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Introduction (MD)

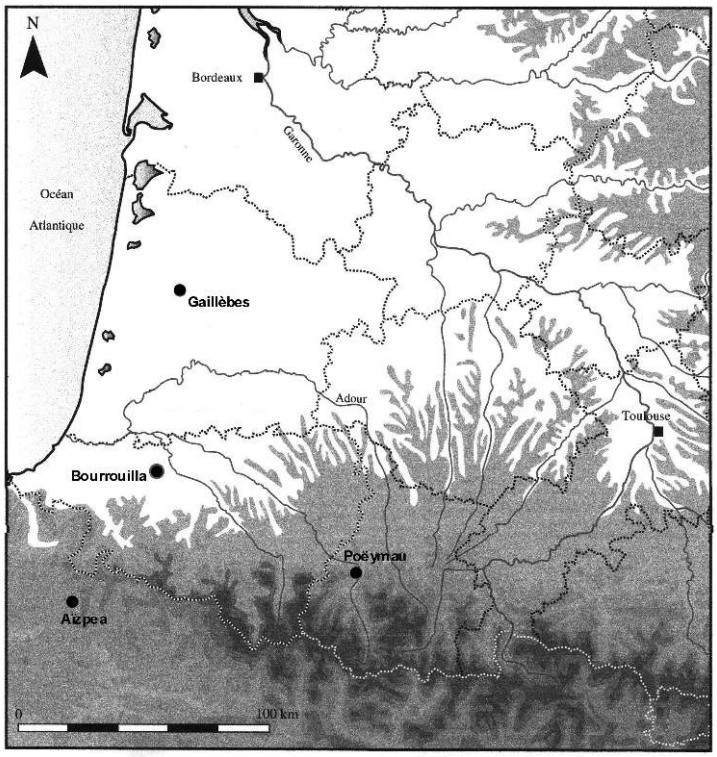
1 The Mesolithic in the extreme southwest of France is still poorly understood. Because of ancient excavations (implying a lack of sieving or an inadequate sieving), because the sequences are disturbed or the series are numerically very small, few sites have provided reliable data on the last hunter-gatherers between the southern Landes and the Spanish border.

2 In this regional context, the discovery in the cave of Bourrouilla in Arancou (Pyrénées-Atlantiques) of remains of Mesolithic occupations provides valuable data. The conservation of the fauna, which is sorely lacking in the open-air sites of Aquitaine, and two radiocarbon dates constitute, in addition to the lithic, very useful elements for a better understanding of the Mesolithic of the Northern slope of the western end of the Pyrenees.

3 The cave of Bourrouilla is located in the Pyrénées-Atlantiques, by the town of Arancou (fig. 1). The discovery of the site took place in 1986, together with a clandestine excavation that affected the inside of the cave. After sieving and sorting the waste soil from an illegal excavation that highlighted the potential and richness of the site and conducting a test pit outside in order to identify the extent of the occupations and the thickness of the stratigraphy (Chauchat et al. 1999), planned excavations were

undertaken in 1998, first under the responsibility of Cl. Chauchat, then under M. Dachary.

Figure 1 - Localisation map of Bourrouilla (Arancou, Pyrénées-Atlantiques, France) and main mesolithic sites mentioned in the text.



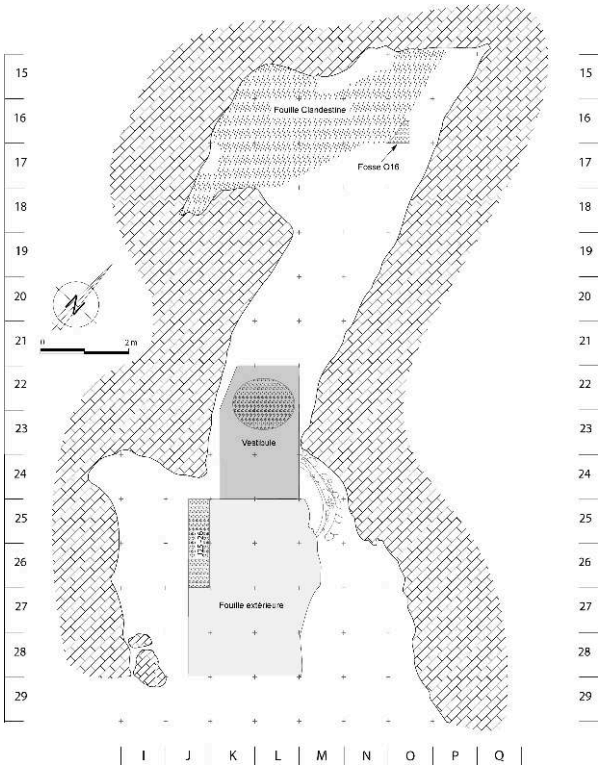
4 In order to locate better the site in its environment, one can note that the cave opens at 50 m above sea level in the limestone with Melobesies of the Albian stage. It dominates the right bank of the Lauhirasse stream, a small tributary of the Bidouze, itself a tributary of the reunited Gaves.

