS	GrA-5143	IntCal13	28272.50	27137.73	29407.28
Kostenki (Kostienki) 14 (Markina Gora)	24030	440	AMS	GrA-5243	IntCal13	28272.50	27137.73	29407.28
Huccorgne - Hermitage	24170	250	AMS	CAMS-5893	IntCal13	28278.00	27616.80	28939.20
Kraków Spadzista, site B "Workshops''	24240	160	AMS	Poz-28735	IntCal13	28278.50	27800.18	28756.83
Chauvet	24050	450	AMS	GifA-11116/SacA-24656	IntCal13	28289.50	27132.88	29446.13
Cendres	24240	220	AMS	Beta-142283	IntCal13	28316.50	27711.83	28921.18
Krakow Spadzista trench	24350	160	AMS	Poz-51330	IntCal13	28359.50	27861.23	28857.78
Borsice	24410	130	AMS	GrA-33892	IntCal13	28399.50	27966.78	28832.23
Anecrial Lapa do Anecrial	24410	170	AMS	GrA-12016	IntCal13	28415.00	27879.20	28950.80
Boccard	24220	400	AMS	LYON-377	IntCal13	28431.00	27389.80	29472.20
Aitzbitarte III Ext	24240	365	AMS	Ua-11146	IntCal13	28434.50	27462.18	29406.83
Krakow Spadzista, site C2	24460	160	AMS	Poz-23644	IntCal13	28455.00	27934.40	28975.60
Krakow Spadzista, site C2	24470	150	AMS	Poz-23645	IntCal13	28461.00	27966.05	28955.95
Edward	24470	110	AMS	OxA-14164	IntCal13	28464.00	28093.50	28834.50
Facteur	24210	500	AMS	OxA-584	IntCal13	28464.50	27167.28	29761.73
Abri Pataud	24250	750	AMS	OxA-164	IntCal13	28497.00	26358.55	30635.45
Krakow Spadzista trench	24480	190	AMS	Poz-48406	IntCal13	28502.00	27887.35	29116.65
Krems-Hundssteig	24400	1000	AMS	VERA-670	IntCal13	28517.50	26036.58	30998.43
Geissenklosterle	24360	380	AMS	OxA-5157	IntCal13	28532.00	27512.65	29551.35
Goyet 3	24440	280	AMS	OxA-4926	IntCal13	28555.50	27733.28	29377.73
Komarowa Cave	24550	220	AMS	Poz-339	IntCal13	28602.00	27879.05	29324.95
Cova Gran de Santa Linya	24600	110	AMS	OxA-19262	IntCal13	28619.50	28265.63	28973.38
Chauvet	24590	190	AMS	LYON-235	IntCal13	28621.50	27968.38	29274.63
Abri Pataud	24340	700	AMS	OxA-582	IntCal13	28628.00	26637.75	30618.25
Blot 3	24610	200	AMS	LYON-1340/GrA-17218	IntCal13	28645.50	27961.03	29329.98
Krakow Spadzista, site F	24625	180	AMS	LuS-7420	IntCal13	28655.00	28027.05	29282.95

Chauvet	24630	150	AMS	GifA-80135/SacA-11417	IntCal13	28655.50	28136.33	29174.68
La Cala	24620	220	AMS	OxA-6263	IntCal13	28659.50	27925.63	29393.38
Kranawetberg	24620	230	AMS	GrA-9063	IntCal13	28662.00	27906.75	29417.25
Blot	24640	120	AMS	LYON-1338/GrA-17336	IntCal13	28666.50	28277.48	29055.53
Krakow Spadzista, site F	24640	160	AMS	Poz-28734	IntCal13	28671.00	28112.40	29229.60
La Vina	24640	190	AMS	OxA-21688	IntCal13	28673.00	28013.70	29332.30
Hyaena Den	24600	300	AMS	OxA-3451	IntCal13	28683.50	27789.08	29577.93
Hyaena Den	24560	340	AMS	OxA-5805	IntCal13	28685.00	27712.20	29657.80
Abri Pataud	24440	740	AMS	OxA-165	IntCal13	28688.00	26645.50	30730.50
Bondi Cave	24620	300	AMS	SacA-12068	IntCal13	28700.00	27799.40	29600.60
Alberndorf I	24490	780	AMS	GrA-5241	IntCal13	28706.00	26601.75	30810.25
Krakow Spadzista trench	24680	200	AMS	Poz-48405	IntCal13	28711.00	28025.10	29396.90
Krakow Spadzista, site C2	24690	230	AMS	Poz-27275	IntCal13	28718.50	27958.98	29478.03
Krakow Spadzista trench	24690	230	AMS	Poz-27375	IntCal13	28718.50	27958.98	29478.03
Esquicho-Grapaou	24595	345	AMS	LYON-887	IntCal13	28720.50	27725.38	29715.63
Krakow Spadzista, site D	24700	180	AMS	LuS-7419	IntCal13	28739.50	28114.88	29364.13
Ferrassie	24710	110	AMS	GrA-31934	IntCal13	28758.00	28403.65	29112.35
Grande Grotte	24660	330	AMS	GifA-93008	IntCal13	28764.00	27781.70	29746.30
Aitzbitarte III Ext	24545	415	AMS	Ua-2626	IntCal13	28774.00	27579.85	29968.15
Cosquer	24730	300	AMS	GifA-9672	IntCal13	28795.50	27860.23	29730.78
Cosquer	24730	300	AMS	GifA-96072	IntCal13	28795.50	27860.23	29730.78
Chauvet	24760	190	AMS	GifA-12107/SacA-28992	IntCal13	28799.50	28156.83	29442.18
Facteur	24400	600	AMS	OxA-585	IntCal13	28802.50	27128.13	30476.88
Dzerava skala	24760	130	AMS	OxA-13861	IntCal13	28832.00	28395.00	29269.00
Klausenhohlen (Obere Klause)	24680	360	AMS	OxA-5721	IntCal13	28833.50	27753.83	29913.18
Chauvet	24800	1300	AMS	GifA-13024/SacA-32468	IntCal13	28843.50	25855.28	31831.73
Grande Grotte	24600	400	AMS	OxA-4999	IntCal13	28844.50	27647.03	30041.98
Krizova	24780	140	AMS	GrA-28183	IntCal13	28855.50	28384.78	29326.23
Kranawetberg	24830	230	AMS	GrA-9066	IntCal13	28860.50	28104.78	29616.23
Cejkov I	24800	110	AMS	Beta-159851	IntCal13	28871.00	28502.40	29239.60
Dzerava skala	24800	130	AMS	GrA-22758	IntCal13	28876.50	28439.03	29313.98
Abri Pataud	24500	600	AMS	OxA-686	IntCal13	28891.50	27219.03	30563.98

Flageolet I	24600	700	AMS	OxA-448	IntCal13	28929.50	27088.88	30770.13
Aitzbitarte III Ext	24635	475	AMS	Ua-2627	IntCal13	28953.00	27545.10	30360.90
Kranawetberg	24930	240	AMS	GrA-9065	IntCal13	28987.50	28207.08	29767.93
Chauvet	24770	780	AMS	LYON-118 (OxA)	IntCal13	29005.50	27065.13	30945.88
Barma Grande	24800	800	AMS	OxA-10093	IntCal13	29007.00	27034.80	30979.20
Cosquer	24840	340	AMS	GifA-95358	IntCal13	29020.50	27872.43	30168.58
Chauvet	24900	1300	AMS	GifA-11115/SacA-24655	IntCal13	29031.50	25943.53	32119.48
Facteur	24690	600	AMS	OxA-586	IntCal13	29035.00	27385.80	30684.20
Bignalats	24970	110	AMS	Beta-93271	IntCal13	29039.50	28663.78	29415.23
Chauvet	25000	60	AMS	LYON-1434	IntCal13	29040.50	28796.83	29284.18
Facteur	24720	600	AMS	OxA-583	IntCal13	29055.00	27408.65	30701.35
Kranawetberg	25010	150	AMS	GrA-28185	IntCal13	29077.00	28600.10	29553.90
Krakow Spadzista, site C2	25000	200	AMS	Poz-31038	IntCal13	29077.50	28446.23	29708.78
Gargas	25030	110	AMS	LYON-3404 GrA	IntCal13	29086.50	28708.88	29464.13
Flageolet I	24800	600	AMS	OxA-597	IntCal13	29104.00	27463.35	30744.65
Gargas	25050	170	AMS	GrA-19506/LYON-1625	IntCal13	29125.00	28586.35	29663.65
Gargas	25050	170	AMS	LYON-1625-GrA	IntCal13	29125.00	28586.35	29663.65
Aitzbitarte III Ext	24920	410	AMS	Ua-2245	IntCal13	29160.50	27824.33	30496.68
Eger-Koporos	25100	170	AMS	Poz-37823	IntCal13	29176.00	28630.70	29721.30
Cassotte	24950	520	AMS	GifA-97330	IntCal13	29204.00	27691.60	30716.40
Borshchevo 2	25040	300	AMS	GrA-11454	IntCal13	29206.50	28142.98	30270.03
Casa Corona UE142	25090	220	AMS	TO-1102	IntCal13	29209.50	28486.08	29932.93
Borsice-Chrastka	25150	160	AMS	Poz-38236	IntCal13	29220.00	28693.70	29746.30
Breinum	25050	320	AMS	OxA-12057	IntCal13	29221.00	28089.55	30352.45
Asprochaliko	25100	700	AMS	OxA-777	IntCal13	29256.50	27505.18	31007.83
Dzerava skala	25050	540	AMS	GrA-22756	IntCal13	29262.00	27724.90	30799.10
Gargas	25230	110	AMS	LYON-3406 GrA	IntCal13	29265.00	28865.05	29664.95
Cougnac	25120	390	AMS	GifA-92425	IntCal13	29300.00	27985.20	30614.80
Jarosov II	25110	240	AMS	GrA-9613	IntCal13	29304.00	28451.85	30156.15
Hohle Fels, Hohler Fels	25240	480	AMS	OxA-4974	IntCal13	29365.00	27912.45	30817.55
Kurtak-4	25160	280	AMS	AA-68669	IntCal13	29369.50	28387.68	30351.33
Krakow Spadzista, site C2	25220	250	AMS	GrA-9062	IntCal13	29431.00	28540.85	30321.15
Knegsel-Schietbaan	25340	440	AMS	OxA-4847	IntCal13	29447.00	28077.10	30816.90
Facteur	25450	650	AMS	OxA-594	IntCal13	29456.50	27801.13	31111.88

Abri Pataud	25500	700	AMS	OxA-687	IntCal13	29481.00	27762.45	31199.55
Aitzbitarte III Ext	25380	430	AMS	Ua-2244	IntCal13	29491.00	28157.20	30824.80
Angel 1, Angel de Ladrunan	25330	190	AMS	GrA-16961	IntCal13	29507.50	28766.03	30248.98
Kranawetberg	25450	90	AMS	VERA-366	IntCal13	29530.50	29179.48	29881.53
Facteur	25630	650	AMS	OxA-595	IntCal13	29550.50	27896.08	31204.93
Bilancino	25410	150	AMS	Beta-106549	IntCal13	29568.00	28926.75	30209.25
Bukowce 3	25675	2750	AMS	Hv-10855	IntCal13	29590.50	23453.03	35727.98
Flageolet I	25700	700	AMS	OxA-447	IntCal13	29592.00	27865.85	31318.15
Alberndorf I	25400	260	AMS	ETH-13040	IntCal13	29626.00	28684.55	30567.45
Chauvet	25700	850	AMS	GifA-95158	IntCal13	29637.00	27660.05	31613.95
Chauvet	25440	250	AMS	GifA-99237	IntCal13	29655.50	28733.53	30577.48
El Castillo	25520	140	AMS	Beta-298431	IntCal13	29690.00	29076.30	30303.70
Gargas	25520	110	AMS	LYON-3401 GrA	IntCal13	29700.00	29200.30	30199.70
Chauvet	25600	280	AMS	GifA-12109/SacA-28994	IntCal13	29765.00	28796.95	30733.05
Chauvet	25610	280	AMS	GifA-11114/SacA-24654	IntCal13	29771.00	28803.90	30738.10
Grotte de la Princesse Pauline	25580	170	AMS	GrA-28204	IntCal13	29772.00	29054.75	30489.25
Chauvet	25600	190	AMS	GifA-11019/SacA-23627	IntCal13	29793.50	29018.78	30568.23
Cova Beneito	25750	410	AMS	Gif-TAN-89229	IntCal13	29819.50	28653.38	30985.63
Chauvet-Pont d'Arc	25640	200	AMS	GifA-11018/SacA-23626	IntCal13	29828.00	29034.75	30621.25
Kranawetberg	25640	160	AMS	GrA-28184	IntCal13	29849.50	29176.43	30522.58
La Cala	25720	240	AMS	OxA-6264	IntCal13	29873.00	29006.60	30739.40
Enlene	25850	360	AMS	LYON-1627/GrA-	IntCal13	29899.50	28824.58	30974.43
Dolní Vestonice IIa	25870	370	AMS	GrA-15134	IntCal13	29907.00	28819.25	30994.75
Jarosov II	25780	250	AMS	GrA-9604	IntCal13	29915.00	29041.95	30788.05
Dolní Vestonice IIa	25890	370	AMS	GrA-15147	IntCal13	29919.00	28834.10	31003.90
Gargas	25700	120	AMS	LYON-3405 GrA	IntCal13	29928.50	29408.38	30448.63
Chauvet	25770	220	AMS	GifA-13025/SacA-32469	IntCal13	29932.00	29127.35	30736.65
Grande Grotte	25930	360	AMS	GifA-95619	IntCal13	29950.00	28887.90	31012.10
Arago	25780	210	AMS	OxA-21669	IntCal13	29956.00	29184.60	30727.40
Cendres	25850	260	AMS	Beta-189078	IntCal13	29965.50	29087.23	30843.78
Breitenbach B	25950	850	AMS	OxA-8513	IntCal13	29972.50	27814.58	32130.43

Chauvet	25740	150	AMS	GifA-80134/SacA-11416	IntCal13	29974.50	29361.28	30587.73
Chauvet-Pont d'Arc	25930	310	AMS	GifA-14233/SacA-39215	IntCal13	29988.50	29021.88	30955.13
Hohle Fels, Hohler Fels	26000	360	AMS	OxA-4598	IntCal13	29997.50	28949.18	31045.83
Chauvet	26090	440	AMS	GifA-11127/SacA-24664	IntCal13	30011.50	28833.03	31189.98
Brillenhohle	25870	230	AMS	KIA-19553	IntCal13	30023.00	29234.50	30811.50
Chauvet	25830	180	AMS	GifA-80142/SacA-11424	IntCal13	30038.50	29368.28	30708.73
Caldeirao	26020	320	AMS	OxA-5542	IntCal13	30045.00	29080.75	31009.25
Grande Grotte	26100	390	AMS	GifA-94589	IntCal13	30045.50	28959.18	31131.83
Chauvet	26120	400	AMS	GifA-95127	IntCal13	30052.50	28950.03	31154.98
Hoyle's Mouth	26200	600	AMS	OxA-6226	IntCal13	30054.00	28583.40	31524.60
Khotogoi-Khapsagai	26220	550	AMS	AA-32669	IntCal13	30077.50	28711.88	31443.13
Grande Grotte	26250	500	AMS	OxA-5003	IntCal13	30102.00	28822.35	31381.65
Kozarnika	26010	270	AMS	GifA-97286	IntCal13	30105.50	29262.38	30948.63
Ferrassie	26250	620	AMS	OxA-404	IntCal13	30109.00	28578.55	31639.45
Dolní Vestonice IIa	26190	390	AMS	GrA-15132	IntCal13	30111.00	29040.35	31181.65
Aitzbitarte III Ext	26260	480	AMS	Ua-37961	IntCal13	30113.50	28870.43	31356.58
Chauvet	26130	330	AMS	GifA-101457	IntCal13	30126.00	29175.05	31076.95
El Castillo	25920	140	AMS	Beta-298430	IntCal13	30127.00	29556.05	30697.95
Gargas	25920	130	AMS	LYON-3403 GrA	IntCal13	30131.00	29581.90	30680.10
Jarosov II	26220	390	AMS	GrA-15137	IntCal13	30134.00	29068.10	31199.90
Geissenklosterle	26300	500	AMS	OxA-5159	IntCal13	30137.00	28856.40	31417.60
Brinzeni I, Brynzeny 1	26200	360	AMS	OxA-4124	IntCal13	30147.50	29144.78	31150.23
Hranice	26300	460	AMS	OxA-3889	IntCal13	30151.50	28949.28	31353.73
Chauvet-Pont d'Arc	26030	230	AMS	GifA-13107/SacA-33485	IntCal13	30164.00	29419.20	30908.80
Cosquer	26180	330	AMS	GifA-92424	IntCal13	30173.00	29242.00	31104.00
Aitzbitarte III Ext	26350	475	AMS	Ua-24967	IntCal13	30183.00	28952.75	31413.25
Chauvet	26020	170	AMS	GifA-80139/SacA-11421	IntCal13	30186.50	29562.83	30810.18
Bondi Cave	26020	170	AMS	Beta-270160	IntCal13	30186.50	29562.83	30810.18
Krems-Wachtberg	26050	200	AMS	VERA-4538	IntCal13	30193.50	29511.88	30875.13
Igue des Rameaux	26320	410	AMS	LYON-3087 Poz-	IntCal13	30198.50	29105.53	31291.48

