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An Analysis of the Identity and Relationship Among Skeletal Remains of the Upper Paleolithic Era

by Brian Kinsman

(Honors Biology 102)

The Assignment: Write a paper following a professional format that describes the author's research of a fictional, but realistic, data set.

Abstract. Two partial skulls of unknown humanoids, an unknown humanoid bone, a wooden section of a tool, a skull and leg bones of an Irish Elk, and a bivalve shell were found in a cave near Vallon-Pont, d'Arc, France. The objectives of the experiment were to determine the age of the artifacts using carbon-14 dating, identify the species and physical data of the hominids, and evaluate the relationship between these artifacts. All of the artifacts, excluding the hominid bone, were dated approximately 17,500 years old; the hominid bone was dated as 3,000 years younger. What resulted was an inconclusive correlation between the artifacts due to the uncertain relationship between the hominid species *Homo sapiens* and *Homo neanderthalensis*.

Introduction

The past 100,000 years in human evolution have spurred much debate over the origin of the species *Homo sapiens* throughout Western Europe; namely, this debate results from the overlapping distribution of several species of coexistent hominids (Tattersall 1995). The two primary species in existence at the time were *H. sapiens* and *H. neanderthalensis*.

The *H. neanderthalensis* as a stockier species of hominid who as the primary inhabitant of Northwestern Europe approximately 127,000 years ago (Gibbons 2001). The Neanderthals were the dominant anthropoid in the north due to their durable, muscular frames that allowed them to adapt to the glacial conditions. These pre-modern hominids functioned by forming small hunting groups to survive (Gore 1997). Most notably, this demonstrates that a form of communication was existent; furthermore, Neanderthal advancement is prevalent through their use of spears for hunting (Trinkaus 1986). The first *H. sapiens* found to coexist with the Neanderthals in Europe appeared approximately 50,000 years ago when the glaciers had melted and the species could safely migrate farther north into Europe. These were the first of the modern humans, forming societal groups capable of both hunting and gathering. In addition, they exhibited heightened cultural development that was little or non-existent in Neanderthal groups (Tattersall and Schwartz 2000).

The dispute arises over the eventual disappearance of the species *Homo neanderthalensis* approximately 28,000 years ago. Two potential scientific theories have been formulated regarding its extinction. One suggests that the Neanderthals were assimilated into the species *H. sapiens* through interbreeding (Zilhao 2000). In contrast, it is also believed that the Neanderthals were driven to extinction through competition with the more advanced humans (Gibbons 2001).

Recently, in a cave near Vallon-Pont, d'Arc, France paleontologists discovered two

partial skulls of unknown humanoids, a wooden section of a tool, bones of an Irish Elk (*Megaloceras*), a bivalve shell, and an unknown humanoid-type bone. The cave is located with a floodplain of a river valley. A stream enters the cave from a plateau high in the river valley and continues to flow through and out of the cave.

The initial objective of this experiment is to estimate the ages of the aforementioned six items. From which point an analysis is made of the three humanoid items to determine their corresponding species and explain the geographic relevance of their discovery. The final objective of this experiment is to discover the physical attributes and cause of death of the two humanoids to which the skulls belonged.

Methods

Carbon-14 dating was utilized to age the materials (the percentage of carbon-14 found in the fossil was measured in proportion to constant amount of stable carbon-12). Differences in the ages if the six cave artifacts were tested using pair wise independent t-tests where significance was determined at $p \leq 0.05$.

The species of the two humanoid skulls and unknown bone were identified based upon the characteristic morphologies of the two existent species in the most accurate temporal frame. In particular, a *H. neanderthalensis* could be identified by its enlarged cranial capacity ranging on average 1400-1600 cm³, the presence of an occipital bun, and large supraorbital arches (protruding brow) (Day 1986). *H. sapiens* may be identified by a notably smaller domed cranium lacking a sagittal crest, reduced brow ridges, and a jaw that does not project forward (a prominent chin is evident) (Gipps 1991). The species of an unknown hominid bone was identified based on average bone length and thickness characteristic of each species.

Other physical attributes evident at the time of death were revealed using several methods. The ages of the two humanoids were discerned by measuring how pronounced are the endocranial sutures (Byers 2002). As humanoids age, these sutures become less visible. The genders of the humanoids were discerned by comparing cranial capacities and by contrasting the robust masculine and the gracile feminine cranial traits (Byers 2002). The cause of death and health at the age of death was formulated based upon any prevalent irregularities in the skulls that would suggest anything other than natural causes.

Results

Table 1 summarizes the archaeological ages of the six cave artifacts and statistical testing. All of the artifacts were found to be of similar ages, except for the bone which was determined to be around 5,000 years younger than the other artifacts.