5 The analysis of the geographical context shows that several elements in the immediate environment of the cave have favoured the settlement of Men:

- the presence of water (Dachary 1993) as an essential element for life (small springs several dozens of meters away), but also as potential food resources for the Bidouze as well as for the Gave d' Oloron (Le Gall in Chauchat et al. 1999);
- the existence in the Mesolithic of at least two terrestrial ecological environments that are the wooded hills of the piedmont and the marshland areas around the watercourses, within a radius of about 2 km (Eastham in Chauchat et al. 1999);
- an ideal topography: a southeast opening - so sheltered from prevailing winds - and situated on a plateau overlooking the torrents.

6 The site has been divided into four sectors (fig. 2): the outer area (bands 25 to 28), the entrance under the porch (bands 22 to 24), the corridor (bands 19 to 21) and the room at the back (bands 15 to 18). Although most of the stratigraphy documents the Magdalenian occupations, remains of Mesolithic occupations were discovered in the outer area, the entrance and the back room.

Figure 2 - Map of Bourrouilla site and localisation of mesolithic excavated areas.



7 The Mesolithic evidence make three groups from the three loci mentioned above, and offer different states of conservation. On the outside, the excavation of squares J25 and J26 squares yielded a homogeneous series within a clear stratigraphy. This area, well preserved, was subjected to careful excavation by 2 cm thick artificial horizons, with water sieving of sediments by quarter of square meter. In the entrance, a highly bioturbated sedimentary assemblage (notably by the action of badgers) was sampled in block, without recording of the objects' position. The sediments were water-sieved with a fine mesh sieve and sorted. The resulting lithic remains were then given a treatment to dissolve the more or less thick concretions that coated them. The tools were then isolated. In other words, part of the fine fraction is missing, probably because, due to the concretions, it was not spotted during the sorting.

8 Finally, a third group of remains comes from the partial excavation of a pit (Stratigraphic Unit 2002) dug in the Magdalenian levels of the back room (square O16). On the edge of the illegal excavation, this hollow structure, visible in the control section, was in danger of collapsing. It was excavated by artificial horizons of 2 cm, on a little less than a quarter of a square meter. Sediments were water-sieved with a fine mesh sieve and sorted.

9 In this article, we are presenting the material by categories of remains and by sector before discussing the value of the series and then placing it in a wider context, across the Mesolithic of southwestern France.

1 - The lithic industry (JCM and MM)

1.1 - Overview of the industry

10 The lithic industry is present in all three sectors containing Mesolithic levels: band J (outer area), entrance and pit O16 (in the back room). It appears necessary to address separately each of these areas, to reflect the variability of their mode of deposition and conservation, before having a global view of Mesolithic frequentations of the site.

11 Distinguishing technologically significant assemblages, allowing the description of phasing, would be ideal. But the exercise is impossible here because of the quantitative and qualitative disparity of the three series and of the context of the excavation.

12 The debate is still on going in Aquitaine on the modalities and implications of the technical developments during the different phases of the Mesolithic (Valdeyron 2000; Roussot-Larroque 2005, 2009), we chose to refer to the division between a First Mesolithic (early and middle phases) and a Second Mesolithic (recent and final phases).

- The First Mesolithic corresponds to the industries with triangles, narrow backed bladelets, narrow blanks obtained by direct soft mineral percussion. Dominated by isosceles triangles and tapered hypermicroliths, these industries are represented in the southwest of France by the early and middle Sauveterrian.
- The Second Mesolithic corresponds to the industries with large trapezes and projectiles insets, large regular and standardized blanks, with the appearance of indirect percussion.