Abri Pataud	26000	1000	AMS	OxA-581	IntCal13	30203.50	27634.23	32772.78
Cosquer	26250	350	AMS	GifA-96069	IntCal13	30208.50	29250.43	31166.58
Cosquer	26360	440	AMS	GifA-95349	IntCal13	30210.50	29055.78	31365.23
Cosquer	26360	440	AMS	GifA-92349	IntCal13	30210.50	29055.78	31365.23
Antolinako Koba	26080	200	AMS	Beta-215542	IntCal13	30215.00	29535.75	30894.25
Chauvet-Pont d'Arc	26070	180	AMS	GifA-11517/SacA-28473	IntCal13	30217.00	29577.65	30856.35
Arbreda	26100	210	AMS	OxA-21668	IntCal13	30224.00	29526.70	30921.30
Chauvet	26160	260	AMS	GifA-101453	IntCal13	30231.50	29451.08	31011.93
Abri Pataud	26100	900	AMS	OxA-166	IntCal13	30233.00	27835.20	32630.80
Chauvet	26080	150	AMS	GifA-80153/SacA-12019	IntCal13	30246.00	29676.00	30816.00
Huccorgne - Hermitage	26300	350	AMS	OxA-3886	IntCal13	30253.00	29310.60	31195.40
Hohlenstein-Barenhohle	26080	140	AMS	KIA-8967	IntCal13	30255.00	29709.70	30800.30
Chauvet	26230	280	AMS	GifA-99081	IntCal13	30264.00	29456.50	31071.50
Kent's Cavern Vestibule	26300	340	AMS	OxA-5695	IntCal13	30264.00	29345.35	31182.65
Chauvet	26250	280	AMS	GifA-102570	IntCal13	30276.50	29471.38	31081.63
Hohle Fels, Hohler Fels	26450	550	AMS	OxA-4976	IntCal13	30281.50	28860.78	31702.23
Cuesta de la Bajada	26470	520	AMS	Ua-3587	IntCal13	30286.00	28941.75	31630.25
Chauvet	26300	310	AMS	Gifa-11132/SacA-24980	IntCal13	30290.00	29435.00	31145.00
Chauvet	26230	230	AMS	GifA-13033/SacA-32532	IntCal13	30295.00	29577.75	31012.25
Cova Gran de Santa Linya	26220	220	AMS	Beta-207577	IntCal13	30295.50	29595.83	30995.18
Chauvet	26240	230	AMS	GifA-13090/SacA-32988	IntCal13	30301.50	29585.68	31017.33
Chauvet	26340	330	AMS	GifA-101468	IntCal13	30304.00	29414.80	31193.20
Kozarnika	26120	100	AMS	GifSLM-10677	IntCal13	30337.00	29913.30	30760.70
Hoxne	26500	550	AMS	OxA-6227	IntCal13	30341.00	28898.90	31783.10
Chauvet	26360	290	AMS	GifA-102569	IntCal13	30341.00	29529.70	31152.30
Combe Saunière	26290	800	AMS	OxA-482	IntCal13	30342.00	28099.05	32584.95
Gargas	26480	420	AMS	LYON-3409 GrA	IntCal13	30342.00	29262.80	31421.20
Grande Grotte	26470	390	AMS	GifA-98184	IntCal13	30361.50	29357.83	31365.18
Geissenklosterle	26540	460	AMS	OxA-5226	IntCal13	30366.00	29181.35	31550.65
Biryuchya Balka 2	26300	200	AMS	Beta-177776	IntCal13	30373.00	29734.60	31011.40
Capo Grosso	26490	390	AMS	GifA-100404	IntCal13	30379.00	29377.70	31380.30

Buor-Khaya/Orto-Stan	26560	450	AMS	GifA-97258	IntCal13	30398.00	29247.55	31548.45
Abri Pataud	26300	900	AMS	OxA-374	IntCal13	30403.00	27936.80	32869.20
Chauvet	26300	1600	AMS	GifA-13098/SacA-33476	IntCal13	30403.50	26585.93	34221.08
Labeko Koba	26575	505	AMS	Ua-3034	IntCal13	30407.00	29075.10	31738.90
Chauvet-Pont d'Arc	26400	240	AMS	GifA-13103/SacA-33481	IntCal13	30407.50	29703.08	31111.93
Chauvet-Pont d'Arc	26460	270	AMS	GifA-14230/SacA-39212	IntCal13	30423.50	29664.93	31182.08
Geissenklosterle	26420	230	AMS	OxA-21740	IntCal13	30433.50	29757.58	31109.43
Boccard	26540	360	AMS	LYON-375	IntCal13	30433.50	29500.13	31366.88
Gargas	26260	130	AMS	LYON-3402 GrA	IntCal13	30441.50	29985.03	30897.98
Kozarnika	26490	270	AMS	GifA-99044	IntCal13	30448.00	29696.55	31199.45
Chauvet	26350	170	AMS	GifA-80143/SacA-11425	IntCal13	30454.00	29906.80	31001.20
Foradada	26610	460	AMS	Beta-132350	IntCal13	30455.00	29273.20	31636.80
Grotta Arene Candide "Il Principe"	26580	350	AMS	OxA-3609	IntCal13	30466.50	29554.03	31378.98
Brinzeni I, Brynzeny 1	26600	370	AMS	OxA-4122	IntCal13	30474.00	29522.10	31425.90
Chauvet	26360	160	AMS	GifA-80145/SacA-11427	IntCal13	30487.50	29980.68	30994.33
Chauvet	26590	300	AMS	GifA-102572	IntCal13	30502.50	29700.23	31304.78
Chauvet	26590	300	AMS	GifA-99777	IntCal13	30502.50	29700.23	31304.78
Chauvet	26650	460	AMS	GifA-11113/SacA-24653	IntCal13	30508.50	29321.48	31695.53
Ash Tree Cave	26660	380	AMS	OxA-5798	IntCal13	30518.00	29544.25	31491.75
Borsuka Cave	26430	180	AMS	Poz-38237	IntCal13	30521.00	29988.05	31053.95
Huccorgne - Hermitage	26670	350	AMS	CAMS-5895	IntCal13	30534.00	29625.80	31442.20
Chauvet-Pont d'Arc	26490	200	AMS	GifA-9227/SacA-14236	IntCal13	30541.50	29973.88	31109.13
Krems-Wachtberg	26520	210	AMS	VERA-3819	IntCal13	30552.50	29967.78	31137.23
Grande Grotte	26700	410	AMS	GifA-84589	IntCal13	30555.00	29507.15	31602.85
Grande Grotte	26700	410	AMS	GifA-94580	IntCal13	30555.00	29507.15	31602.85
Cova Gran	26340	130	AMS	OxA-19250	IntCal13	30579.50	30210.43	30948.58
Gargas	26380	120	AMS	LYON-3410 GrA	IntCal13	30623.50	30290.53	30956.48
La Cadena	26640	240	AMS	OxA-6266	IntCal13	30634.00	30023.15	31244.85
Flageolet	26500	900	AMS	OxA-579	IntCal13	30638.50	28070.18	33206.83

Bos-del-Ser	26691	530	AMS	Erl-8203	IntCal13	30644.50	29124.98	32164.03
Dolní Vestonice IIa	26460	140	AMS	OxQ-18038	IntCal13	30663.00	30304.85	31021.15
Abri Pataud	26500	980	AMS	OxA-167	IntCal13	30668.50	27949.13	33387.88
Biryuchya Balka 2	26630	230	AMS	Beta-183588	IntCal13	30676.00	30125.95	31226.05
Engihoul, nv. 3	26820	340	AMS	OxA-8827	IntCal13	30680.50	29815.53	31545.48
Abri Pataud	26780	280	AMS	OxA/OxA-X-2225-38	IntCal13	30732.50	30065.13	31399.88
Abri Pataud	26600	800	AMS	OxA-690	IntCal13	30735.50	28469.28	33001.73
Flageolet I	26860	420	AMS	GifA-95558	IntCal13	30749.00	29614.70	31883.30
Geissenklosterle	26530	120	AMS	Beta-143244	IntCal13	30751.00	30473.60	31028.40
La Cala	26880	320	AMS	OxA-5869	IntCal13	30770.50	29987.23	31553.78
Kostenki (Kostienki) 14 (Markina Gora)	26700	190	AMS	GrA-10945	IntCal13	30801.50	30395.38	31207.63
La Boja	26760	230	AMS	VERA-5789HS	IntCal13	30808.50	30313.08	31303.93
Antolinako Koba	26710	180	AMS	Beta-230282	IntCal13	30824.00	30449.70	31198.30
Chauvet-Pont d'Arc	26740	200	AMS	GifA-12097/SacA-28982	IntCal13	30824.50	30404.13	31244.88
Antolinako Koba	26720	180	AMS	Beta-251299	IntCal13	30833.00	30462.50	31203.50
Gargas	26860	460	AMS	GifA-92369	IntCal13	30849.50	29527.58	32171.43
Chauvet	26800	1700	AMS	GifA-11125/SacA-24665	IntCal13	30852.00	26930.40	34773.60
Krems-Wachtberg	26800	220	AMS	VERA-5196	IntCal13	30855.00	30398.05	31311.95
Krems-Wachtberg	26840	220	AMS	VERA-4532	IntCal13	30893.50	30450.33	31336.68
Dolní Vestonice IIa	26770	140	AMS	OxA-17811	IntCal13	30914.00	30656.55	31171.45
Krems-Wachtberg	26870	220	AMS	VERA-3941	IntCal13	30922.50	30488.83	31356.18
Chauvet	26980	410	AMS	GifA-95129	IntCal13	30956.50	29773.28	32139.73
Dolní Vestonice IIa	26850	140	AMS	OxA-17814	IntCal13	30962.00	30712.15	31211.85
Abri Pataud	26900	1000	AMS	OxA-168	IntCal13	30972.00	28245.50	33698.50
Chauvet	26980	420	AMS	GifA-95130	IntCal13	30987.00	29743.45	32230.55
Labeko Koba	26910	500	AMS	Ua-3320	IntCal13	30990.00	29483.30	32496.70
Chauvet-Pont d'Arc	27010	290	AMS	GifA-14229/SacA-39211	IntCal13	30997.00	30389.95	31604.05
Gargas	26910	130	AMS	LYON-3408 GrA	IntCal13	30998.00	30769.05	31226.95
Franchthi	26910	120	AMS	OxA-21351	IntCal13	30999.50	30788.13	31210.88
Kostenki (Kostienki) 14 (Markina Gora)	26970	180	AMS	OxA-9566	IntCal13	31026.00	30705.85	31346.15
Krems-Wachtberg	26980	210	AMS	VERA-4536	IntCal13	31026.00	30644.10	31407.90

Chauvet-Pont d'Arc	26980	200	AMS	GifA-12098/SacA-28983	IntCal13	31029.00	30668.95	31389.05
Krems-Wachtberg	27000	220	AMS	VERA-3938	IntCal13	31036.50	30634.18	31438.83
Dzerava skala	27000	200	AMS	Poz-7092	IntCal13	31042.00	30682.90	31401.10
Hohle Fels, Hohler Fels	27030	250	AMS	KIA-3503	IntCal13	31046.00	30571.00	31521.00
Brillenhohle	27030	180	AMS	KIA-19549	IntCal13	31063.50	30744.78	31382.23
Bunsoh	27080	140	AMS	Beta-362946	IntCal13	31092.50	30847.88	31337.13
Antolinako Koba	27100	190	AMS	Beta-251300	IntCal13	31107.00	30768.80	31445.20
Aghitu-3 Cave	27110	170	AMS	KIA-39640	IntCal13	31112.00	30811.80	31412.20
Geissenklosterle	27000	550	AMS	OxA-4855	IntCal13	31115.00	29448.70	32781.30
Aghitu-3 Cave	27120	170	AMS	KIA-39642	IntCal13	31117.50	30816.83	31418.18
Bondi Cave	27120	240	AMS	OxA-23902	IntCal13	31126.50	30682.38	31570.63
Grande Grotte	27080	410	AMS	GifA-98185	IntCal13	31150.00	29902.65	32397.35
Font-Yves	27190	150	AMS	Beta-103782	IntCal13	31157.50	30892.93	31422.08
Cosquer	27110	350	AMS	GifA-92491	IntCal13	31169.00	30304.50	32033.50
Krems-Wachtberg	27190	230	AMS	VERA-3934	IntCal13	31178.50	30750.53	31606.48
Dzudzuana Cave	27150	300	AMS	RTT-3436	IntCal13	31182.00	30538.85	31825.15
La Cala	27050	850	AMS	OxA-5868	IntCal13	31185.50	28780.58	33590.43
Krems-Hundssteig	27200	240	AMS	VERA-2291	IntCal13	31194.00	30738.95	31649.05
Geissenklosterle	27240	200	AMS	Beta-161019	IntCal13	31200.50	30834.28	31566.73
Krems-Wachtberg	27220	230	AMS	VERA-3935	IntCal13	31203.50	30769.83	31637.18
Krems-Wachtberg	27230	230	AMS	VERA-4533	IntCal13	31212.00	30775.95	31648.05
Cosquer	27110	390	AMS	GifA-92409	IntCal13	31214.00	30073.05	32354.95
Krems-Hundssteig	27290	160	AMS	OxA-16031	IntCal13	31220.50	30933.13	31507.88
Chauvet	27100	1700	AMS	GifA-13630/SacA-32529	IntCal13	31227.50	27363.38	35091.63
Chauvet	27130	490	AMS	GifA-101454	IntCal13	31235.00	29710.25	32759.75
Alberndorf I	27080	650	AMS	GrA-5242	IntCal13	31238.50	29237.33	33239.68
Breitenbach B	27180	320	AMS	OxA-8510	IntCal13	31243.50	30503.93	31983.08
Govorukcha	27230	260	AMS	GrA-3239	IntCal13	31244.00	30721.50	31766.50
Fuentes de San Cristobal	27200	1000	AMS	OxA-8589	IntCal13	31259.50	28621.83	33897.18
Krems-Hundssteig	27360	150	AMS	OxA-16029	IntCal13	31261.50	30988.38	31534.63
Geissenklosterle	27340	180	AMS	Beta-161018	IntCal13	31263.00	30927.65	31598.35
Aitzbitarte III Ext	27165	520	AMS	Ua-24966	IntCal13	31273.00	29668.45	32877.55
Buor-Khaya/Orto-Stan	27430	150	AMS	Beta-362947	IntCal13	31306.50	31021.98	31591.03
Grotta Arene Candide	27381	200	AMS	LTL-3769A	IntCal13	31316.00	30917.95	31714.05

Kebliny 3	27370	210	AMS	GrA-24329	IntCal13	31318.00	30895.25	31740.75
Alberndorf I	27140	650	AMS	GrA-5223	IntCal13	31318.00	29329.65	33306.35
Hohle Fels, Hohler Fels	27150	600	AMS	OxA-4978	IntCal13	31323.50	29482.88	33164.13
Bench Quarry, Bench Tunnel Cavern	27150	600	AMS	OxA-1985	IntCal13	31323.50	29482.88	33164.13
Bench Quarry, Bench Tunnel Cavern	27150	600	AMS	OxA-4985	IntCal13	31323.50	29482.88	33164.13
Goyet	27440	170	AMS	KIA-18986	IntCal13	31333.00	30999.55	31666.45
Kostenki (Kostienki) 17 (Spitsynskaya site)	27490	165	AMS	GrA-20141	IntCal13	31368.00	31029.80	31706.20
Espinilla	27220	360	AMS	LYON-886	IntCal13	31408.50	30415.28	32401.73
Krems-Wachtberg	27420	240	AMS	VERA-3933	IntCal13	31420.00	30877.55	31962.45
Antolinako Koba	27520	190	AMS	Beta-230279	IntCal13	31435.50	31012.28	31858.73
Krems-Hundssteig	27590	170	AMS	OxA-16030	IntCal13	31468.00	31070.90	31865.10
Goyet 3	27590	170	AMS	KIA-22281	IntCal13	31468.00	31070.90	31865.10
Albersdorf	27730	130	AMS	GrA-32898	IntCal13	31534.50	31192.98	31876.03
Breitenbach B	27340	320	AMS	OxA-8509	IntCal13	31547.00	30691.05	32402.95
El Miron, Burial area	27580	210	AMS	GX-27113	IntCal13	31572.50	31019.13	32125.88
Borsuka Cave	27350	450	AMS	Poz-32394	IntCal13	31586.00	30294.00	32878.00
Dzudzuana Cave	27400	300	AMS	RTA-3437	IntCal13	31586.50	30772.83	32400.18
Cosquer	27350	430	AMS	GifA-95195	IntCal13	31588.50	30354.93	32822.08
Dzudzuana Cave	27450	275	AMS	RTA-4338	IntCal13	31597.00	30846.50	32347.50
Ferrassie	27530	720	AMS	OxA-403	IntCal13	31649.00	29600.80	33697.20
Hohle Fels, Hohler Fels	27780	150	AMS	KIA-17744	IntCal13	31662.50	31194.63	32130.38
Hohle Fels, Hohler Fels	27600	800	AMS	OxA-4979	IntCal13	31678.50	29502.53	33854.48
Krems-Hundssteig	27630	230	AMS	VERA-3515	IntCal13	31717.00	31023.50	32410.50
Breitenbach B	27480	340	AMS	OxA-8511	IntCal13	31723.50	30762.58	32684.43
Kostenki (Kostienki) 14 (Markina Gora)	27460	390	AMS	OxA-4116	IntCal13	31729.50	30642.23	32816.78
Geissenklosterle	27500	550	AMS	OxA-4857	IntCal13	31737.00	30077.35	33396.65
Hohle Fels, Hohler Fels	27830	150	AMS	KIA-17743	IntCal13	31748.00	31222.65	32273.35
Krems-Hundssteig	27640	260	AMS	VERA-3280	IntCal13	31776.50	30989.43	32563.58
Caldeirao	27600	600	AMS	OxA-1941	IntCal13	31801.50	30045.43	33557.58
Chez-Pinaud I	27780	200	AMS	GrA-20853 (LYON-1776)	IntCal13	31810.00	31134.55	32485.45
Cro-le-Biscop	27680	270	AMS	Beta-157439	IntCal13	31829.50	31000.63	32658.38
Hohle Fels, Hohler Fels	27840	190	AMS	Beta-161022	IntCal13	31850.50	31178.38	32522.63
Püskökhatvan	27700	300	AMS	Deb-1901	IntCal13	31875.00	30969.65	32780.35
Geissenklosterle	27870	190	AMS	Beta-161020	IntCal13	31880.00	31195.05	32564.95
Aitzbitarte III Ext	27580	550	AMS	Ua-18464	IntCal13	31884.50	30307.98	33461.03