Skull A was determined to belong to a *H. sapiens* based upon the pronounced chin, small brow ridges, and a cranial capacity of 1200 cm³ (Gipps 1991). Upon further investigation, this individual was determined to be a female between the ages of 32 and 40 based on the slight endocranial sutures remaining, and illustration of gracile cranial features such as a round chin, slight supraorbital ridges, and sharp orbital borders (Byers 2002). Rough estimates of height and weight based on averages for the time period equate to roughly 1.55 m and 58.9 kg, respectively (Tattersall and Schwartz 2000).

The unknown bone was classified as the tibia of a right leg because on the proximal end of the bone, lateral and medial condyles, which articulate with the condyles of the femur, were

present. Furthermore, the lateral side was smooth, indicating the bone's articulation with the fibula (Wingerd 1994). The bone was found to belong to a *H. sapiens*, due to its length of 34 cm, which corresponds to the average length of a human tibia (Wingerd 1994).

Skull B belongs to a member of species *H. neanderthalensis*. This was deduced by its protruding brow, occipital bun, and oversized cranial capacity of 1500 cm³ (Day 1986). Through further investigation this Neanderthal was determined to be a male, as it exhibited a larger cranial capacity of 1500 cm³ that is heavily accentuated in male members of the species. The specimen was believed to be between the ages of 32 and 43 at the time of death based on the fading of the endocranial sutures (Byers 2002). Likewise, there is not enough evidence to determine a definite height and weight, but if the specimen followed the average for the species he would weigh 90.7 kg and measure around 1.65 m in height (Trinkaus 1986).

The skulls of both the human and Neanderthal indicated good health at the time of death based on the healthy complement and condition of teeth. There is no additional physical evidence to suggest otherwise; thus, cause of death of each individual was unknown.

Discussion

The discovery of a Neanderthal and a human in this cave at around the same temporal zone (Upper Paleolithic) suggests that the species *H. neanderthalensis* survived 10,000 years beyond what has been previously accepted. If the Neanderthals retained morphology integral to their species significantly longer than originally believed and still managed to temporally overlap with modern humans, then it is less likely that they interbred with the population of *H. sapiens*. This possibly refutes the theory that Neanderthals were fully assimilated into the *H. sapiens* gene pool; however, there is a. Findings indicate that the Neanderthals coexisted longer with modern humans.

There are several possible explanations for the simultaneous discovery of all six of these items. Neanderthals, and frequently modern humans, were group hunters and often hunted large prey with long spears with wooden base and tips composed of sharp mammalian teeth. One such prey of the Neanderthal and also *H. sapiens* was *Megaloceras* (Irish Elk). Thus, it is possible the *Megaloceras* fossil was the result of either hominid's hunting expedition using the wooden tool; however, the condition of the skeletal remains was not submitted by the paleontologists who excavated the cave. Consequently, the reason behind the *Megaloceras* remains in the cave remains unknown.

This, however, does not account for the bivalve shell or the *H. sapiens* tibia. It is likely that the bivalve shell once contained a species of edible mollusk that the human might have gathered for food. In this case, the wooden tool could have been used as a means of prying open the shell. In addition, modern humans adorned themselves with natural objects such as shells; hence, the bivalve shell may have been decorative. Furthermore, the placement of the shell might be simply random, as the result of being swept into the cave from atop the plateau by the current of the stream. Still, the potentials of the shell's use and location are inconclusive and its size remains unknown.

The more questionable discovery is the tibia. There are two primary explanations for its discovery in this locale. First, the cave in which it was found has a stream flowing through it. This stream enters the cave from a plateau, which suggests that items atop the plateau may have been swept from above, down into the cave by the current of the stream. In this case, it is feasible that the human tibia was swept down by the current into the cave. This occurrence would explain

the temporal difference between it and the other artifacts. It could also be that the discovery of the tibia denotes the future occupation of the cave by *H. sapiens* residents, and places possible extinction of *H. neanderthalensis* within the proximal 5,000 years of its archaeological age.

The discovery of just the individual skulls of the *H. sapiens* and *H. neanderthalensis*, let alone the tibia, denotes the possibility that the paleontologists may not have been entirely thorough in their excavation of the cave. Therefore, the other remains may still exist in the cave. Nevertheless, if upon further investigation additional corresponding skeletal remains are not recovered, it is possible they were swept from the cave by the current of the stream.

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Table 1. Temporal analysis (mean \pm standard deviation age in years) of the six artifacts utilizing Carbon-14 dating. All $n = 6$. The age of the hominid bone was significantly different from the ages of the other cave artifacts (all t 's > 3.6 , $p < 0.05$, independent t -tests). The remaining cave artifacts did not differ significantly in age.

Cave artifact	Archeological age (years)
Skull A (<i>Homo sapiens</i>)	17571 \pm 1547
Skull B (<i>Homo neanderthalensis</i>)	17378 \pm 1339
Hominid bone (<i>H. sapiens</i> right tibia)	14399 \pm 1425
Wood tool	17580 \pm 1557
Skeleton of Irish elk	17875 \pm 1537
Bivalve shell	18083 \pm 1525