13 The focus will be on some relevant features, paying particular attention to microlithic projectiles insets because these objects, heavily invested from a techno-cultural view, are the most diagnostic elements of the assemblage.

14 Given the varied nature of the existing typologies, we must also clarify the definition of some terms used. The terminology adopted incorporates elements of the GEEM typology (GEEM 1969, 1972, 1975), revised by Gregor Marchand (Marchand 1999). We identified three families within the retouched objects:

- Family of the geometric projectile insets (groups of the bitruncations and the truncations/back edges).
- Family of non-geometric projectile insets (groups of the truncations/backed edges and of the backed edges).
- Family of the tools from the common fund (groups of the backed edges, notched blades and bladelets, truncations, end scrapers, borers, retouched pieces, a posteriori tools or worn objects).

15 Note also that we have distinguished blades, bladelets and micro-bladelets on morphometric criteria (length/width ratio, bladelet width < 12 mm).

1.1.1 - Lithic count

16 The total of the lithic objects from the Mesolithic levels of Arancou accounts 9,915 flint pieces, out of which 185 are retouched, 213 are blade/bladelets and 16 are cores. Their breakdown by major categories and by locus is detailed in table 1.

17 The outline of the technological analysis is presented below; the detailed results are presented in the excavation reports of 2010 and 2012 (Merlet and Miqueou in Dachary et al., 2010, 2012). The study focused specifically on diagnostic objects (projectiles

insets, technical objects, cores) that represent 238 elements (table 2), then on the blades and bladelets. The rest of the objects were studied according to the observations made on the diagnostic objects.

1.1.2 - The supply of siliceous materials

18 Few objects allow a determination of the flint used because many have been altered (patina, heating up) or are too small in dimensions. The review of those that could be determined shows the almost exclusive presence of flint from the “Bidache type” Flysch. The Bourrouilla cave is in the area of the Cretaceous Flysch of the Pyrenean foothills, and this material is available here in a few kilometres radius, where it outcrops in various aspects. It is generally in the form of thick plaques with a layered structure and mostly a grainstone texture. Several projectile insets are made from this material, as well as the cores.

Table 1 - Composition of mesolithic lithic industry from Bourrouilla Cave.

Lithique	vestibule remanié	J25-J26	O16 (US 2002)	Total
lames/lamelles	144	14	55	213
éclats silex	7336	68	322	9418
fragments silex		245	1447	
cupules thermiques	0	17	29	46
nucléus	9	0	7	16
blocs testés	2	0	0	2
pièces techniques	30	0	5	35
pièces retouchées	137	19	29	185
Total silex	7658	363	1894	9915
autres fragments lithiques (grès, cristal de roche, quartzite)	non décomptés	4	172	176

19 One can note the absence of foreign flint, such as the flint with Lepidorbitoides known in numerous deposits in the Chalosse or again the small pebbles below 10 cm with marine erosion cortex found on the Atlantic coast. The supply here was from a radius of several kilometres around the cave.

20 It should not hastily be concluded that the groups that stayed in the cave moved only within a limited territory. Recent studies have shown that, further north in the Landes, the Mesolithic people of Gaillèbes -2 were getting supplies on the coast and in the Chalosse, remote sources 45 km away (Merlet and Miqueou 2009). On the southern slopes of the Pyrenees, in the lower levels of Aizpea (dated to 7,790 ± 70 and 7,170 ± 70 BP), a small percentage of flint comes from the Chalosse and pebbles whose cortex has undergone a sea abrasion "from the coastal area of the Landes", as well as the Flysch flint that could also come from the northern Basque Country (Cava et al. 2007-2008), implying movements over 50 kilometres. At Bourrouilla, they could in reality use the resources of a large enough living space with various stops and implying movements on distances, also close to several dozens of kilometres. Simply, the objects abandoned here reflect the manufacture of the lithic equipment necessary for the activities developed at this place from an opportunistic choice of materials available to them nearby. In other words, Flysch flint met their requirements and habits.

Table 2 - Distribution of diagnostic artefacts of mesolithic lithic industry from Bourrouilla Cave.