Krems-Hundssteig	27790	250	AMS	VERA-3943	IntCal13	31895.50	31081.83	32709.18
Hohle Fels, Hohler Fels	27970	140	AMS	KIA-17741	IntCal13	31895.50	31319.33	32471.68
Grande Grotte	27630	400	AMS	GifA-92330	IntCal13	31904.00	30774.45	33033.55
Krempachy 1	27800	250	AMS	VERA-3279	IntCal13	31904.00	31087.95	32720.05
Klisoura Cave 1, Klissoura Cave 1	27950	160	AMS	OxA-19936	IntCal13	31907.50	31279.08	32535.93
Kurtak-4	27770	310	AMS	AA-68668	IntCal13	31936.00	31000.25	32871.75
Grotte du Docteur	27740	340	AMS	OxA-8370	IntCal13	31936.50	30937.58	32935.43
Krems-Hundssteig	27820	270	AMS	VERA-3910	IntCal13	31938.00	31075.40	32800.60
Ferrassie	27900	770	AMS	OxA-402	IntCal13	31956.50	29916.38	33996.63
Krems-Hundssteig	27900	230	AMS	VERA-3944	IntCal13	31959.00	31162.90	32755.10
Kostenki (Kostienki) 14 (Markina Gora)	27860	270	AMS	GrA-13292	IntCal13	31966.00	31095.80	32836.20
Krems-Hundssteig	27860	270	AMS	VERA-3513	IntCal13	31966.00	31095.80	32836.20
Isoletta	27933	224	AMS	ISGS-A-0186	IntCal13	31978.00	31188.55	32767.45
Krems-Hundssteig	27940	220	AMS	VERA-1615	IntCal13	31979.50	31197.18	32761.83
Grotte des Gorges	28010	170	AMS	Beta-355065	IntCal13	31980.50	31301.73	32659.28
Dolní Vestonice IIa	28050	150	AMS	OxA-17810	IntCal13	31991.00	31356.40	32625.60
Breitenbach B	27800	340	AMS	OxA-8512	IntCal13	31992.00	30978.35	33005.65
Kostenki (Kostienki) 14 (Markina Gora)	27710	410	AMS	OxA-4117	IntCal13	32006.00	30818.50	33193.50
Hohle Fels, Hohler Fels	28060	170	AMS	Beta-156094	IntCal13	32024.00	31332.40	32715.60
Karain B	27980	240	AMS	OxA-8362	IntCal13	32025.00	31194.70	32855.30
Cosquer	27740	410	AMS	GifA-96073	IntCal13	32037.50	30840.03	33234.98
Krems-Hundssteig	27970	270	AMS	VERA-3281	IntCal13	32046.50	31153.98	32939.03
Krems-Wachtberg	28000	250	AMS	VERA-4534	IntCal13	32048.50	31193.03	32903.98
Kent's Cavern	27780	400	AMS	OxA-4436	IntCal13	32063.00	30881.20	33244.80
Geissenklosterle	27960	290	AMS	OxA-21660	IntCal13	32064.50	31126.38	33002.63
Harvincourt Hav.1	28100	180	AMS	Beta-332604	IntCal13	32066.00	31343.05	32788.95
Krems-Hundssteig	28160	150	AMS	AxA-15988	IntCal13	32091.50	31429.83	32753.18
Krems-Hundssteig	28070	240	AMS	VERA-3514	IntCal13	32093.00	31243.70	32942.30
Ferrassie	28190	150	AMS	GrA-31935	IntCal13	32117.00	31450.10	32783.90
Hohle Fels, Hohler Fels	28170	180	AMS	Beta-161023	IntCal13	32121.00	31388.55	32853.45
El Nino	28270	80	AMS	UGAMS-7737	IntCal13	32136.00	31656.25	32615.75
Egerszalok-Eger-lato	28170	200	AMS	Poz-19088	IntCal13	32136.00	31357.95	32914.05
Kent's Cavern Vestibule	27820	500	AMS	OxA-5693	IntCal13	32141.00	30756.85	33525.15
Grande Grotte	27850	440	AMS	GifA-95629	IntCal13	32146.50	30871.13	33421.88
Grande Grotte	27850	450	AMS	GifA-92628	IntCal13	32151.00	30857.10	33444.90
Hyaena Den	27850	460	AMS	OxA-4112	IntCal13	32155.00	30843.05	33466.95

Hohle Fels, Hohler Fels	28170	220	AMS	Beta-156093	IntCal13	32157.00	31328.60	32985.40
Cosquer	27870	470	AMS	GifA-92350	IntCal13	32170.50	30840.98	33500.03
Hoyle's Mouth	27900	600	AMS	OxA-1024	IntCal13	32173.00	30613.10	33732.90
Castlepook	27930	390	AMS	OxA-3605	IntCal13	32178.50	30995.28	33361.73
Grande Grotte	28010	350	AMS	GifA-97339	IntCal13	32204.50	31087.78	33321.23
Grande Grotte	27950	440	AMS	GifA-95620	IntCal13	32215.50	30937.28	33493.73
Foradada	28300	170	AMS	Beta-132351	IntCal13	32225.00	31490.65	32959.35
Geissenklosterle	27950	550	AMS	OxA-5229	IntCal13	32228.00	30773.55	33682.45
Enlene	27980	480	AMS	GifA-97306	IntCal13	32242.50	30899.68	33585.33
Abri Pataud	28180	270	AMS	OxA-21585	IntCal13	32250.50	31268.68	33232.33
Abri Pataud	28150	290	AMS	OxA-21587	IntCal13	32251.00	31228.80	33273.20
Balauziere	28360	140	AMS	OxA-18495	IntCal13	32258.50	31589.23	32927.78
Aitzbitarte III Ext	28010	600	AMS	Ua-21160	IntCal13	32263.50	30732.58	33794.43
Kostenki (Kostienki) 14 (Markina Gora)	28370	140	AMS	GrA-15960	IntCal13	32268.00	31596.35	32939.65
Kent's Cavern	28060	440	AMS	OxA-4435	IntCal13	32285.50	31008.23	33562.78
Alberndorf I	28250	250	AMS	VERA-0006	IntCal13	32290.50	31335.28	33245.73
Geissenklosterle	28050	550	AMS	OxA-5227	IntCal13	32291.00	30843.20	33738.80
Bistricioara Lutarie Shore (Mal)	28068	452	AMS	Erl-9969	IntCal13	32292.00	30995.25	33588.75
Krems-Wachtberg	28240	270	AMS	VERA-3937	IntCal13	32305.50	31302.78	33308.23
Abri Pataud	28230	290	AMS	OxA-21586	IntCal13	32314.00	31270.90	33357.10
Isturitz	28290	240	AMS	Beta-136048	IntCal13	32318.00	31374.65	33261.35
Grotte XVI	28140	405	AMS	AA-6840	IntCal13	32320.00	31091.65	33548.35
Krems-Hundssteig	28250	280	AMS	VERA-3282	IntCal13	32321.50	31295.03	33347.98
Arbreda	28260	280	AMS	OxA-21781	IntCal13	32329.00	31300.15	33357.85
Huccorgne - Hermitage	28170	430	AMS	CAMS-6371	IntCal13	32345.00	31078.65	33611.35
Chauvet-Pont d'Arc	28170	730	AMS	GifA-11126/SacA-24666	IntCal13	32351.00	30579.25	34122.75
Arbreda	28280	290	AMS	OxA-21782	IntCal13	32351.00	31298.40	33403.60
Krems-Wachtberg	28300	270	AMS	VERA-3932	IntCal13	32353.00	31336.50	33369.50
Hohle Fels, Hohler Fels	28350	220	AMS	Beta-156092	IntCal13	32354.00	31442.00	33266.00
Abri Pataud	28400	1100	AMS	OxA-169	IntCal13	32354.50	29645.58	35063.43
Dolní Vestonice IIa	28380	210	AMS	OxA-27331	IntCal13	32373.50	31477.18	33269.83
Gorham's Cave	28360	240	AMS	Beta-196784	IntCal13	32381.00	31416.75	33345.25
Dolní Vestonice IIa	28450	170	AMS	OxA-17853	IntCal13	32400.00	31594.40	33205.60
Krems-Hundssteig	28360	280	AMS	VERA-3283	IntCal13	32403.00	31356.10	33449.90
Grotte du Docteur	28340	360	AMS	OxA-8371	IntCal13	32418.00	31240.95	33595.05

Kostenki (Kostienki) 12 (Volkovskaya site)	28500	140	AMS	GrA-5552	IntCal13	32433.00	31714.80	33151.20
Byzovaya	28380	340	AMS	Tua-7310	IntCal13	32436.00	31285.55	33586.45
Byzovaya VI	28420	280	AMS	Tua-7307	IntCal13	32445.00	31390.50	33499.50
Kostenki (Kostienki) 14 (Markina Gora)	28420	290	AMS	GrA-13311	IntCal13	32448.50	31376.43	33520.58
Coscobilo	28370	440	AMS	GifA-96074	IntCal13	32455.00	31162.05	33747.95
Aitzbitarte III Ext	28320	605	AMS	Ua-18465	IntCal13	32463.00	30933.50	33992.50
Huccorgne - Hermitage	28390	430	AMS	CAMS-5891	IntCal13	32463.00	31182.40	33743.60
Chez-Pinaud I	28350	520	AMS	KIA-29229	IntCal13	32464.50	31063.73	33865.28
Cioarei-Borosteni	28510	170	AMS	OxA-15527	IntCal13	32472.50	31641.73	33303.28
Krems-Wachtberg	28470	280	AMS	VERA-3940	IntCal13	32479.00	31419.75	33538.25
Dolní Vestonice IIa	28550	150	AMS	OxA-17812	IntCal13	32512.50	31737.78	33287.23
Krems-Hundssteig	28550	250	AMS	VERA-2293	IntCal13	32528.00	31514.35	33541.65
Buran Kaya III	28520	460	AMS	OXA-6674	IntCal13	32541.00	31208.15	33873.85
Komarowa Cave	28500	500	AMS	GdA-94	IntCal13	32541.50	31154.03	33928.98
Alaiz	28360	760	AMS	GrA-5224	IntCal13	32555.50	30719.63	34391.38
Abric Romani	28440	650	AMS	NzA-1817	IntCal13	32558.50	30941.13	34175.88
Geissenklosterle	28500	550	AMS	OxA-5228	IntCal13	32559.00	31099.80	34018.20
Geissenklosterle	28600	290	AMS	OxA-21739	IntCal13	32563.50	31479.08	33647.93
Kostenki (Kostienki) 14 (Markina Gora)	28580	420	AMS	OxA-4115	IntCal13	32565.50	31283.48	33847.53
Hohle Fels, Hohler Fels	28580	460	AMS	OxA-4597	IntCal13	32575.50	31236.48	33914.53
Ferrassie	28600	1050	AMS	OxA-409	IntCal13	32588.50	30008.78	35168.23
Grotte des Gorges	28620	160	AMS	Lyon-5230 (GrA)	IntCal13	32593.50	31785.53	33401.48
Geissenklosterle	28640	380	AMS	KIA-8962	IntCal13	32594.00	31366.60	33821.40
Hyaena Den	28600	500	AMS	OxA-4111	IntCal13	32599.50	31199.68	33999.33
Aitzbitarte III Ext	28530	645	AMS	Ua-37962	IntCal13	32627.50	31000.63	34254.38
Krems-Wachtberg	28700	290	AMS	VERA-4535	IntCal13	32627.50	31539.28	33715.73
Grotte des Gorges	28650	160	AMS	Beta-55063	IntCal13	32628.50	31825.28	33431.73
Aghitu-3 Cave	28680	200	AMS	KIA-39643	IntCal13	32633.50	31721.03	33545.98
Flageolet I	28520	670	AMS	GifA-95560	IntCal13	32639.00	30961.30	34316.70
Karabi Tamchin	28720	240	AMS	TO-10991	IntCal13	32649.00	31651.50	33646.50
Krems-Wachtberg	28750	270	AMS	VERA-3939	IntCal13	32663.00	31609.45	33716.55
Krems-Hundssteig	28780	270	AMS	VERA-2292	IntCal13	32684.50	31632.38	33736.63
Dolní Vestonice IIa	28750	220	AMS	OxA-27332	IntCal13	32684.50	31735.93	33633.08
Kent's Cavern	28700	600	AMS	OxA-4438	IntCal13	32728.50	31134.88	34322.13
Buran Kaya III	28840	460	AMS	OxA-6673	IntCal13	32736.50	31360.43	34112.58

El Nino	28660	90	AMS	UGAMS-7739	IntCal13	32740.50	32278.33	33202.68
Buraca Grande - 9A	28700	620	AMS	OxA-4128	IntCal13	32747.50	31114.93	34380.08
Chauvet	28780	180	AMS	GrA-27316	IntCal13	32756.00	31928.55	33583.45
Kent's Cavern Vestibule	28880	440	AMS	OxA-5694	IntCal13	32757.50	31408.98	34106.03
Garchi I	28750	150	AMS	TUa-868	IntCal13	32762.50	32023.88	33501.13
Hohle Fels, Hohler Fels	28920	440	AMS	OxA-4599	IntCal13	32786.50	31430.38	34142.63
Alberndorf I	28950	400	AMS	OxA-18523	IntCal13	32797.00	31507.85	34086.15
Buor-Khaya/Orto-Stan	28790	160	AMS	Beta-362948	IntCal13	32802.00	32050.55	33553.45
Gobelsburg	28930	260	AMS	VERA-1762	IntCal13	32819.00	31815.80	33822.20
Hohle Fels, Hohler Fels	28750	750	AMS	OxA-4980	IntCal13	32819.50	30981.73	34657.28
Garbas	28750	795	AMS	Tua-941	IntCal13	32828.50	30921.38	34735.63
Ferrassie	29000	370	AMS	OxA-15217	IntCal13	32828.50	31588.28	34068.73
Chauvet	28930	250	AMS	GrA-22573	IntCal13	32830.00	31854.35	33805.65
Byzovaya VI	29020	300	AMS	Tua-7309	IntCal13	32868.00	31781.20	33954.80
Chauvet	28850	170	AMS	GrA-23145	IntCal13	32877.50	32138.88	33616.13
Aitzbitarte III Ext	28950	655	AMS	Ua-18466	IntCal13	32912.50	31183.98	34641.03
Dolní Vestonice IIa	29060	280	AMS	OxA-27255	IntCal13	32929.50	31909.68	33949.33
Acagizli Magara	29130	380	AMS	AA-38202	IntCal13	32937.00	31661.15	34212.85
Byzovaya VI	29110	320	AMS	TUa-7308	IntCal13	32940.50	31818.08	34062.93
Cioclovina 1, Pestera Muierii	29000	700	AMS	LuA-5229	IntCal13	32958.50	31157.78	34759.23
Kostenki (Kostienki) 14 (Markina Gora)	29130	320	AMS	CURL-15796	IntCal13	32961.50	31843.83	34079.18
La Cala	29120	300	AMS	OxA-6265	IntCal13	32971.00	31908.90	34033.10
Istallosko	29035	237	AMS	ISGS-A-0185	IntCal13	32975.50	32093.43	33857.58
Cioarei-Borosteni	29100	570	AMS	OxA-2848	IntCal13	32978.00	31346.85	34609.15
Chauvet	29180	340	AMS	GifA-102568	IntCal13	32999.50	31831.48	34167.53
Geissenklosterle	29200	460	AMS	OxA-4592	IntCal13	33027.50	31558.33	34496.68
Geissenklosterle	29200	500	AMS	OxA-4593	IntCal13	33031.00	31495.80	34566.20
Ferrassie	29000	850	AMS	OxA-405	IntCal13	33039.00	30986.05	35091.95
Geissenklosterle	29220	500	AMS	OxA-5706	IntCal13	33044.50	31506.93	34582.08
Chauvet	28930	160	AMS	GrA-23136	IntCal13	33052.00	32446.85	33657.15
Byzovaya VI	29230	340	AMS	TUa-7312	IntCal13	33057.50	31895.18	34219.83
Stratzing/Krems-Rehberg, Galgenberg	29260	460	AMS	KN-4140	IntCal13	33069.00	31594.60	34543.40
Byzovaya VI	29190	290	AMS	TUa-7313	IntCal13	33070.50	32069.68	34071.33
Kostenki (Kostienki) 14 (Markina Gora)	29240	330	AMS	GrA-13312	IntCal13	33077.50	31949.38	34205.63
Bajondillo	29165	725	AMS	Ua-18051	IntCal13	33081.50	31200.98	34962.03

Grotte XVI	29285	420	AMS	AA-6841	IntCal13	33093.50	31695.58	34491.43
Gorham's Cave	29250	650	AMS	OxA-7077	IntCal13	33100.50	31319.73	34881.28
Chauvet	29050	190	AMS	GrA-45998	IntCal13	33143.50	32495.13	33791.88
Chauvet	29080	200	AMS	GrA-46926	IntCal13	33162.00	32493.20	33830.80
Gorham's Cave	29250	750	AMS	OxA-7110	IntCal13	33167.00	31211.90	35122.10
Isturitz	29400	370	AMS	Beta-136049	IntCal13	33251.50	32010.33	34492.68
Kostenki (Kostienki) 14 (Markina Gora)	29400	370	AMS	CURL-17829	IntCal13	33251.50	32010.33	34492.68
Fumane	29361	320	AMS	LTL-1796A	IntCal13	33300.00	32276.85	34323.15
Hohle Fels, Hohler Fels	29550	650	AMS	OxA-5007	IntCal13	33351.00	31474.75	35227.25
Grotte des Gorges	29240	170	AMS	LYON-5231 (GrA)	IntCal13	33361.50	32831.88	33891.13
Grande Grotte	29640	590	AMS	GifA-93012	IntCal13	33391.00	31618.30	35163.70
Kalavan 2	29230	110	AMS	UGAMS-2295A	IntCal13	33397.00	33019.85	33774.15
Kostenki (Kostienki) 14 (Markina Gora)	29320	150	AMS	GrA-15955	IntCal13	33441.50	32972.68	33910.33
Grotte XVI	29710	510	AMS	GifA-94201	IntCal13	33459.50	31894.38	35024.63
Geissenklosterle	29390	210	AMS	Beta-156088	IntCal13	33468.00	32854.30	34081.70
Chauvet	29400	210	AMS	GrA-46927	IntCal13	33477.00	32864.25	34089.75
Grotte des Gorges	29390	170	AMS	Lyon-5232 (grA)	IntCal13	33489.50	32978.88	34000.13
Grotte des Gorges	29430	190	AMS	Beta-355064	IntCal13	33513.50	32955.38	34071.63
Goyet	29420	170	AMS	OxA-V-2223-49	IntCal13	33518.00	33013.55	34022.45
Ferrassie	29390	140	AMS	GrA-31945	IntCal13	33522.00	33103.05	33940.95
Foradada	29440	190	AMS	Beta-103781	IntCal13	33522.50	32965.33	34079.68
Brno-Bohunice B2002	29490	240	AMS	OxA-18320	IntCal13	33552.50	32862.33	34242.68
Labeko Koba	29750	740	AMS	Ua-3325	IntCal13	33577.00	31465.15	35688.85
Gorham's Cave	29800	700	AMS	OxA-7075	IntCal13	33595.00	31549.65	35640.35
Hohle Fels, Hohler Fels	29560	240	AMS	KIA-8964	IntCal13	33627.00	32933.50	34320.50
Chauvet	29670	950	AMS	GifA-98160	IntCal13	33644.50	31196.83	36092.18
Goats hair Cave	29600	280	AMS	VERA-1768	IntCal13	33670.00	32855.85	34484.15
Flageolet I	29840	750	AMS	Gifa-95541	IntCal13	33671.00	31504.05	35837.95
Chauvet	29560	160	AMS	GrA-32590	IntCal13	33693.50	33277.88	34109.13
Chauvet	29740	390	AMS	GifA-99239	IntCal13	33712.00	32628.05	34795.95
El Castillo	29600	180	AMS	Beta-298433	IntCal13	33714.50	33239.03	34189.98
Divje Babe	29760	340	AMS	OxA-28219	IntCal13	33780.50	32845.23	34715.78
Hohle Fels, Hohler Fels	29780	330	AMS	KIA-18878	IntCal13	33803.50	32895.78	34711.23
Chauvet	29900	1000	AMS	AA-98842	IntCal13	33809.50	31247.83	36371.18
Barbing	29680	0	AMS	Gra-16157	IntCal13	33831.00	33800.60	33861.40

Hohle Fels, Hohler Fels	29710	210	AMS	KIA-32056	IntCal13	33837.50	33272.73	34402.28
El Castillo	29740	190	AMS	Beta-298432	IntCal13	33884.00	33401.40	34366.60
Grotte des Gorges	29740	200	AMS	Beta-355062	IntCal13	33885.00	33366.30	34403.70
Karabi Tamchin	29800	0	AMS	OxA-11387	IntCal13	33907.00	33876.60	33937.40
Geissenklosterle	29800	240	AMS	KIA-8960	IntCal13	33916.50	33276.68	34556.33
Franchthi	29780	160	AMS	OxA-22270	IntCal13	33919.50	33530.48	34308.53
Jarama VI	29500	2700	AMS	Beta-56638	IntCal13	33937.00	27794.30	40079.70
Gorham's Cave	29910	300	AMS	Beta-196786	IntCal13	33958.00	33169.50	34746.50
Cova Beneito	30160	680	AMS	GifA-89283	IntCal13	33961.00	31923.25	35998.75
Chauvet	29980	360	AMS	GifA-13227/SacA-34351	IntCal13	33979.00	33028.05	34929.95
Hohle Fels, Hohler Fels	29840	210	AMS	KIA-16038	IntCal13	33985.50	33447.33	34523.68
Gorham's Cave	30200	700	AMS	OxA-7074	IntCal13	33991.00	31910.50	36071.50
Guelga	29950	310	AMS	Beta-172345	IntCal13	33993.50	33191.23	34795.78
Hohle Fels, Hohler Fels	29990	340	AMS	KIA-3505	IntCal13	34006.50	33120.63	34892.38
Chauvet	30020	350	AMS	GifA-102573	IntCal13	34033.50	33125.78	34941.23
Gorham's Cave	30250	700	AMS	OxA-7076	IntCal13	34047.00	31983.60	36110.40
Geissenklosterle	30300	750	AMS	OxA-5161	IntCal13	34056.00	31880.50	36231.50
Geissenklosterle	30100	550	AMS	OxA-6256	IntCal13	34063.00	32534.45	35591.55
Foradada	29950	200	AMS	Beta-103783	IntCal13	34078.50	33576.43	34580.58
Antolinako Koba	29990	230	AMS	GrA-23898	IntCal13	34103.00	33538.70	34667.30
Hohle Fels, Hohler Fels	30010	220	AMS	KIA-8965	IntCal13	34120.50	33580.43	34660.58
Hohle Fels, Hohler Fels	30040	210	AMS	KIA-32057	IntCal13	34143.50	33626.23	34660.78
Chauvet	30230	630	AMS	GifA-96145	IntCal13	34158.00	32355.85	35960.15
Hohle Fels, Hohler Fels	30110	220	AMS	KIA-32060	IntCal13	34192.00	33657.15	34726.85
La Vina	30130	170	AMS	OxA-19195	IntCal13	34203.00	33766.95	34639.05
Bockstein-Torle	30130	260	AMS	KIA-8952	IntCal13	34206.50	33588.53	34824.48
Chauvet	30140	180	AMS	GrA-23141	IntCal13	34210.50	33754.98	34666.03
Grande Grotte	30160	140	AMS	GifA-93013	IntCal13	34220.50	33843.83	34597.18
Hohle Fels, Hohler Fels	30170	250	AMS	KIA-18877	IntCal13	34236.50	33640.38	34832.63
Grotte des Gorges	30190	180	AMS	LYON-5233 (GrA)	IntCal13	34243.00	33787.95	34698.05
Chauvet	30230	530	AMS	GifA-96065	IntCal13	34243.50	32812.33	35674.68
Kent's Cavern	30220	460	AMS	OxA-6108	IntCal13	34245.00	33003.35	35486.65
Aghitu-3 Cave	30210	180	AMS	KIA-39641	IntCal13	34257.00	33801.95	34712.05
Asfaka-konitsa road 7	30250	550	AMS	OxA-4104	IntCal13	34265.00	32771.60	35758.40
Aldene, Coquille, Minerve, Fauzan	30260	220	AMS	Beta-188750	IntCal13	34296.50	33761.18	34831.83

Chauvet	30270	240	AMS	GifA-80132/SacA-11417	IntCal13	34308.50	33730.43	34886.58
Biryuchya Balka 2	30240	360	AMS	Beta-183591	IntCal13	34311.50	33434.18	35188.83
Hyaena Den	30240	380	AMS	OxA-13323	IntCal13	34313.50	33366.83	35260.18
Chauvet	30290	210	AMS	GrA-27052	IntCal13	34315.50	33799.18	34831.83
Cueva Hora	30300	190	AMS	Beta-212190	IntCal13	34318.50	33842.08	34794.93
Geissenklosterle	30300	550	AMS	OxA-6629	IntCal13	34329.50	32838.48	35820.53
Gorodok 2	30300	300	AMS	OxA-15080	IntCal13	34352.50	33636.68	35068.33
Chauvet	30350	190	AMS	GrA-47156	IntCal13	34353.50	33875.18	34831.83
Dzerava skala	30330	500	AMS	Poz-8485	IntCal13	34355.00	33011.70	35698.30
Chauvet	30360	180	AMS	GrA-23139	IntCal13	34358.00	33899.15	34816.85
Chauvet	30360	180	AMS	GrA-23134	IntCal13	34358.00	33899.15	34816.85
Chauvet-Pont d'Arc	30340	570	AMS	GifA-95128	IntCal13	34377.50	32825.68	35929.33
Fumane	30320	320	AMS	OxA-8050	IntCal13	34380.00	33610.50	35149.50
Hohle Fels, Hohler Fels	30340	290	AMS	KIA-32055	IntCal13	34382.00	33684.70	35079.30
Franchthi	30410	160	AMS	OxA-21115	IntCal13	34389.50	33969.13	34809.88
Covalejos, Cobalejos	30380	250	AMS	GrA-22443	IntCal13	34395.50	33784.18	35006.83
Brillenhohle	30400	240	AMS	KIA-19550	IntCal13	34407.00	33815.15	34998.85
Chauvet	30430	190	AMS	GrA-23137	IntCal13	34411.00	33925.55	34896.45
Chauvet	30100	2000	AMS	GifA-13094/SacA-33475	IntCal13	34411.50	29485.28	39337.73
Hohle Fels, Hohler Fels	30420	220	AMS	KIA-32058	IntCal13	34414.50	33864.93	34964.08
Chauvet	30420	230	AMS	GrA-46923	IntCal13	34418.00	33846.10	34989.90
Eext-Hooidijk	30400	270	AMS	Poz-37827	IntCal13	34421.50	33761.73	35081.28
Engis	30460	210	AMS	GrA-21545	IntCal13	34440.50	33907.08	34973.93
Labeko Koba	30615	820	AMS	Ua-3322	IntCal13	34447.00	32129.00	36765.00
Dzudzuana Cave	30350	400	AMS	RTA-3438	IntCal13	34448.00	33438.15	35457.85
Hohe Liet	30460	250	AMS	KIA-32059	IntCal13	34459.50	33835.83	35083.18
Chauvet	30460	250	AMS	GrA-24198	IntCal13	34459.50	33835.83	35083.18
Cobrante	30480	250	AMS	GrA-22441	IntCal13	34476.50	33848.08	35104.93
Geissenklosterle	30450	550	AMS	OxA-6628	IntCal13	34494.50	33006.33	35982.68
Chauvet	30530	220	AMS	GrA-46930	IntCal13	34501.00	33933.85	35068.15
Chauvet	30530	240	AMS	GrA-46922	IntCal13	34512.50	33897.38	35127.63
Ferrassie	30640	170	AMS	GrA-31933	IntCal13	34569.50	34102.58	35036.43
Hohle Fels, Hohler Fels	30640	190	AMS	KIA-16040	IntCal13	34578.00	34062.15	35093.85
Hohle Fels, Hohler Fels	30550	550	AMS	OxA-4601	IntCal13	34602.50	33137.13	36067.88

Anton Koba	30640	240	AMS	Beta-251304	IntCal13	34616.00	33967.15	35264.85
Chauvet	30690	180	AMS	GrA-45942	IntCal13	34616.50	34116.33	35116.68
Chauvet	30690	190	AMS	GrA-23144	IntCal13	34622.00	34095.70	35148.30
Chauvet	30560	370	AMS	GifA-102566	IntCal13	34636.00	33689.80	35582.20
La Vina	30600	370	AMS	OxA-21687	IntCal13	34668.50	33717.08	35619.93
Chauvet-Pont d'Arc	30760	80	AMS	GrA-28195	IntCal13	34688.00	34473.30	34902.70
Chauvet	30740	220	AMS	GrA-46931	IntCal13	34696.50	34071.88	35321.13
La Vina	30650	360	AMS	OxA-21845	IntCal13	34704.50	33767.33	35641.68
Krems-Hundssteig	30750	290	AMS	VERA-1616	IntCal13	34752.50	33951.18	35553.83
Grotte des Gorges	30500	1300	AMS	GifA-12196/SacA-29928	IntCal13	34781.00	31260.30	38301.70
Chauvet	30710	400	AMS	GifA-102571	IntCal13	34787.50	33739.18	35835.83
Chauvet	30800	300	AMS	GifA-70055 (SacA-8546)	IntCal13	34796.50	33965.73	35627.28
Chauvet	30790	600	AMS	GifA-95133	IntCal13	34840.50	33338.08	36342.93
Chauvet	30900	270	AMS	GrA-28202	IntCal13	34866.00	34089.85	35642.15
Arbreda	30950	220	AMS	OxA-19935	IntCal13	34893.00	34232.75	35553.25
Chauvet-Pont d'Arc	30890	340	AMS	GifA-9226/SacA/14235	IntCal13	34905.50	33957.88	35853.13
Kabazi V	30980	220	AMS	OxA-X-2134-45	IntCal13	34920.50	34259.78	35581.23
Klisoura Cave 1, Klissoura Cave 1	30925	420	AMS	RTT-4786	IntCal13	34973.50	33850.13	36096.88
Acagizli Magara	31060	140	AMS	AA-35258	IntCal13	34998.50	34580.03	35416.98
Chauvet	30980	410	AMS	GifA-102567	IntCal13	35011.00	33903.30	36118.70
Chauvet	30940	610	AMS	GifA-95126	IntCal13	35012.50	33505.33	36519.68
Cueva Anton	31070	170	AMS	OxA-20882	IntCal13	35020.50	34514.63	35526.38
Chauvet	31020	350	AMS	GifA-99773	IntCal13	35023.50	34030.28	36016.73
Kara-Bom	30990	460	AMS	GX-17593	IntCal13	35025.00	33827.05	36222.95
Chauvet	31020	370	AMS	GifA-99778	IntCal13	35029.50	33995.43	36063.58
Geissenklosterle	31090	200	AMS	Beta-143245	IntCal13	35035.00	34442.20	35627.80
Kostenki (Kostienki)	31020	400	AMS	CURL-15811	IntCal13	35037.00	33945.45	36128.55
Chauvet	31093	260	AMS	KiA-28595/GifA-50160	IntCal13	35042.50	34266.83	35818.18
Gorham's Cave	31110	230	AMS	Beta-184045	IntCal13	35051.00	34367.00	35735.00
Chauvet	31061	373	AMS	Muse-241 (Sac-31534)	IntCal13	35060.50	34018.83	36102.18
Chauvet	31060	400	AMS	GifA-102565	IntCal13	35065.00	33972.50	36157.50
Chauvet	31120	180	AMS	Lyon-8930 (GrA)	IntCal13	35068.00	34536.00	35600.00
Dzerava skala	31000	1100	AMS	OxA-15335	IntCal13	35072.00	31800.20	38343.80

Chauvet	31130	170	AMS	GrA-32596	IntCal13	35075.50	34569.63	35581.38
Chauvet-Pont d'Arc	30800	1500	AMS	GifA-95155	IntCal13	35081.50	31223.08	38939.93
Hohle Fels, Hohler Fels	31010	600	AMS	KIA-18876	IntCal13	35085.50	33597.33	36573.68
Hohle Fels, Hohler Fels	31140	250	AMS	KIA-16039	IntCal13	35090.50	34340.48	35840.53
Cueva Anton	31150	170	AMS	OxA-20881	IntCal13	35092.50	34585.68	35599.33
Chauvet	31120	420	AMS	GifA-13028/SacA-32472	IntCal13	35108.50	33979.43	36237.58
La Dehesa	31100	500	AMS	OxA-4603	IntCal13	35110.50	33836.08	36384.93
Kent's Cavern	30900	900	AMS	OxA-1621	IntCal13	35113.00	32451.10	37774.90
Kent's Cavern	31150	330	AMS	OxA-14715	IntCal13	35120.50	34163.38	36077.63
La Vina	31160	380	AMS	OxA-21705	IntCal13	35133.00	34076.60	36189.40
Klisoura Cave 1, Klissoura Cave 1	31150	480	AMS	GdA-228	IntCal13	35141.50	33901.28	36381.73
Geissenklosterle	31180	270	AMS	KIA-8963	IntCal13	35142.00	34327.85	35956.15
Chauvet	31180	400	AMS	GifA-101462	IntCal13	35148.00	34054.55	36241.45
Abri Pataud	31200	400	AMS	OxA-21681	IntCal13	35162.50	34069.53	36255.48
Geissenklosterle	30950	800	AMS	OxA-4856	IntCal13	35165.00	32914.45	37415.55
Hohle Fels, Hohler Fels	31100	600	AMS	OxA-4600	IntCal13	35180.50	33672.38	36688.63
Chauvet	31230	260	AMS	GifA-80154/SacA-12020	IntCal13	35195.50	34415.08	35975.93
Abri Pataud	31250	400	AMS	OxA-21676	IntCal13	35198.00	34105.50	36290.50
Chauvet	31260	190	AMS	GrA-32592	IntCal13	35198.00	34628.95	35767.05
Abri Pataud	31270	390	AMS	OxA-21677	IntCal13	35212.00	34138.50	36285.50
Chauvet	31250	230	AMS	GrA-27646	IntCal13	35217.00	34533.00	35901.00
Hohle Fels, Hohler Fels	31290	180	AMS	OxA-19860	IntCal13	35218.50	34670.83	35766.18
Chauvet	31300	180	AMS	GrA-32593	IntCal13	35228.00	34677.95	35778.05
Gorham's Cave	31290	340	AMS	Beta-196768	IntCal13	35230.50	34258.18	36202.83
Abri Pataud	31300	400	AMS	OxA-21582	IntCal13	35235.00	34142.50	36327.50
Chauvet	31297	227	AMS	ETH-46133 b	IntCal13	35264.00	34581.90	35946.10
Chauvet	31340	180	AMS	A-3259*5	IntCal13	35266.50	34707.43	35825.58
Aitzbitarte III Ext	31000	835	AMS	Ua-18468	IntCal13	35275.00	32881.00	37669.00
Chauvet	31350	440	AMS	GifA-102574	IntCal13	35287.00	34106.15	36467.85
Chauvet	31360	190	AMS	GrA-45941	IntCal13	35295.50	34702.23	35888.78
Chauvet	31330	270	AMS	GifA-80109/SacA-11411	IntCal13	35296.00	34505.60	36086.40
Coca	31360	310	AMS	GrA-20267	IntCal13	35302.50	34410.93	36194.08
Hohle Fels, Hohler Fels	31380	180	AMS	OxA-19780	IntCal13	35305.50	34735.98	35875.03

Chauvet	31370	320	AMS	GifA-80004 (SacA-9877)	IntCal13	35306.00	34392.10	36219.90
Chauvet	31390	420	AMS	GifA-99810	IntCal13	35312.50	34172.98	36452.03
Chauvet	31360	490	AMS	GifA-101456	IntCal13	35335.50	34026.88	36644.13
Castanet Southern sector	31430	390	AMS	GrA-99165	IntCal13	35340.00	34267.45	36412.55
Chauvet	31390	230	AMS	GrA-27045	IntCal13	35343.00	34646.65	36039.35
Chauvet	31430	420	AMS	GifA-99238	IntCal13	35350.00	34204.30	36495.70
Askondo	31440	190	AMS	Beta-303670	IntCal13	35369.50	34759.13	35979.88
Chauvet	31430	260	AMS	GrA-47166	IntCal13	35379.50	34616.18	36142.83
Hohlenstein-Stadel	31440	250	AMS	KIA-8951	IntCal13	35386.00	34644.05	36127.95
Kent's Cavern	31100	800	AMS	OxA-1029	IntCal13	35389.50	33087.18	37691.83
Ash Tree Cave	31300	600	AMS	OxA-4105	IntCal13	35390.00	33815.85	36964.15
Klisoura Cave 1, Klissoura Cave 1	31460	210	AMS	AA-73821	IntCal13	35392.00	34734.60	36049.40
La Vina	31500	400	AMS	OxA-21689	IntCal13	35411.00	34309.00	36513.00
Hohle Fels, Hohler Fels	31160	1530	AMS	KIA-18879	IntCal13	35413.00	31370.75	39455.25
Aitzbitarte III Ext	31065	870	AMS	Ua-21159	IntCal13	35416.00	32867.15	37964.85
Chauvet	31490	430	AMS	GifA-13195/SacA-33483	IntCal13	35416.50	34232.33	36600.68
Chauvet	31510	360	AMS	GifA-90224/SacA-14233	IntCal13	35421.00	34431.10	36410.90
Fumane	31490	250	AMS	OxA-11348	IntCal13	35423.00	34679.15	36166.85
Dubalen	31520	360	AMS	GifA-98106	IntCal13	35432.50	34444.03	36420.98
Chauvet	31520	360	AMS	GifA-99769	IntCal13	35432.50	34444.03	36420.98
Chauvet	31510	270	AMS	GifA-80174 (SacA-12039)	IntCal13	35438.50	34655.23	36221.78
Bockstein-Torle	31530	230	AMS	KIA-8953	IntCal13	35449.50	34745.08	36153.93
Chauvet	31540	234	AMS	ETH-46133	IntCal13	35457.50	34744.53	36170.48
Bondi Cave	31270	640	AMS	SacA-12069	IntCal13	35460.50	33734.83	37186.18
Chauvet	31547	264	AMS	VERA-5779HS-2	IntCal13	35464.50	34692.63	36236.38
Henrykow 15	31550	350	AMS	Poz-60000	IntCal13	35467.50	34511.33	36423.68
Biryuchya Balka 1a	31560	200	AMS	Beta-183589	IntCal13	35467.50	34824.83	36110.18
Hyaena Den	31550	340	AMS	OxA-13803	IntCal13	35468.50	34537.98	36399.03
Chauvet	31530	450	AMS	GifA-13087/SacA-32985	IntCal13	35474.50	34224.78	36724.23
Chauvet	31570	240	AMS	GrA-27315	IntCal13	35479.00	34753.20	36204.80
Chauvet	31570	300	AMS	GrA-27051	IntCal13	35483.50	34640.38	36326.63
Fumane	31590	160	AMS	OxA-17571	IntCal13	35486.50	34935.03	36037.98