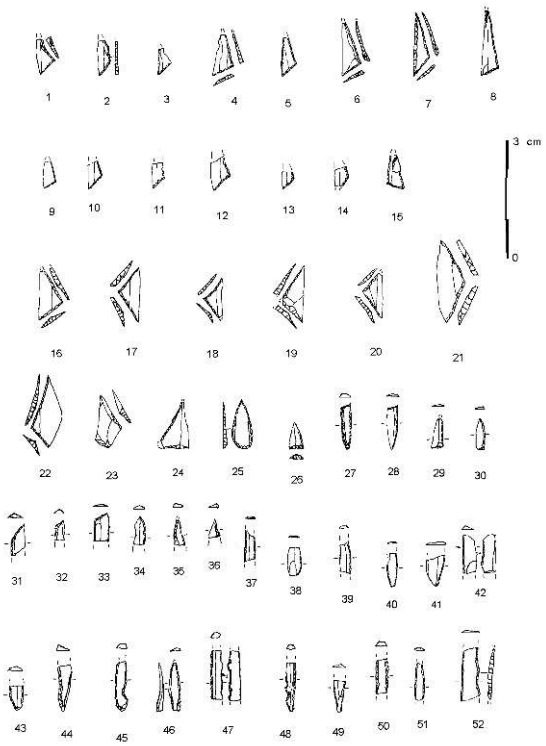
Pièces diagnostiques	Vestibule remanié	J25-J26 tamisage	O16 (US 2002)	Total
armatures géométriques	21	4	6	31
armatures non géométriques	74	5	9	88
outils du fonds commun	16	2	5	23
Indéterminables	21	7	8	36
microburins	5	1	1	7
nucléus	9	0	7	16
blocs testés	2	0	0	2
pièces techniques	30	0	5	35
Sous-total pièces retouchées	137	19	29	185
Sous-total débitage	41	0	12	53
Total	178	19	41	238

1.2 – Indication of occupation in the outer area (J25 and J26)

21 The lithic industry gathered in J25 and J26 is numerically small (363 pieces) and uncharacteristic. It does not include any cores, only eight blades, six bladelets, 19 retouched objects and 334 other debitage products. The 19 retouched objects include nine projectile insets out of which four geometric: a backed bipoint similar to a Sauveterre point, an isosceles triangle and two scalene triangles whose third side is retouched. The blade-bladelet blanks show the use of direct soft percussion. The profiles are mostly straight and the arris sinuous. Other objects are mostly fragments (74.5 %) and flint flakes (19.8 %) as well as splinters and thermal cupmarks. They fall into three broad typometric classes with 46.3% of maximum dimension under 5 mm, 39.9% between 5 and 10 mm and only 13.8% of the objects over 10 mm. More than 60 % of the products show signs of heating up.

22 For this sector, in view of the association "Sauveterre point - isosceles triangle – scalene triangle with retouch on three sides", we can consider the presence of a First Mesolithic. There is no apparent contamination by underlying levels. The high proportion of fragmented and burned objects and of debitage products ≤ 5 mm invites us to see this space as a refuse area.

Figure 3 - Vestibule. Geometric and non geometric weapon. First Mesolithic. 1 to 16, 19: Scalenes triangles. 7, 18, 20 and 21: Isosceles triangles. 22: Bi-truncated point. 23: Natural base point. 24: Asymmetrical trapeze. 25: Convexe base point. 26: Concave base point. 27, 28: Scalenes bladelets. 29, 30, 34 to 52: Baked bladelets. 31 to 33: Truncated bladelets (© J.-C. Merlet).



1.3 - Evidence of occupation of the entrance

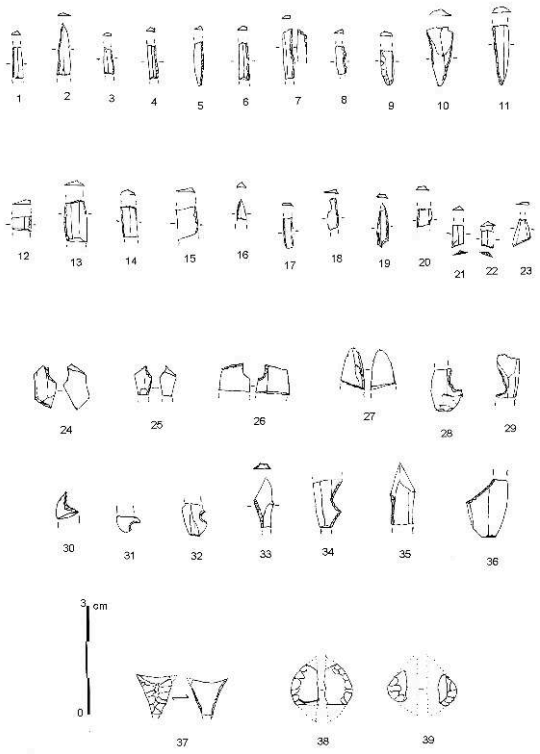
23 The series of the entrance is numerically the largest: 7,658 flints. It includes nine cores and two tested blocks, 31 blades, 107 bladelets, 137 retouched pieces and 7,366 other debitage products. However, it is known that the sediments it is issued from are not in place. It is therefore necessary to first put aside, using the morpho-technical criteria, the objects that can be safely attributed to the Magdalenian and/or the Epipalaeolithic. Such is the case of the five burins and 21 burin spalls, of four large points with backed edges, of part of the blades, etc. The problem is more complex for the backed bladelets that can be found in the Mesolithic industries and that are therefore difficult to attach to one or another of these periods.