Chauvet	31570	360	AMS	GifA-90219/SacA-14204	IntCal13	35487.50	34504.73	36470.28
Chauvet	31580	280	AMS	GifA-80107/SacA-11409	IntCal13	35489.00	34685.30	36292.70
Chauvet	31580	280	AMS	GifA-80108/SacA-11410	IntCal13	35489.00	34685.30	36292.70
Chauvet	31580	370	AMS	GifA-99223/SacA-14232	IntCal13	35498.50	34485.33	36511.68
Istallosko	31608	295	AMS	ISGS-A-0188	IntCal13	35511.00	34676.90	36345.10
Chauvet	31619	238	AMS	ETH-46133 c	IntCal13	35514.50	34792.03	36236.98
Chauvet	31610	320	AMS	GifA-80002 (SacA-9875)	IntCal13	35517.00	34630.65	36403.35
Klisoura Cave 1, Klissoura Cave 1	31630	250	AMS	AA-73817	IntCal13	35522.50	34776.28	36268.73
Chauvet	31630	280	AMS	GifA-80144/SacA-11426	IntCal13	35525.00	34720.35	36329.65
Bordes-Fitte, Roches d'Abilly	31640	230	AMS	Beta-234193	IntCal13	35529.00	34822.20	36235.80
Dolní Vestonice IIa	31650	280	AMS	OxA-27333	IntCal13	35539.50	34733.43	36345.58
Chauvet	31350	620	AMS	GifA-96063	IntCal13	35543.50	33823.53	37263.48
Chauvet	31663	238	AMS	ETH-46134 c	IntCal13	35546.00	34823.05	36268.95
Chauvet	31600	450	AMS	OxA-26485	IntCal13	35550.50	34284.63	36816.38
Chauvet	31670	230	AMS	GrA-27042	IntCal13	35551.00	34844.20	36257.80
Geissenklosterle	31629	391	AMS	KIA-19557	IntCal13	35563.00	34479.05	36646.95
Cova Eiros	31690	240	AMS	Beta-254280	IntCal13	35565.50	34838.28	36292.73
Chauvet	31500	3000	AMS	GifA-13032/SacA-32351	IntCal13	35569.50	29056.78	42082.23
Chauvet	31690	290	AMS	Gifa-80138/SacA-11420	IntCal13	35572.50	34742.68	36402.33
Chauvet	31700	280	AMS	KiA-28575:GifA-50130B	IntCal13	35577.00	34767.60	36386.40
Chauvet	31710	230	AMS	GrA-53781	IntCal13	35580.00	34873.20	36286.80
Chauvet	31680	330	AMS	GifA-80003 (SacA-98716	IntCal13	35582.00	34662.40	36501.60
Chauvet	31710	300	AMS	GifA-80150/SacA-11489	IntCal13	35592.00	34737.95	36446.05
Aitzbitarte III Ext	31210	860	AMS	Ua-18467	IntCal13	35594.50	33063.23	38125.78
Cave 8, Uphill quarry	31730	250	AMS	OxA-13716	IntCal13	35595.50	34847.38	36343.63
Hohle Fels, Hohler Fels	31750	260	AMS	KIA-35464	IntCal13	35612.00	34841.55	36382.45

Goyet 3	31750	200	AMS	OxA-V-2223-44	IntCal13	35614.00	34972.75	36255.25
Chauvet	31759	244	AMS	VERA-5780HS_2	IntCal13	35617.00	34880.75	36353.25
Kostenki (Kostienki) 12 (Volkovskaya site)	31760	230	AMS	OxA-X-2158-14	IntCal13	35618.50	34912.18	36324.83
Hohle Fels, Hohler Fels	31760	200	AMS	OxA-19783	IntCal13	35622.00	34980.75	36263.25
Altwasser Höhle 1	31690	370	AMS	KIA-4944	IntCal13	35622.50	34592.23	36652.78
Chauvet	31500	1200	AMS	GifA-13093/SacA-33471	IntCal13	35641.50	32292.28	38990.73
Chauvet	31800	230	AMS	GrA-53780	IntCal13	35650.00	34944.15	36355.85
Fumane	31620	500	AMS	OxA-6465	IntCal13	35651.00	34202.25	37099.75
Chauvet	31810	200	AMS	GrA-27642	IntCal13	35662.00	35024.55	36299.45
Chauvet	31810	190	AMS	OxA-X-2130-48	IntCal13	35664.50	35049.38	36279.63
Fumane	31830	260	AMS	OxA-11360	IntCal13	35679.00	34900.95	36457.05
Chauvet	31864	245	AMS	ETH-46134 b	IntCal13	35706.00	34962.15	36449.85
Chauvet	31870	210	AMS	GrA-27645	IntCal13	35709.50	35051.63	36367.38
Geissenklosterle	31870	260	AMS	KIA-8958	IntCal13	35717.00	34933.25	36500.75
Chauvet	31875	265	AMS	ETH-46134 a	IntCal13	35724.50	34926.03	36522.98
Chauvet	31886	247	AMS	ETH-46134 d	IntCal13	35727.00	34975.55	36478.45
Buran Kaya III	31900	240	AMS	GrA-37938	IntCal13	35738.50	35003.68	36473.33
Kostenki (Kostienki) 14 (Markina Gora)	31760	430	AMS	GrA-13288	IntCal13	35745.50	34513.83	36977.18
Chauvet	31870	300	AMS	GrA-28194	IntCal13	35745.50	34850.13	36640.88
Chauvet	31910	250	AMS	OxA-26645	IntCal13	35752.00	34988.20	36515.80
Chauvet	31920	190	AMS	OxA-X-2138-36	IntCal13	35758.00	35152.85	36363.15
Buran Kaya III	31320	820	AMS	GifA-10021/SacA-19018	IntCal13	35758.50	33376.38	38140.63
Chauvet	31900	280	AMS	OxA-26473	IntCal13	35760.00	34913.55	36606.45
Chauvet	31360	860	AMS	Lyon-9299 (SacA-29721)	IntCal13	35762.50	33283.48	38241.53
Chauvet	31920	180	AMS	OxA-13975	IntCal13	35762.50	35183.48	36341.53
Chauvet	31810	390	AMS	SacA-33746	IntCal13	35766.50	34645.03	36887.98
Chauvet	31940	200	AMS	Lyon-8931 (GrA°	IntCal13	35774.50	35144.18	36404.83
Geographical Society Cave	31550	600	AMS	GrA-16819	IntCal13	35789.00	33991.60	37586.40
Chauvet	31960	240	AMS	GrA-27044	IntCal13	35799.50	35056.13	36542.88
Labeko Koba	31455	915	AMS	Ua-3321	IntCal13	35809.00	33236.40	38381.60
Chauvet	31860	380	AMS	GifA-99770	IntCal13	35810.00	34698.50	36921.50
Chauvet	31900	3100	AMS	GifA-11129/SacA-24977	IntCal13	35836.50	29243.98	42429.03

Chauvet	32030	210	AMS	GrA-27644	IntCal13	35866.50	35205.78	36527.23
Cova Gran de Santa Linya	32000	300	AMS	Beta-195430	IntCal13	35883.50	34950.13	36816.88
Chauvet	31890	400	AMS	SacA-33747	IntCal13	35899.00	34686.80	37111.20
Chauvet	31970	350	AMS	GifA-8007 (SacA-9880)	IntCal13	35901.00	34828.45	36973.55
Chauvet	31910	390	AMS	GifA-99768	IntCal13	35902.00	34717.35	37086.65
Hohle Fels, Hohler Fels	32030	280	AMS	KIA-35463	IntCal13	35902.50	35020.43	36784.58
La Chaire à Calvin	32070	220	AMS	OxA-12142	IntCal13	35916.50	35217.78	36615.23
Kostenki (Kostienki) 14 (Markina Gora)	32070	190	AMS	OxA-15055	IntCal13	35916.50	35324.18	36508.83
Kostenki (Kostienki) 14 (Markina Gora)	32060	260	AMS	OxA-9567	IntCal13	35923.50	35095.58	36751.43
Chauvet	32080	200	AMS	OxA-X-2130-47	IntCal13	35927.50	35299.08	36555.93
Chauvet	32010	340	AMS	GifA-80008 (SacA-9881)	IntCal13	35938.00	34876.85	36999.15
Chauvet-Pont d'Arc	31830	450	AMS	GifA-13134/SacA-33762	IntCal13	35941.00	34539.75	37342.25
Chauvet	31830	450	AMS	GifA-13095/SacA-33473	IntCal13	35941.00	34539.75	37342.25
Kostenki (Kostienki) 14 (Markina Gora)	32100	200	AMS	GrA-13354	IntCal13	35953.00	35324.10	36581.90
Gargas	31540	720	AMS	LYON-1624	IntCal13	35961.50	33809.28	38113.73
Chauvet	32100	3200	AMS	GifA-13099/SacA-33477	IntCal13	35964.50	29266.53	42662.48
Fragland's Lane	32110	200	AMS	OxA-20615	IntCal13	35965.50	35336.13	36594.88
Chauvet	31940	390	AMS	SacA-28829	IntCal13	35968.00	34739.65	37196.35
Abri Pataud	31850	450	AMS	OxA-22778	IntCal13	35975.50	34559.53	37391.48
Fumane	32120	240	AMS	OxA-19413	IntCal13	35984.50	35208.83	36760.18
Dzerava skala	31600	900	AMS	OxA-15334	IntCal13	35991.00	33522.90	38459.10
Chauvet	31590	780	AMS	Lyon-3096 (Poz-15048)	IntCal13	36010.00	33750.90	38269.10
Chauvet	32131	272	AMS	Wk-33808	IntCal13	36013.50	35129.53	36897.48
Chauvet	32158	276	AMS	VERA-5779-2	IntCal13	36051.00	35145.65	36956.35
Chauvet	32140	46	AMS	GifA-13027/SacA-32471	IntCal13	36052.00	35888.60	36215.40
Chauvet	32160	278	AMS	Wk-33807	IntCal13	36055.50	35142.08	36968.93
Castanet North	31900	450	AMS	OxA-21640	IntCal13	36056.00	34606.30	37505.70
Goyet	31680	750	AMS	Beta-239920	IntCal13	36069.50	33859.33	38279.68

Kostenki (Kostienki) 14 (Markina Gora)	31880	500	AMS	CURL-17827	IntCal13	36081.50	34453.68	37709.33
Chauvet	32010	390	AMS	GifA-90218/SacA-14203	IntCal13	36093.50	34790.58	37396.43
Hohle Fels, Hohler Fels	32140	310	AMS	OxA-19782	IntCal13	36095.00	35047.15	37142.85
Franchthi	32110	330	AMS	GifA80104/SacA-11206	IntCal13	36104.50	34978.28	37230.73
Kostenki (Kostienki) 14 (Markina Gora)	31960	430	AMS	AA-91463	IntCal13	36105.50	34688.58	37522.43
Fumane	31900	500	AMS	UtC-2049	IntCal13	36112.50	34478.03	37746.98
Castanet	31950	450	AMS	OxA-21641	IntCal13	36125.00	34645.85	37604.15
Hohle Fels, Hohler Fels	32090	350	AMS	KIA-35462	IntCal13	36126.00	34921.40	37330.60
Chauvet	32190	290	AMS	GifA-80137/SacA-11419	IntCal13	36135.00	35141.30	37128.70
Chauvet	31950	460	AMS	GifA-13034/SacA-32533	IntCal13	36139.00	34627.55	37650.45
Arbreda	31900	530	AMS	SANU-29014	IntCal13	36150.50	34396.33	37904.68
Abrigo de Buendia	32270	170	AMS	OxA-28336	IntCal13	36157.00	35612.65	36701.35
Chauvet-Pont d'Arc	31800	990	AMS	GifA-13104/SacA-33482	IntCal13	36161.50	33532.38	38790.63
Chauvet	31815	855	AMS	ETH-46133 a	IntCal13	36164.50	33794.73	38534.28
Chauvet	32100	360	AMS	GifA-70154 (SacA-8545)	IntCal13	36166.50	34911.08	37421.93
Gorham's Cave	31850	760	AMS	Beta-196769	IntCal13	36179.50	33957.93	38401.08
La Vina	31860	680	AMS	GifA-95463	IntCal13	36184.00	34083.55	38284.45
Castlepook	32300	160	AMS	OxA-5739	IntCal13	36186.50	35669.23	36703.78
Chauvet	32060	400	AMS	SacA-28830	IntCal13	36188.00	34810.50	37565.50
Castanet North	32000	450	AMS	OxA-21645	IntCal13	36188.50	34683.23	37693.78
Chauvet	32130	360	AMS	GifA-8009 (SacA-9882)	IntCal13	36213.50	34935.28	37491.73
Chauvet-Pont d'Arc	32010	460	AMS	GifA-13106/SacA-33484	IntCal13	36217.00	34674.20	37759.80
Chauvet	32010	460	AMS	GifA-13091/SacA-32989	IntCal13	36217.00	34674.20	37759.80
Kostenki (Kostienki) 14 (Markina Gora)	32300	220	AMS	GrA-5557	IntCal13	36218.00	35496.00	36940.00
Kiesgrube Rotenhof, Porta Westfalica	32300	3000	AMS	Ki-8163	IntCal13	36231.00	29887.85	42574.15

Chauvet	32220	300	AMS	GifA-50157/KiA-28592	IntCal13	36233.50	35147.18	37319.83
Gorham's Cave	32100	400	AMS	Beta-196789	IntCal13	36239.50	34839.68	37639.33
Grotte des Gorges	31930	880	AMS	GifA-12198/SacA-29930	IntCal13	36252.50	33838.08	38666.93
Castanet	32050	450	AMS	OxA-21561	IntCal13	36253.50	34719.73	37787.28
Chauvet	32100	410	AMS	SacA-33745	IntCal13	36254.50	34822.38	37686.63
Hohlenstein-Stadel	32270	270	AMS	KIA-13077	IntCal13	36255.50	35287.93	37223.08
Chauvet	32080	430	AMS	GifA-99775	IntCal13	36259.50	34774.18	37744.83
Fumane	31900	1100	AMS	OxA-6566	IntCal13	36278.50	33329.23	39227.78
Chauvet	32350	210	AMS	OxA-X-2131-14	IntCal13	36278.50	35580.73	36976.28
Ciur-Izbuc	32200	350	AMS	Poz-54806	IntCal13	36298.00	35014.55	37581.45
Hohlenstein-Stadel	32000	550	AMS	ETH-2877	IntCal13	36301.50	34456.13	38146.88
Arbreda	32100	450	AMS	OxA-21783	IntCal13	36323.50	34756.48	37890.53
Aitzbitarte III Ext	31975	960	AMS	Ua-37963	IntCal13	36325.50	33752.43	38898.58
Flageolet I	32040	850	AMS	GifA-95538	IntCal13	36327.50	33956.78	38698.23
Chauvet	32191	380	AMS	KiA-28575:GifA-50130a	IntCal13	36327.50	34945.73	37709.28
Castlepook	32060	630	AMS	OxA-6303	IntCal13	36329.50	34325.48	38333.53
Geissenklosterle	32050	600	AMS	OxA-6077	IntCal13	36332.00	34382.60	38281.40
Chauvet-Pont d'Arc	32090	470	AMS	GifA-13102/SacA-33480	IntCal13	36348.00	34716.85	37979.15
Grotte des Gorges	32100	710	AMS	SaCA-25147	IntCal13	36348.50	34210.53	38486.48
Chauvet	32350	250	AMS	GrA-27049	IntCal13	36379.00	35460.35	37297.65
Chauvet	32130	460	AMS	GifA-101461	IntCal13	36384.00	34762.35	38005.65
Brillenhohle	32110	480	AMS	KIA-19950	IntCal13	36388.50	34715.08	38061.93
Labeko Koba	32150	450	AMS	OxA-21841	IntCal13	36393.50	34792.28	37994.73
Abri Pataud	32150	450	AMS	OxA/OxA-X-2276-20	IntCal13	36393.50	34792.28	37994.73
Cova Gran de Santa Linya	32368	241	AMS	AA-68834	IntCal13	36394.50	35512.43	37276.58
Fumane	32100	500	AMS	Utc-2047	IntCal13	36396.00	34673.65	38118.35
Cova Gran de Santa Linya	32180	430	AMS	Beta-187423	IntCal13	36398.50	34847.63	37949.38
Chauvet	32220	400	AMS	GifA-99771	IntCal13	36399.50	34931.28	37867.73
Grotte du Renne, Arcy-sur-Cure	32100	550	AMS	OxA-21575	IntCal13	36404.00	34574.30	38233.70
Chauvet	32313	310	AMS	KiA-28574/GifA-50129	IntCal13	36406.00	35219.45	37592.55
Chauvet	32180	444	AMS	VERA-5779HS	IntCal13	36423.50	34825.13	38021.88

Chauvet	32240	400	AMS	GifA-10345/SacA-23118	IntCal13	36429.00	34947.95	37910.05
Bacho Kiro	32200	780	AMS	OxA-3181	IntCal13	36430.00	34171.85	38688.15
Kostenki (Kostienki) 14 (Markina Gora)	32180	450	AMS	GrA-13293	IntCal13	36432.00	34815.10	38048.90
Chauvet	32170	470	AMS	AA-98841	IntCal13	36442.50	34774.78	38110.23
Chauvet	32290	370	AMS	GifA-80111/SacA-11413	IntCal13	36449.50	35052.53	37846.48
Chauvet	32460	200	AMS	OxA-13974	IntCal13	36451.00	35718.55	37183.45
Castanet North	32200	450	AMS	OxA-21643	IntCal13	36455.00	34829.55	38080.45
Labeko Koba	32200	450	AMS	OxA-21794	IntCal13	36455.00	34829.55	38080.45
Abri Pataud	32200	450	AMS	OxA-21584	IntCal13	36455.00	34829.55	38080.45
Hohle Fels, Hohler Fels	32370	280	AMS	KIA-35460	IntCal13	36466.50	35386.83	37546.18
Arbreda	32250	450	AMS	OxA-21667	IntCal13	36505.00	34866.25	38143.75
Geissenklosterle	32300	700	AMS	OxA-5708	IntCal13	36510.50	34408.63	38612.38
Chauvet	32330	370	AMS	GifA-12014 (SacA-32303	IntCal13	36511.50	35090.78	37932.23
Chauvet	32290	410	AMS	SacA-29315	IntCal13	36514.50	34971.23	38057.78
Chauvet	32357	350	AMS	KiA-28573 GifA-50128	IntCal13	36518.50	35162.38	37874.63
Cova Gran de Santa Linya	32260	490	AMS	Beta-207575	IntCal13	36523.50	34806.38	38240.63
Kostenki (Kostienki) 14 (Markina Gora)	32280	530	AMS	CURL-17832	IntCal13	36537.00	34754.80	38319.20
Chauvet	32200	950	AMS	Lyon-3097 (Poz-15049)	IntCal13	36538.00	33927.40	39148.60
Chauvet	32290	510	AMS	Muse-240 (SacA-31533)	IntCal13	36544.00	34794.10	38293.90
Chauvet	32370	360	AMS	GifA-70148 (SacA-9871)	IntCal13	36555.00	35151.85	37958.15
Castanet	32310	520	AMS	GifA-99179	IntCal13	36557.50	34792.88	38322.13
Buran Kaya III	32350	700	AMS	OxA-6672	IntCal13	36558.50	34466.13	38650.88
Castanet North	32350	450	AMS	OxA-21644	IntCal13	36588.00	34944.50	38231.50
Castanet Southern sector	32350	450	AMS	OxA-21558	IntCal13	36588.00	34944.50	38231.50
Chauvet	32360	490	AMS	GifA-99809	IntCal13	36593.50	34880.18	38306.83
Chauvet	32410	350	AMS	GifA-80010 (SacA-9883)	IntCal13	36602.50	35220.73	37984.28
Chauvet	32380	410	AMS	SacA-29314	IntCal13	36610.50	35051.08	38169.93
Brillenhohle	32470	270	AMS	KIA-19551	IntCal13	36612.50	35548.98	37676.03
Chauvet	32410	720	AMS	GifA-95132	IntCal13	36615.00	34486.05	38743.95
Hyenes	32410	370	AMS	GifA-98105	IntCal13	36625.00	35170.55	38079.45

Chauvet	32410	370	AMS	GifA-70149 (SacA-9872)	IntCal13	36625.00	35170.55	38079.45
Abri Pataud	32400	450	AMS	OxA-21583	IntCal13	36626.50	34986.33	38266.68
Hohle Fels, Hohler Fels	32470	290	AMS	KIA-16037	IntCal13	36630.00	35486.20	37773.80
Klisoura Cave 1, Klissoura Cave 1	32690	110	AMS	AA-75629	IntCal13	36631.00	36233.90	37028.10
Kostenki (Kostienki) 14 (Markina Gora)	32420	440	AMS	GrA-18053	IntCal13	36643.50	35024.23	38262.78
Fumane	32450	500	AMS	OxA-21795	IntCal13	36654.50	34932.63	38376.38
Fumane	32530	240	AMS	OxA-19411	IntCal13	36660.50	35691.03	37629.98
Kostenki (Kostienki) 14 (Markina Gora)	32460	480	AMS	CURL-15801	IntCal13	36665.50	34979.73	38351.28
Castanet	32460	420	AMS	GifA-97312	IntCal13	36680.00	35104.90	38255.10
Fumane	32600	190	AMS	OxA-18200	IntCal13	36698.50	35924.73	37472.28
Kostenki (Kostienki) 14 (Markina Gora)	32500	460	AMS	AA-91464	IntCal13	36700.50	35056.53	38344.48
Castanet North	32500	450	AMS	OxA-21642	IntCal13	36703.50	35077.58	38329.43
Chauvet	32500	310	AMS	OxA-26572	IntCal13	36703.50	35464.23	37942.78
Cisek 6	32500	400	AMS	Poz-54805	IntCal13	36719.50	35192.38	38246.63
Castanet	32550	600	AMS	OxA-21566	IntCal13	36727.00	34840.30	38613.70
Chauvet	32500	350	AMS	GifA-99774	IntCal13	36731.50	35335.48	38127.53
Chauvet	32560	500	AMS	GifA-13016 (SacA_32305)	IntCal13	36737.00	35028.90	38445.10
Castanet	32550	450	AMS	OxA-21562	IntCal13	36742.50	35126.08	38358.93
Chauvet	32600	490	AMS	GifA-99811	IntCal13	36771.00	35087.60	38454.40
Chauvet	32430	980	AMS	Lyon-9300 (Saca-29722)	IntCal13	36771.00	34043.55	39498.45
Hohle Fels, Hohler Fels	32550	300	AMS	KIA-35459	IntCal13	36772.00	35559.80	37984.20
Castanet	32600	450	AMS	OxA-21563	IntCal13	36783.50	35177.53	38389.48
Fumane	32415	1045	AMS	LYON-1286 OxA	IntCal13	36790.00	33943.80	39636.20
Geissenklosterle	32620	250	AMS	KIA-16033	IntCal13	36798.00	35761.55	37834.45
Bench Quarry, Bench Tunnel Cavern	32400	1100	AMS	OxA-4984	IntCal13	36802.50	33857.98	39747.03
Cova Gran de Santa Linya	32630	450	AMS	Beta-207578	IntCal13	36809.00	35210.15	38407.85
Kostenki (Kostienki) 12 (Volkovskaya site)	32600	280	AMS	OxA-9568	IntCal13	36817.50	35666.58	37968.43
Kostenki (Kostienki) 14 (Markina Gora)	32600	280	AMS	OA-9568	IntCal13	36817.50	35666.58	37968.43
Chauvet	32600	390	AMS	GifA-13016 (SacA-32305)	IntCal13	36820.50	35345.63	38295.38
Chauvet	32580	360	AMS	GifA-70147 (SacA-9870)	IntCal13	36821.50	35415.03	38227.98
Grotte du Renne, Arcy-sur-Cure	32620	400	AMS	OxA-17484	IntCal13	36832.50	35341.48	38323.53

Chauvet	32660	454	AMS	VERA-5780HS	IntCal13	36833.50	35234.18	38432.83
Chauvet	32400	1300	AMS	GifA-13096/SacA-33474	IntCal13	36841.00	33485.60	40196.40
Chauvet	32400	1200	AMS	GifA-13101/SacA-33479	IntCal13	36842.50	33706.08	39978.93
Chauvet	32640	400	AMS	GifA-12014 (SacA-32303)	IntCal13	36852.50	35369.08	38335.93
Chauvet	32600	320	AMS	KiA-28570 GifA-50124	IntCal13	36855.50	35564.93	38146.08
Chauvet	32639	390	AMS	GifA-13017 (SacA-32306)	IntCal13	36859.50	35399.83	38319.18
Chauvet	33100	3600	AMS	GifA-11130/SacA-24978	IntCal13	36895.00	29634.15	44155.85
Chauvet	32670	380	AMS	GifA-12015 (SacA-32304)	IntCal13	36899.00	35475.90	38322.10
Chauvet	32680	390	AMS	GifA-11003/SacA-23418	IntCal13	36900.50	35456.98	38344.03
Chauvet-Pont d'Arc	32600	1000	AMS	GifA-13108/SacA-35486	IntCal13	36922.00	34132.80	39711.20
Grotte des Gorges	32600	1000	AMS	GifA-12197/SacA-29929	IntCal13	36922.00	34132.80	39711.20
Bench Quarry, Bench Tunnel Cavern	32500	1200	AMS	OxA-5961	IntCal13	36929.00	33785.45	40072.55
Chauvet	33000	0	AMS	GifA-13133/SacA-33761	IntCal13	36930.50	36871.13	36989.88
Istallosko	32701	316	AMS	ISGS-A-0187	IntCal13	36957.00	35686.85	38227.15
Kostenki (Kostienki) 14 (Markina Gora)	32600	1100	AMS	OxA-7073	IntCal13	36971.50	33993.73	39949.28
Castanet North	32800	450	AMS	OxA-21560	IntCal13	36975.50	35433.18	38517.83
Chauvet	32850	540	AMS	GifA-101459	IntCal13	36978.50	35229.08	38727.93
Krems-Hundssteig	32810	450	AMS	VERA-2289	IntCal13	36985.50	35446.98	38524.03
Abri Pataud	32850	500	AMS	OxA-21680	IntCal13	36994.00	35342.90	38645.10
Fumane	32800	400	AMS	UtC-2051	IntCal13	37008.50	35584.93	38432.08
Chauvet	32700	1000	AMS	GifA-13088/SacA-32986	IntCal13	37009.00	34205.55	39812.45
Chauvet	32700	1000	AMS	GifA-13089/sacA-32987	IntCal13	37009.00	34205.55	39812.45
Dyuktai Cave	32770	320	AMS	GrA-22759	IntCal13	37016.00	35749.65	38282.35
Castanet Southern sector	32900	500	AMS	OxA-21639	IntCal13	37047.50	35411.13	38683.88

Chauvet	32810	320	AMS	GrA-53609	IntCal13	37052.00	35796.10	38307.90
Buran Kaya III	32790	280	AMS	OxA-13302	IntCal13	37052.50	35889.23	38215.78
Chauvet	32900	490	AMS	GifA-99776	IntCal13	37053.50	35443.73	38663.28
Geissenklosterle	32900	450	AMS	OxA-21661	IntCal13	37076.50	35566.48	38586.53
Cueva del Higueral de Valleja	32840	210	AMS	OxA-12362	IntCal13	37085.00	36152.10	38017.90
Castanet	32950	520	AMS	GifA-99180	IntCal13	37093.50	35415.33	38771.68
Bajo Corbones	32770	1065	AMS	Ua-18050	IntCal13	37096.00	34158.60	40033.40
Chauvet	32700	1600	AMS	GifA-13100/SacA-33478	IntCal13	37099.50	33040.63	41158.38
Castanet	32950	500	AMS	OxA-21564	IntCal13	37102.50	35479.43	38725.58
Covalejos, Cobalejos	32840	280	AMS	GrA-24220	IntCal13	37107.00	35960.35	38253.65
Chauvet	32870	200	AMS	OxA-13976	IntCal13	37109.50	36201.78	38017.23
Chauvet	33400	3800	AMS	GifA-13031/SacA-32530	IntCal13	37124.00	29561.05	44686.95
Cueva Anton	32890	200	AMS	OxA-21244	IntCal13	37136.50	36221.18	38051.83
Geissenklosterle	32910	330	AMS	KIA-19555	IntCal13	37138.00	35892.55	38383.45
Chauvet	32910	320	AMS	GrA-53610	IntCal13	37146.50	35925.28	38367.73
Geissenklosterle	33000	500	AMS	OxA-21656	IntCal13	37157.50	35543.93	38771.08
Geissenklosterle	32900	850	AMS	OxA-6255	IntCal13	37181.00	34702.45	39659.55
Abri Pataud	33050	500	AMS	OxA/OxA-X-2276-19	IntCal13	37210.50	35601.68	38819.33
Grotte du Renne, Arcy-sur-Cure	33010	182	AMS	EVA-93	IntCal13	37251.50	36356.13	38146.88
Grotte des Fours	33030	750	AMS	GifA-11511:SacA-27627	IntCal13	37253.00	34958.75	39547.25
Istallosko	33101	512	AMS	ISGS-A-0184	IntCal13	37266.00	35625.35	38906.65
Chauvet	33100	590	AMS	GifA-101458	IntCal13	37274.50	35394.93	39154.08
Chauvet	32900	1200	AMS	GifA-13146/SacA-33771	IntCal13	37283.50	34057.78	40509.23
Geographical Society Cave	33000	1000	AMS	GrA-16839	IntCal13	37288.50	34464.63	40112.38
Chauvet-Pont d'Arc	33600	3900	AMS	GifA-13109/SacA-33487	IntCal13	37289.00	29598.75	44979.25
Geissenklosterle	33100	680	AMS	ETH-8268	IntCal13	37298.50	35156.73	39440.28
Cova Gran de Santa Linya	33090	350	AMS	Beta-195431	IntCal13	37301.00	36066.95	38535.05
Hohle Fels, Hohler Fels	33090	260	AMS	KIA-16036	IntCal13	37323.00	36268.50	38377.50
Fumane	33160	400	AMS	OxA-8054	IntCal13	37341.00	35996.75	38685.25
Kostenki (Kostienki) 14 (Markina Gora)	33120	220	AMS	GrA-20140	IntCal13	37348.00	36368.55	38327.45

Klisoura Cave 1, Klissoura Cave 1	33150	120	AMS	AA-75628	IntCal13	37364.00	36648.65	38079.35
Kostenki (Kostienki) 14 (Markina Gora)	33200	510	AMS	GrA-13301	IntCal13	37372.50	35727.58	39017.43
Geissenklosterle	33200	520	AMS	KIA-21280	IntCal13	37377.50	35704.08	39050.93
Hyenes	33100	920	AMS	GifA-101093	IntCal13	37384.50	34737.33	40031.68
Geissenklosterle	33210	300	AMS	KIA-8961	IntCal13	37405.00	36282.10	38527.90
Geissenklosterle	33200	800	AMS	OxA-5707	IntCal13	37424.00	35003.40	39844.60
Castanet Southern sector	33250	500	AMS	OxA-21559	IntCal13	37426.00	35801.50	39050.50
Kostenki (Kostienki) 14 (Markina Gora)	33250	500	AMS	OxA-X-2395-15	IntCal13	37426.00	35801.50	39050.50
Geissenklosterle	33150	1000	AMS	OxA-5705	IntCal13	37452.50	34636.23	40268.78
Hohle Fels, Hohler Fels	33290	270	AMS	KIA-16035	IntCal13	37463.00	36396.15	38529.85
Buran Kaya III	33210	900	AMS	OxA-4129	IntCal13	37469.00	34845.10	40092.90
Fumane	33300	400	AMS	OxA-8021	IntCal13	37480.00	36143.35	38816.65
Cobrante	33320	310	AMS	GrA-22442	IntCal13	37486.50	36342.23	38630.78
Castlepook	33310	770	AMS	OxA-4231	IntCal13	37522.50	35156.53	39888.48
Geissenklosterle	33200	1100	AMS	OxA-5162	IntCal13	37524.00	34446.95	40601.05
Geissenklosterle	33380	390	AMS	OxA-18718	IntCal13	37554.00	36229.70	38878.30
Geissenklosterle	33350	550	AMS	Beta-156089	IntCal13	37571.50	35776.48	39366.53
Chauvet	33380	460	AMS	GifA-9225/SacA-14234	IntCal13	37584.50	36073.53	39095.48
Hyaena Den	33200	1600	AMS	OxA-13554	IntCal13	37611.50	33696.08	41526.93
Abri nord de Bavans	33400	500	AMS	OxA-21673	IntCal13	37623.50	35973.83	39273.18
Geissenklosterle	33430	480	AMS	KIA-19558	IntCal13	37659.00	36071.55	39246.45
Abri Pataud	33450	500	AMS	OxA-21670	IntCal13	37689.00	36034.10	39343.90
Geissenklosterle	33500	640	AMS	ETH-8269	IntCal13	37739.00	35706.95	39771.05
Abri Pataud	33500	500	AMS	OxA-21602	IntCal13	37749.00	36089.35	39408.65
Hyenes	33600	240	AMS	Gif/LSM-11034	IntCal13	37750.50	36767.73	38733.28
Ferrassie	33610	340	AMS	OxA-15218	IntCal13	37752.50	36484.73	39020.28
Geissenklosterle	33600	1900	AMS	OxA-6076	IntCal13	37783.50	33417.78	42149.23
Abri Pataud	33550	550	AMS	OxA-21580	IntCal13	37799.50	35994.98	39604.03
Abri Pataud	33550	550	AMS	OxA-21581	IntCal13	37799.50	35994.98	39604.03
Labeko Koba	33550	550	AMS	OxA-21780	IntCal13	37799.50	35994.98	39604.03
Kumyshanskaya	33670	300	AMS	OxA-10929	IntCal13	37809.00	36640.50	38977.50
Aitzbitarte III Ext	33605	165	AMS	Ua-21158	IntCal13	37821.50	37062.93	38580.08
Istallosko	33600	900	AMS	OxA-X-2170 18	IntCal13	37845.00	35147.00	40543.00
Labattut, Labatut	33600	500	AMS	OxA-21768	IntCal13	37852.50	36174.33	39530.68
Fumane	33700	350	AMS	LTL-566A	IntCal13	37863.50	36533.03	39193.98

Fumane	33700	350	AMS	OxA-6463	IntCal13	37863.50	36533.03	39193.98
Fumane	33640	440	AMS	OxA-8053	IntCal13	37866.50	36321.33	39411.68
Chauvet	33580	1000	AMS	Lyon-3095 (Poz-15047)	IntCal13	37869.50	34952.53	40786.48
Abri Pataud	33650	500	AMS	OxA-21679	IntCal13	37901.50	36213.83	39589.18
Bison, Arcy-sur-Ceure	33670	450	AMS	Beta-180086	IntCal13	37901.50	36324.03	39478.98
Hyaena Den	33660	680	AMS	OxA-3277	IntCal13	37905.00	35761.80	40048.20
Fonte Santa	33720	410	AMS	UCIAMS-11216	IntCal13	37927.50	36426.98	39428.03
Kostenki (Kostienki) 14 (Markina Gora)	34300	2900	AMS	UtC-749	IntCal13	37935.50	31705.88	44165.13
Ceahlau Dirtu, Ceahlau-Dartu	33775	408	AMS	Erl-12165	IntCal13	37980.50	36468.58	39492.43
Canyars	33800	350	AMS	Beta-273965	IntCal13	37989.50	36624.83	39354.18
Geissenklosterle	33700	1100	AMS	OxA-5160	IntCal13	37999.00	34883.00	41115.00
Flageolet I	33800	1800	AMS	OxA-598	IntCal13	37999.50	33843.73	42155.28
Bacho Kiro	33750	850	AMS	OxA-3184	IntCal13	38009.00	35421.20	40596.80
Kara-Bom	33780	570	AMS	GX-17594	IntCal13	38043.00	36172.45	39913.55
Arbreda	33800	550	AMS	OxA-21674	IntCal13	38057.00	36229.20	39884.80
Gatzarria	33800	550	AMS	OxA-22553	IntCal13	38057.00	36229.20	39884.80
Krakow Spadzista trench	33690	120	AMS	Poz-51376	IntCal13	38091.00	37615.05	38566.95
Geissenklosterle	33900	280	AMS	KIA-17302	IntCal13	38119.50	36978.08	39260.93
Foradada	33900	310	AMS	Beta-132349	IntCal13	38119.50	36871.68	39367.33
Hohlenstein-Stadel	33920	270	AMS	KIA-8949	IntCal13	38148.00	37042.20	39253.80
Cova Beneito	33900	1100	AMS	AA-1388	IntCal13	38150.50	35024.53	41276.48
Fumane	33890	220	AMS	OxA-17981	IntCal13	38177.50	37329.63	39025.38
Geissenklosterle	33950	550	AMS	OxA-21724	IntCal13	38197.00	36338.80	40055.20
Abri Pataud	34050	550	AMS	OxA-21672	IntCal13	38284.00	36406.80	40161.20
Gent-Tweekerkenstraat	34300	1700	AMS	AA-38229	IntCal13	38323.00	34297.85	42348.15
Geissenklosterle	34100	550	AMS	OxA-21727	IntCal13	38328.50	36442.28	40214.73
Labeko Koba	34215	1265	AMS	Ua-3324	IntCal13	38369.00	34988.90	41749.10
Dzerava skala	34100	320	AMS	Beta-173341	IntCal13	38373.00	37110.45	39635.55
Abri Pataud	34150	550	AMS	OxA-21601	IntCal13	38374.00	36478.75	40269.25
Geissenklosterle	34080	300	AMS	KIA-13076	IntCal13	38375.00	37191.30	39558.70
Geographical Society Cave	34400	1800	AMS	AA-37183	IntCal13	38376.50	34222.63	42530.38
Castlepook	34100	840	AMS	OxA-4235	IntCal13	38398.50	35815.93	40981.08
Arbreda	34100	750	AMS	AA-3777	IntCal13	38407.50	36052.93	40762.08
Kostenki (Kostienki) 14 (Markina Gora)	34140	340	AMS	Beta-177778	IntCal13	38408.50	37087.53	39729.48
Abri Pataud	34200	550	AMS	OxA-21600	IntCal13	38421.50	36518.18	40324.83