1.3.1 - The retouched pieces

24 **Geometric projectile insets** include 21 triangles (17 scalene and four isosceles) and two scalene bladelets (fig. 3). Several ordinary short triangles and one scalene bladelet show evolved characteristics: the retouched third edge. The blanks are mostly narrow bladelets as evidenced by the visible arris and their size, these triangles not exceeding 7 mm wide and 2 mm thick. The measurement of the angle formed by the two truncations, allowing addressing the broken objects, confirms the classification, as several of these also carry a retouch of the third edge, an observation that correlates well with the foregoing. An object recalls the shape of the segment. An asymmetrical trapezoid on a two-faceted bladelet has straight edges and arris (fig. 3, n° 24). Semi-

abrupt direct retouches form two truncations: an oblique truncation and a straight one. Finally, there is a Montclus arrow (fig. 4, 37), measuring 9.25 mm wide and 2.11 mm thick.

Figure 4 - Vestibule. Non geometric weapon, microburins, diverse. 1 to 20: Baked bladelets. 21 and 22: Truncated bladelets. 23: Retouched base bladelet. 24 and 25: Microburins. 26 to 35: Waste of weapon: notched bladelet, part-truncated bladelets. 36: Oblique trunk. 37: Arrow of Monclus. 38 and 39: Segment of Betey (37 to 39: second Mesolithic/early Neolithic) (© J.-C. Merlet).



25 **Points**. 15 points (fig. 3 and 4) are as follows: three narrow points with one backed edge, four narrow points with two backed edge, four points on oblique truncation and four large points with one backed edge (on blade). The elongation indices point out two groups: one on long and wide blanks, the other shorter and narrower. Moreover, when the arris are visible, they are sinuous. The most fragmented projectile insets are narrow points. Only one is whole. For the others, one of the ends has been broken. The angle of the piercing ends of the narrow points with backed edges and of the points on oblique truncation varies between 40° and 55°, which supports the interpretation of a hafting as an axial point (Domingo Martinez 2005; Chesnaux 2008) although the observed fractures on the apex bear no traces of impact (Fischer, Wemming-Hansen, Rasmussen 1984).

26 The narrow points with one backed edge are with abrupt scaled direct retouch while those with two backed edges are made by direct semi-abrupt scaled and invasive retouch. There is a narrow point with one backed edge and a narrow point with two backed edges with a base in the proximal part.

27 **Blades and bladelets with backed edges**. This group comprises 54 objects including two backed blades. The bladelets (fig. 4) can be divided into four types:

- 30 bladelets with one backed edge with direct retouches
- 1 bladelet with one backed edge with inverse retouches

- 15 bladelets with two backed edges with direct retouches
- 6 bladelets with two backed edges with alternate retouches

28 Only three whole projectile insets are among the bladelets. For the others, it is the mesial, then mesio-distal parts that were mostly preserved. We have a homogeneous group of bladelets in terms of dimensions, but variable in terms of retouches. The edges are straight and the retouch is continuous along the entire edge.

29 **Blades and truncated bladelets**. Besides a truncated blade with two backed edges, there are mostly nine truncated bladelets (fig. 3, n°. 31-33) out of which four have one backed bladelet, three with two backed edges and two simple truncated bladelets. The size of the retouched blank is fairly constant within two categories: micro-bladelets and bladelets. When the arris are visible, they are sinuous. The retouches are direct, semi-abrupt to abrupt and scaled and they cover all the edges. The measurements of the angles formed by the intersection of a backed edge with the truncation show, for two truncated bladelets with one backed edge, angles of 100° and 110°. They could be perfectly integrated to the scalene bladelets.