Geiseltal	34200	550	AMS	OxA-21726	IntCal13	38421.50	36518.18	40324.83
Buran Kaya III	34050	260	AMS	GrA-40485	IntCal13	38428.00	37449.50	39406.50
La Quina Aval	34130	700	AMS	AA-3639	IntCal13	38433.50	36200.53	40666.48
Geographical Society Cave	34510	1800	AMS	AA-38230	IntCal13	38448.50	34296.53	42600.48
Kara-Bom	34180	640	AMS	GX-17595	IntCal13	38453.50	36348.78	40558.23
Grotte des Gorges	34250	550	AMS	OxA-22997	IntCal13	38472.00	36561.55	40382.45
Gatzarria	34250	550	AMS	OxA-22556	IntCal13	38472.00	36561.55	40382.45
Fumane	34200	900	AMS	UtC-2690	IntCal13	38482.00	35780.20	41183.80
Flageolet I	34300	1100	AMS	GifA-95559	IntCal13	38482.00	35385.00	41579.00
Cueva del Higueral de Valleja	33950	20	AMS	OxA-12271	IntCal13	38482.50	38422.18	38542.83
Hohle Fels, Hohler Fels	34190	340	AMS	KIA-18880	IntCal13	38491.00	37200.90	39781.10
Buran Kaya III	34400	1200	AMS	OxA-6990	IntCal13	38519.00	35254.80	41783.20
Bench Quarry, Bench Tunnel Cavern	34500	1400	AMS	OxA-1620	IntCal13	38539.50	34980.33	42098.68
Castanet	34320	520	AMS	GifA-99166	IntCal13	38549.00	36716.45	40381.55
Abri Pataud	34300	600	AMS	OxA-21671	IntCal13	38550.00	36503.70	40596.30
Fumane	34180	270	AMS	OxA-19414	IntCal13	38637.50	37687.98	39587.03
Gatzarria	34400	550	AMS	OxA-22555	IntCal13	38649.50	36726.23	40572.78
Abri Pataud	34500	600	AMS	OxA-21596	IntCal13	38768.00	36701.75	40834.25
Hyaena Den	34900	1450	AMS	OxA-4113	IntCal13	38813.00	35203.95	42422.05
Kostenki (Kostienki) 14 (Markina Gora)	34550	610	AMS	GrA-13297	IntCal13	38825.50	36735.03	40915.98
Grotte des Gorges	34550	600	AMS	OxA-22996	IntCal13	38828.00	36765.55	40890.45
Gorham's Cave	34600	900	AMS	OxA-10295	IntCal13	38851.50	36205.28	41497.73
Geographical Society Cave	35100	1900	AMS	AA-37069	IntCal13	38882.50	34615.58	43149.43
Bacho Kiro	34800	1150	AMS	OxA-3212	IntCal13	38890.50	35806.33	41974.68
Labeko Koba	34650	600	AMS	OxA-21779	IntCal13	38947.50	36900.73	40994.28
Grotte du Renne, Arcy-sur-Cure	34750	750	AMS	OxA-21591	IntCal13	38976.50	36589.63	41363.38
Arbreda	34800	780	AMS	SANU-29017	IntCal13	39011.50	36571.43	41451.58
Grotte XVI	35000	1200	AMS	GifA-95581	IntCal13	39028.00	35886.35	42169.65
Abri Pataud	34750	600	AMS	OxA-21598	IntCal13	39062.00	37037.55	41086.45
Labeko Koba	34750	600	AMS	OxA-21767	IntCal13	39062.00	37037.55	41086.45
Buran Kaya III	34910	950	AMS	GifA-80181/SacA-12260	IntCal13	39074.50	36361.78	41787.23
Fumane	34500	270	AMS	OxA-19410	IntCal13	39101.00	38294.45	39907.55
Cantalouette II	34540	330	AMS	OxA-23643	IntCal13	39113.00	38109.80	40116.20
Buxu	35300	1500	AMS	OxA-4896	IntCal13	39120.50	35493.88	42747.13
Klisoura Cave 1, Klissoura Cave 1	34580	220	AMS	OxA-21068	IntCal13	39150.50	38462.23	39838.78

Hohle Fels, Hohler Fels	34570	260	AMS	OxA-19859	IntCal13	39165.00	38381.25	39948.75
Abri Pataud	34850	600	AMS	OxA-21599	IntCal13	39194.50	37217.08	41171.93
Castanet	35200	1100	AMS	GifA-97313	IntCal13	39244.50	36319.93	42169.08
Castlepook	35200	950	AMS	OxA-4236	IntCal13	39270.00	36573.90	41966.10
Kostenki (Kostienki) 14 (Markina Gora)	34940	630	AMS	GrA-13302	IntCal13	39282.00	37263.25	41300.75
Hyaena Den	34810	540	AMS	GifA-101094	IntCal13	39286.00	37557.00	41015.00
Dzerava skala	34900	600	AMS	Poz-8793	IntCal13	39302.50	37389.68	41215.33
Hohle Fels, Hohler Fels	34720	280	AMS	OxA-19779	IntCal13	39303.00	38451.80	40154.20
Abri Pataud	35000	650	AMS	OxA-21597	IntCal13	39342.00	37300.45	41383.55
Grotte du Putois IV	34810	210	AMS	EVA-95	IntCal13	39345.50	38643.93	40047.08
Chauvet	34790	250	AMS	GrA-34333	IntCal13	39346.00	38551.80	40140.20
Caminade [Caneda]	35400	1100	AMS	GifA-97186	IntCal13	39382.00	36463.60	42300.40
Blot	35250	850	AMS	OxA-3460	IntCal13	39382.50	36899.68	41865.33
Bondi Cave	34950	600	AMS	OxA-23904	IntCal13	39394.50	37532.03	41256.98
Fumane	35450	1180	AMS	LTL-569A	IntCal13	39403.50	36368.73	42438.28
Canyars	34810	360	AMS	OxA-23644	IntCal13	39424.00	38367.60	40480.40
Istallosko	34890	250	AMS	OxA-X-2244-32	IntCal13	39431.00	38622.55	40239.45
Ferrassie	35700	1500	AMS	OxA-X-2395-26	IntCal13	39463.50	35896.73	43030.28
Abri Pataud	35000	600	AMS	OxA-21579	IntCal13	39473.50	37649.03	41297.98
Fumane	34940	280	AMS	OxA-19412	IntCal13	39491.00	38600.85	40381.15
Canyars	34900	340	AMS	OxA-24057	IntCal13	39496.50	38469.08	40523.93
Franchthi	34980	220	AMS	OxA-20253	IntCal13	39499.50	38750.43	40248.58
Kostenki (Kostienki) 14 (Markina Gora)	34900	350	AMS	GrA-6895	IntCal13	39506.00	38452.45	40559.55
Fees	34940	330	AMS	OxA-14166	IntCal13	39526.00	38511.40	40540.60
Canyars	34980	350	AMS	OxA-2416-44	IntCal13	39584.00	38504.80	40663.20
Labeko Koba	35100	600	AMS	OxA-21778	IntCal13	39610.00	37843.00	41377.00
Abric Romani	35400	810	AMS	AA-8037A	IntCal13	39612.50	37316.83	41908.18
Chauvet	35160	650	AMS	GrA-32815	IntCal13	39617.00	37724.60	41509.40
Fumane	35180	220	AMS	OxA-17570	IntCal13	39698.00	38924.70	40471.30
Fuentes de San Cristobal	36000	1900	AMS	OxA-8590	IntCal13	39704.50	35297.93	44111.08
Labeko Koba	35250	650	AMS	OxA-21840	IntCal13	39732.50	37889.03	41575.98
Arbreda	35480	820	AMS	OxA-3730	IntCal13	39733.50	37492.93	41974.08
Abri Pataud	35400	750	AMS	OxA-15216	IntCal13	39771.00	37710.45	41831.55
La Vina	35800	1000	AMS	GifA-95550	IntCal13	39787.50	37148.88	42426.13
Bondi Cave	35300	650	AMS	OxA-650	IntCal13	39798.50	37984.48	41612.53
Grotte du Renne, Arcy-sur-Cure	35450	750	AMS	OxA-X-2279-14	IntCal13	39834.00	37803.85	41864.15

Cieksyn	35300	230	AMS	OS-84009	IntCal13	39842.50	39023.13	40661.88
Kostenki (Kostienki) 14 (Markina Gora)	35280	330	AMS	OxA-9569	IntCal13	39853.50	38754.83	40952.18
Kostenki (Kostienki) 14 (Markina Gora)	35330	240	AMS	GrA-15958	IntCal13	39879.50	39025.93	40733.08
Labeko Koba	35400	650	AMS	OxA-21793	IntCal13	39939.00	38191.95	41686.05
Grotte du Renne, Arcy-sur-Cure	35380	390	AMS	EVA-54	IntCal13	39953.00	38713.25	41192.75

Table S2. Supplementary Table S2. MESS values (mean ± 95% CI) calculated in Eurasia for each species during its life span. High (low) MESS values indicate no (relevant) extrapolation effect on SDMs predictions.

Table S2 can be found online at: https://doi.org/10.1016/j.palaeo.2018.03.036

Table S3. Results of the Multinomial Logistic Regressions performed by using the consecutive bins approach (Table S3.1) and the temporal windows approach (Table S3.2).

Table S3.1. Consecutive bins approach

All groups (reference group: Extinct large herbivores)						
Coefficients						
Groups	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extinct large carnivores	-1.135	0.327	0.469	-1.412	1.014	-0.797
Extant large carnivores	-1.493	0.110	-0.512	-0.464	-0.183	0.007
Extant medium carnivores	-0.596	0.281	0.486	-0.672	0.232	-1.112
Extinct medium herbivores	-1.714	0.327	-0.197	-3.060	-0.058	1.032
Extant medium herbivores	1.067	0.475	-0.136	-0.856	-0.134	2.302
p values						
	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extinct large carnivores	0.041	0.341	0.146	0.003	0.049	0.624
Extant large carnivores	0.011	0.830	0.166	0.247	0.658	0.997
Extant medium carnivores	0.163	0.410	0.115	0.026	0.487	0.420
Extinct medium herbivores	0.032	0.389	0.540	0.002	0.902	0.535
Extant medium herbivores	0.000	0.101	0.570	0.000	0.579	0.051
Only herbivores (reference group: Extinct large herbivores)						
Coefficients						
Groups	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extinct medium herbivores	-1.434	0.251	-0.203	-2.470	-0.015	1.526
Extant medium herbivores	1.081	0.403	-0.161	-0.737	-0.135	2.650

p values						
	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extinct medium herbivores	0.061	0.487	0.557	0.010	0.976	0.368
Extant medium herbivores	0.001	0.145	0.521	0.001	0.575	0.041
Only carnivores (reference group: Extinct large carnivores)						
Coefficients						
Groups	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extant large carnivores	-0.239	-0.191	-0.765	2.226	-0.708	1.925
Extant medium carnivores	0.645	-0.093	0.126	1.351	-0.494	0.175
p values						
	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extant large carnivores	0.765	0.758	0.105	0.022	0.282	0.520
Extant medium carnivores	0.282	0.804	0.703	0.058	0.357	0.922

Table S3.2. Temporal windows approach

All groups (reference group: Extinct large herbivores)						
Coefficients						
Groups	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extinct large carnivores	-70.007	361.788	36.867	70.850	519.985	276.985
Extant large carnivores	227.641	577.121	85.956	-76.187	-177.301	6.748
Extant medium carnivores	-13.114	-11.926	-1.082	0.748	4.183	-19.937
Extinct medium herbivores	-608.369	-564.884	17.246	-70.307	-85.594	-570.416
Extant medium herbivores	3.435	2.988	-0.719	-0.754	1.568	5.182
p values						
	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extinct large carnivores	0.260	0.001	0.934	0.730	0.000	0.000
Extant large carnivores	0.000	0.000	0.000	0.000	0.000	0.000
Extant medium carnivores	0.004	0.022	0.211	0.208	0.021	0.001

Extinct medium herbivores	0.000	0.000	0.930	0.264	0.842	0.000
Extant medium herbivores	0.138	0.338	0.128	0.011	0.105	0.110

Only herbivores (reference group: Extinct large herbivores)

Coefficients

	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extinct medium herbivores	-125.643	-91.238	2.820	-20.720	12.672	-176.223
Extant medium herbivores	5.596	5.461	-0.720	-0.885	2.299	8.387

p values

	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extinct medium herbivores	0.000	0.000	0.772	0.121	0.702	0.001
Extant medium herbivores	0.041	0.118	0.103	0.004	0.033	0.030

Only carnivores (reference group: Extinct large carnivores)

Coefficients

	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extant large carnivores	140.550	49.486	-49.707	-142.827	-299.012	-30.625
Extant medium carnivores	-8.372	-178.879	-55.577	-129.021	-248.841	-157.038

p values

	Intercept	Distance	Climatic Plasticity	Overlap	PIXEL95	PIXEL95H
Extant large carnivores	0.000	0.000	0.000	0.000	0.000	0.000
Extant medium carnivores	0.989	0.728	0.970	0.794	0.849	0.955

Table S4. Results of the 24 simple linear regressions

Species	mass	Slope	Std. Error	t value	p value
Alces alces	385000	-0.31102	0.061759	-5.03603	0.000
Bison priscus	1000000	-0.42244	0.088976	-4.74783	0.000
Bos primigenius	1050000	0.903299	0.044609	20.24946	0.000
Canis lupus	29000	0.251041	0.063011	3.984077	0.000

Capra ibex	98000	0.444252	0.090984	4.882754	0.000
Capreolus capreolus	30000	0.556291	0.067354	8.259254	0.000
Cervus elaphus	180000	0.932331	0.060464	15.41958	0.000
Coelodonta antiquitatis	2900000	0.109432	0.085934	1.273448	0.203
Crocuta crocuta	75000	1.03328	0.080269	12.87266	0.000
Elephas antiquus	6499000	0.412536	0.060489	6.819999	0.000
Equus ferus	350000	1.090293	0.073259	14.88269	0.000
Equus hydruntinus	290000	0.420523	0.082193	5.11632	0.000
Lynx lynx	9899	-0.10013	0.038338	-2.61177	0.009
Mammuthus primigenius	4285485	0.108231	0.09089	1.190792	0.234
Megaloceros giganteus	700000	-0.36387	0.079572	-4.57282	0.000
Panthera leo	156000	0.189612	0.071996	2.633654	0.009
Rangifer tarandus	135000	0.411911	0.122054	3.374824	0.001
Rupicapra rupicapra	40000	0.888332	0.085398	10.40224	0.000
Saiga tatarica	43000	0.02505	0.041284	0.606779	0.544
Stephanorhinus hemitoechus	1400000	0.648946	0.076277	8.507764	0.000
Sus scrofa	55000	0.659301	0.053156	12.40324	0.000
Ursus arctos	172720	-0.05299	0.077659	-0.68236	0.495
Ursus spelaeus	300000	0.652379	0.088957	7.333615	0.000
Vulpes vulpes	8000	1.266034	0.074481	16.99797	0.000

Table S5. Results of the multiple regressions performed bin by bin with the specific intervals approach (Table S5.1) and with the temporal windows approach (Table S5.2).

Table S5.1. Specific intervals approach

From 40 to 36 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	-0.175	0.065	-2.686	0.008
Bos primigenius	0.235	0.067	3.487	0.001
Canis lupus	-0.392	0.098	-3.987	0.000

Capra ibex	-0.081	0.051	-1.600	0.112
Capreolus capreolus	-0.112	0.082	-1.367	0.175
Cervus elaphus	-0.120	0.096	-1.254	0.212
Coelodonta antiquitatis	0.158	0.085	1.865	0.065
Crocuta crocuta	0.162	0.085	1.897	0.061
Elephas antiquus	-0.230	0.129	-1.779	0.078
Equus ferus	0.385	0.089	4.329	0.000
Equus hydruntinus	-0.213	0.048	-4.425	0.000
Lynx lynx	-0.109	0.097	-1.120	0.265
Mammuthus primigenius	0.106	0.090	1.169	0.245
Megaloceros giganteus	-0.072	0.084	-0.861	0.391
Panthera leo	0.041	0.065	0.636	0.526
Rangifer tarandus	-0.064	0.058	-1.100	0.274
Rupicapra rupicapra	-0.042	0.055	-0.758	0.450
Saiga tatarica	-0.033	0.081	-0.402	0.688
Stephanorhinus hemitoechus	0.153	0.081	1.895	0.061
Sus scrofa	0.363	0.099	3.648	0.000
Ursus arctos	0.083	0.077	1.078	0.283
Ursus spelaeus	0.304	0.061	4.963	0.000
Vulpes vulpes	-0.161	0.084	-1.914	0.058
From 36 to 32 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	0.022	0.073	0.300	0.765
Bos primigenius	0.138	0.074	1.859	0.066
Canis lupus	-0.117	0.088	-1.335	0.185
Capra ibex	-0.085	0.054	-1.568	0.120
Capreolus capreolus	-0.090	0.080	-1.122	0.264
Cervus elaphus	-0.128	0.088	-1.448	0.151
Coelodonta antiquitatis	0.191	0.098	1.961	0.053
Crocuta crocuta	0.239	0.079	3.035	0.003
Elephas antiquus	-0.422	0.121	-3.496	0.001
Equus ferus	0.367	0.085	4.304	0.000

Equus hydruntinus	-0.156	0.056	-2.808	0.006
Lynx lynx	-0.274	0.088	-3.114	0.002
Mammuthus primigenius	-0.190	0.109	-1.736	0.086
Megaloceros giganteus	0.032	0.082	0.392	0.696
Panthera leo	-0.069	0.065	-1.054	0.294
Rangifer tarandus	-0.070	0.060	-1.166	0.246
Rupicapra rupicapra	-0.036	0.046	-0.783	0.435
Saiga tatarica	-0.080	0.102	-0.783	0.435
Stephanorhinus hemitoechus	0.109	0.087	1.245	0.216
Sus scrofa	0.463	0.099	4.661	0.000
Ursus arctos	-0.049	0.097	-0.504	0.615
Ursus spelaeus	0.115	0.060	1.916	0.058
Vulpes vulpes	-0.064	0.076	-0.837	0.404
From 32 to 28 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	-0.130	0.074	-1.755	0.082
Bos primigenius	0.213	0.080	2.671	0.009
Canis lupus	-0.219	0.091	-2.400	0.018
Capra ibex	0.026	0.053	0.489	0.626
Capreolus capreolus	-0.087	0.086	-1.010	0.315
Cervus elaphus	0.140	0.097	1.444	0.151
Coelodonta antiquitatis	0.013	0.087	0.153	0.879
Crocuta crocuta	-0.029	0.082	-0.349	0.728
Elephas antiquus	-0.461	0.104	-4.432	0.000
Equus ferus	0.412	0.087	4.728	0.000
Equus hydruntinus	-0.133	0.058	-2.289	0.024
Lynx lynx	0.123	0.129	0.953	0.343
Mammuthus primigenius	0.056	0.093	0.606	0.546
Megaloceros giganteus	-0.091	0.088	-1.037	0.302
Panthera leo	-0.053	0.070	-0.756	0.451
Rangifer tarandus	0.002	0.056	0.044	0.965
Rupicapra rupicapra	-0.197	0.055	-3.602	0.000

Saiga tatarica	-0.270	0.102	-2.634	0.010
Stephanorhinus hemitoechus	0.060	0.082	0.734	0.465
Sus scrofa	0.142	0.115	1.237	0.218
Ursus arctos	-0.065	0.075	-0.868	0.387
Ursus spelaeus	0.211	0.058	3.650	0.000
Vulpes vulpes	0.113	0.076	1.490	0.139

From 28 to 24 kya

Species	Slope	Std.Error	t value	p value
Bison priscus	-0.269	0.089	-3.025	0.003
Bos primigenius	0.053	0.072	0.730	0.467
Canis lupus	-0.200	0.107	-1.867	0.064
Capra ibex	0.073	0.050	1.460	0.147
Capreolus capreolus	-0.223	0.080	-2.785	0.006
Cervus elaphus	-0.049	0.093	-0.530	0.597
Coelodonta antiquitatis	0.140	0.099	1.408	0.162
Crocuta crocuta	0.282	0.091	3.098	0.002
Elephas antiquus	-0.201	0.128	-1.573	0.118
Equus ferus	0.191	0.103	1.853	0.066
Equus hydruntinus	-0.230	0.062	-3.744	0.000
Lynx lynx	-0.056	0.142	-0.390	0.697
Mammuthus primigenius	-0.172	0.096	-1.784	0.077
Megaloceros giganteus	-0.100	0.084	-1.195	0.234
Panthera leo	0.096	0.073	1.321	0.189
Rangifer tarandus	0.165	0.056	2.970	0.004
Rupicapra rupicapra	-0.054	0.060	-0.913	0.363
Saiga tatarica	0.085	0.095	0.901	0.369
Stephanorhinus hemitoechus	0.000	0.074	-0.003	0.998
Sus scrofa	0.366	0.091	4.038	0.000
Ursus arctos	-0.091	0.079	-1.141	0.256
Ursus spelaeus	0.127	0.063	1.996	0.048
Vulpes vulpes	0.033	0.083	0.403	0.687

From 24 to 20 kya

Species	Slope	Std.Error	t value	p value
Bison priscus	-0.079	0.075	-1.046	0.298
Bos primigenius	0.111	0.074	1.498	0.137
Canis lupus	-0.258	0.110	-2.345	0.021
Capra ibex	0.079	0.051	1.543	0.125
Capreolus capreolus	-0.275	0.088	-3.132	0.002
Cervus elaphus	0.044	0.106	0.416	0.678
Coelodonta antiquitatis	0.189	0.100	1.892	0.061
Crocuta crocuta	0.200	0.086	2.331	0.021
Equus ferus	0.181	0.086	2.104	0.037
Equus hydruntinus	-0.077	0.055	-1.412	0.161
Lynx lynx	-0.135	0.147	-0.915	0.362
Mammuthus primigenius	-0.410	0.108	-3.788	0.000
Megaloceros giganteus	-0.106	0.088	-1.202	0.232
Panthera leo	-0.035	0.078	-0.452	0.652
Rangifer tarandus	0.181	0.053	3.434	0.001
Rupicapra rupicapra	0.029	0.066	0.436	0.664
Saiga tatarica	0.010	0.080	0.121	0.904
Stephanorhinus hemitoechus	-0.102	0.072	-1.405	0.163
Sus scrofa	0.112	0.107	1.051	0.296
Ursus arctos	0.066	0.076	0.863	0.390
Ursus spelaeus	0.153	0.065	2.342	0.021
Vulpes vulpes	0.073	0.076	0.965	0.337

From 20 to 16 kya

Species	Slope	Std.Error	t value	p value
Bison priscus	-0.119	0.064	-1.848	0.067
Bos primigenius	0.161	0.075	2.162	0.033
Canis lupus	-0.097	0.111	-0.876	0.383
Capra ibex	0.064	0.055	1.166	0.246
Capreolus capreolus	-0.403	0.090	-4.489	0.000
Cervus elaphus	0.023	0.098	0.238	0.813

Coelodonta antiquitatis	0.094	0.113	0.833	0.407
Crocuta crocuta	0.294	0.082	3.580	0.001
Equus ferus	0.057	0.091	0.621	0.536
Equus hydruntinus	-0.156	0.068	-2.308	0.023
Lynx lynx	-0.137	0.132	-1.041	0.300
Mammuthus primigenius	0.008	0.124	0.067	0.947
Megaloceros giganteus	-0.189	0.086	-2.204	0.030
Panthera leo	0.095	0.076	1.242	0.217
Rangifer tarandus	0.061	0.056	1.081	0.282
Rupicapra rupicapra	-0.073	0.059	-1.234	0.220
Saiga tatarica	-0.237	0.115	-2.069	0.041
Sus scrofa	0.425	0.105	4.033	0.000
Ursus arctos	0.014	0.078	0.185	0.854
Ursus spelaeus	0.016	0.052	0.299	0.765
Vulpes vulpes	0.175	0.076	2.310	0.023
From 16 to 12 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	-0.233	0.070	-3.345	0.001
Bos primigenius	0.174	0.065	2.667	0.009
Canis lupus	-0.083	0.111	-0.749	0.456
Capra ibex	-0.025	0.039	-0.636	0.526
Capreolus capreolus	-0.108	0.068	-1.605	0.111
Cervus elaphus	0.209	0.061	3.419	0.001
Coelodonta antiquitatis	0.028	0.077	0.360	0.719
Equus ferus	0.177	0.073	2.425	0.017
Equus hydruntinus	-0.246	0.050	-4.949	0.000
Lynx lynx	0.027	0.129	0.210	0.834
Mammuthus primigenius	0.163	0.059	2.766	0.007
Megaloceros giganteus	-0.080	0.090	-0.893	0.374
Panthera leo	0.040	0.066	0.601	0.549
Rangifer tarandus	0.032	0.046	0.692	0.490
Rupicapra rupicapra	-0.060	0.047	-1.275	0.205

Saiga tatarica	-0.094	0.101	-0.929	0.355
Sus scrofa	0.119	0.086	1.377	0.171
Ursus arctos	-0.131	0.063	-2.062	0.042
Ursus spelaeus	0.168	0.046	3.632	0.000
Vulpes vulpes	-0.021	0.046	-0.447	0.656
From 12 to 8 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	-0.214	0.044	-4.896	0.000
Bos primigenius	0.070	0.047	1.497	0.137
Canis lupus	0.128	0.073	1.747	0.083
Capra ibex	0.015	0.033	0.455	0.650
Capreolus capreolus	-0.132	0.052	-2.546	0.012
Cervus elaphus	0.216	0.054	3.996	0.000
Coelodonta antiquitatis	0.117	0.071	1.652	0.101
Equus ferus	0.101	0.055	1.817	0.072
Equus hydruntinus	-0.131	0.049	-2.681	0.008
Lynx lynx	0.089	0.091	0.976	0.331
Mammuthus primigenius	0.171	0.055	3.109	0.002
Megaloceros giganteus	-0.117	0.075	-1.563	0.121
Panthera leo	0.149	0.050	2.957	0.004
Rangifer tarandus	-0.092	0.041	-2.266	0.025
Rupicapra rupicapra	-0.065	0.046	-1.435	0.154
Saiga tatarica	-0.041	0.090	-0.461	0.646
Sus scrofa	0.009	0.076	0.121	0.904
Ursus arctos	-0.094	0.051	-1.855	0.066
Ursus spelaeus	-0.004	0.045	-0.089	0.929
Vulpes vulpes	0.124	0.036	3.474	0.001

Table S5.2. Temporal widows approach

From 40 to 32 kya				
Species	Slope	Std.Error	t value	p value

Bison priscus	-0.136	0.082	-1.666	0.098
Bos primigenius	0.291	0.076	3.816	0.000
Canis lupus	-0.120	0.093	-1.291	0.199
Capra ibex	-0.008	0.064	-0.120	0.905
Capreolus capreolus	-0.164	0.089	-1.829	0.070
Cervus elaphus	0.030	0.095	0.314	0.754
Coelodonta antiquitatis	-0.001	0.101	-0.011	0.992
Crocuta crocuta	0.048	0.085	0.569	0.571
Elephas antiquus	-0.457	0.112	-4.082	0.000
Equus ferus	0.417	0.103	4.052	0.000
Equus hydruntinus	-0.207	0.061	-3.393	0.001
Lynx lynx	-0.101	0.113	-0.887	0.377
Mammuthus primigenius	0.106	0.108	0.987	0.326
Megaloceros giganteus	-0.126	0.078	-1.627	0.106
Panthera leo	0.054	0.075	0.716	0.475
Rangifer tarandus	-0.023	0.064	-0.366	0.715
Rupicapra rupicapra	-0.113	0.050	-2.278	0.024
Saiga tatarica	-0.140	0.112	-1.249	0.214
Stephanorhinus hemitoechus	0.086	0.079	1.093	0.277
Sus scrofa	0.275	0.104	2.633	0.010
Ursus arctos	-0.032	0.081	-0.397	0.692
Ursus spelaeus	0.205	0.060	3.398	0.001
From 36 to 28 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	-0.327	0.090	-3.624	0.000
Bos primigenius	0.373	0.084	4.448	0.000
Canis lupus	-0.092	0.104	-0.888	0.376
Capra ibex	0.011	0.060	0.181	0.857
Capreolus capreolus	-0.315	0.095	-3.324	0.001
Cervus elaphus	0.139	0.110	1.260	0.210
Coelodonta antiquitatis	0.121	0.113	1.065	0.289
Crocuta crocuta	-0.035	0.107	-0.330	0.742

Elephas antiquus	-0.528	0.129	-4.087	0.000
Equus ferus	0.538	0.121	4.444	0.000
Equus hydruntinus	-0.243	0.068	-3.559	0.001
Lynx lynx	-0.059	0.136	-0.430	0.668
Mammuthus primigenius	-0.155	0.111	-1.395	0.165
Megaloceros giganteus	-0.077	0.082	-0.935	0.352
Panthera leo	0.229	0.078	2.954	0.004
Rangifer tarandus	0.080	0.064	1.250	0.213
Rupicapra rupicapra	-0.093	0.056	-1.661	0.099
Saiga tatarica	0.032	0.134	0.237	0.813
Stephanorhinus hemitoechus	0.008	0.100	0.076	0.940
Sus scrofa	0.140	0.113	1.242	0.216
Ursus arctos	-0.076	0.092	-0.823	0.412
Ursus spelaeus	0.221	0.057	3.865	0.000

From 32 to 24 kya

Species	Slope	Std.Error	t value	p value
Bison priscus	-0.346	0.086	-4.048	0.000
Bos primigenius	-0.034	0.086	-0.396	0.693
Canis lupus	-0.101	0.113	-0.893	0.374
Capra ibex	0.094	0.061	1.539	0.126
Capreolus capreolus	-0.261	0.091	-2.872	0.005
Cervus elaphus	-0.080	0.105	-0.762	0.447
Coelodonta antiquitatis	0.129	0.123	1.050	0.296
Crocuta crocuta	0.361	0.090	4.018	0.000
Equus ferus	0.314	0.111	2.840	0.005
Equus hydruntinus	-0.129	0.065	-1.974	0.050
Lynx lynx	-0.302	0.150	-2.004	0.047
Mammuthus primigenius	-0.323	0.120	-2.696	0.008
Megaloceros giganteus	-0.069	0.085	-0.803	0.423
Panthera leo	0.146	0.077	1.883	0.062
Rangifer tarandus	0.217	0.053	4.056	0.000
Rupicapra rupicapra	0.023	0.058	0.399	0.690

Saiga tatarica	0.044	0.113	0.390	0.697
Stephanorhinus hemitoechus	-0.109	0.074	-1.479	0.141
Sus scrofa	0.204	0.103	1.972	0.051
Ursus arctos	0.133	0.094	1.420	0.158
Ursus spelaeus	0.051	0.061	0.839	0.403
From 28 to 20 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	-0.346	0.086	-4.048	0.000
Bos primigenius	-0.034	0.086	-0.396	0.693
Canis lupus	-0.101	0.113	-0.893	0.374
Capra ibex	0.094	0.061	1.539	0.126
Capreolus capreolus	-0.261	0.091	-2.872	0.005
Cervus elaphus	-0.080	0.105	-0.762	0.447
Coelodonta antiquitatis	0.129	0.123	1.050	0.296
Crocuta crocuta	0.361	0.090	4.018	0.000
Equus ferus	0.314	0.111	2.840	0.005
Equus hydruntinus	-0.129	0.065	-1.974	0.050
Lynx lynx	-0.302	0.150	-2.004	0.047
Mammuthus primigenius	-0.323	0.120	-2.696	0.008
Megaloceros giganteus	-0.069	0.085	-0.803	0.423
Panthera leo	0.146	0.077	1.883	0.062
Rangifer tarandus	0.217	0.053	4.056	0.000
Rupicapra rupicapra	0.023	0.058	0.399	0.690
Saiga tatarica	0.044	0.113	0.390	0.697
Stephanorhinus hemitoechus	-0.109	0.074	-1.479	0.141
Sus scrofa	0.204	0.103	1.972	0.051
Ursus arctos	0.133	0.094	1.420	0.158
Ursus spelaeus	0.051	0.061	0.839	0.403
From 24 to 16 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	-0.327	0.090	-3.624	0.000

Bos primigenius	0.373	0.084	4.448	0.000
Canis lupus	-0.092	0.104	-0.888	0.376
Capra ibex	0.011	0.060	0.181	0.857
Capreolus capreolus	-0.315	0.095	-3.324	0.001
Cervus elaphus	0.139	0.110	1.260	0.210
Coelodonta antiquitatis	0.121	0.113	1.065	0.289
Crocuta crocuta	-0.035	0.107	-0.330	0.742
Elephas antiquus	-0.528	0.129	-4.087	0.000
Equus ferus	0.538	0.121	4.444	0.000
Equus hydruntinus	-0.243	0.068	-3.559	0.001
Lynx lynx	-0.059	0.136	-0.430	0.668
Mammuthus primigenius	-0.155	0.111	-1.395	0.165
Megaloceros giganteus	-0.077	0.082	-0.935	0.352
Panthera leo	0.229	0.078	2.954	0.004
Rangifer tarandus	0.080	0.064	1.250	0.213
Rupicapra rupicapra	-0.093	0.056	-1.661	0.099
Saiga tatarica	0.032	0.134	0.237	0.813
Stephanorhinus hemitoechus	0.008	0.100	0.076	0.940
Sus scrofa	0.140	0.113	1.242	0.216
Ursus arctos	-0.076	0.092	-0.823	0.412
Ursus spelaeus	0.221	0.057	3.865	0.000
From 20 to 12 kya				
Species	Slope	Std.Error	t value	p value
Bison priscus	-0.136	0.082	-1.666	0.098
Bos primigenius	0.291	0.076	3.816	0.000
Canis lupus	-0.120	0.093	-1.291	0.199
Capra ibex	-0.008	0.064	-0.120	0.905
Capreolus capreolus	-0.164	0.089	-1.829	0.070
Cervus elaphus	0.030	0.095	0.314	0.754
Coelodonta antiquitatis	-0.001	0.101	-0.011	0.992
Crocuta crocuta	0.048	0.085	0.569	0.571
Elephas antiquus	-0.457	0.112	-4.082	0.000

Equus ferus	0.417	0.103	4.052	0.000
Equus hydruntinus	-0.207	0.061	-3.393	0.001
Lynx lynx	-0.101	0.113	-0.887	0.377
Mammuthus primigenius	0.106	0.108	0.987	0.326
Megaloceros giganteus	-0.126	0.078	-1.627	0.106
Panthera leo	0.054	0.075	0.716	0.475
Rangifer tarandus	-0.023	0.064	-0.366	0.715
Rupicapra rupicapra	-0.113	0.050	-2.278	0.024
Saiga tatarica	-0.140	0.112	-1.249	0.214
Stephanorhinus hemitoechus	0.086	0.079	1.093	0.277
Sus scrofa	0.275	0.104	2.633	0.010
Ursus arctos	-0.032	0.081	-0.397	0.692
Ursus spelaeus	0.205	0.060	3.398	0.001

Table S6. Results of the Wilcoxon rank sum tests

Wilcoxon rank sum test with the specific intervals approach		
Intervals	w	*p*
40 - 32	64.000	0.125
36 - 28	69.000	0.194
32 - 24	50.000	0.016
28 - 20	84.000	0.163
24 - 16	75.000	0.047
20 - 12	70.000	0.029
Wilcoxon rank sum test with the temporal windows approach		
Intervals	w	p
40 - 28	98.000	0.580
36 - 24	66.000	0.019
32 - 20	76.000	0.051
28 - 16	63.000	0.014
24 - 12	79.000	0.110