30 **Notched blades and bladelets**. The notched bladelets (fig. 4) are all broken at the notch after fashioning. They could therefore be waste from the manufacturing of projectile insets, resulting from the fractioning of the blanks and not from strictly speaking notched bladelets. Especially as only the notch is retouched (the edges are not retouched), with the exception of two bladelets with a back and a notch on the same edge. The widths vary between 5.5 and 7.5 mm on the one hand and 9 and 8.5 mm on the other hand. The thicknesses are less than 2 mm. All the retouched are direct, short, semi- abrupt and scaled.

31 **The tools of the common fund** include two end scrapers, a borer, a truncation and two denticulates.

32 **Other retouched objects, undetermined**. 21 objects, among which we can identify six projectile insets fragments.

33 **The technical objects** include 22 burin spalls and three maintenance crests. The co-occurrence of burin spalls and of five burins clearly indicates an intrusion of Magdalenian objects.

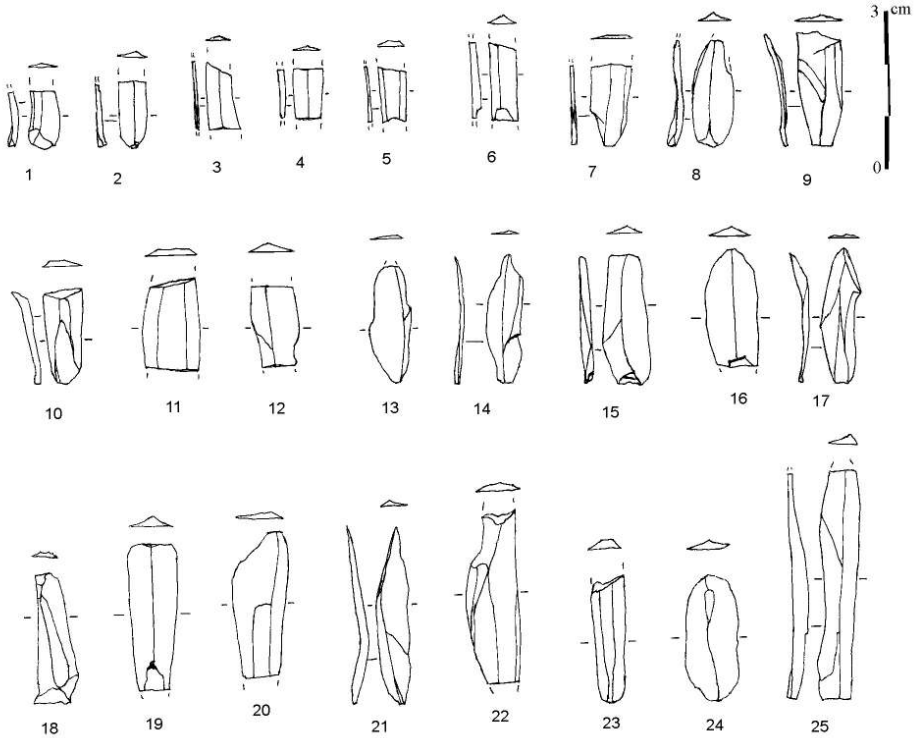
34 **The microburins** (fig. 4, n°. 24, 25) are five in number. Although collected in the disturbed context of the entrance, they can be attached by their morphology to the First Mesolithic.

1.3.2 – Debitage products

35 **Nucleus.** Nine whole nucleus and two tested blocks are counted. One of the cores was made from a thick flake, the scared face having been used as a striking platform. There is only one debitage table. The debitage is semi-turning and the negatives of the last removals are elongated (blades/ bladelets?). The other eight cores were made on what appears to be pebbles but only two examples still retain the cortex. It is granular and vacuolated. Regarding the final volume, the unipolar cores are small, not exceeding 30 mm high. They are very similar as the final negatives of removals are flakes, except for two of them. The striking platforms are smooth and associated to a debitage table that extends essentially over the sides of the cores. The bipolar cores are between 34 and 65 mm high whilst the tested blocks are between 68 and 76 mm high.

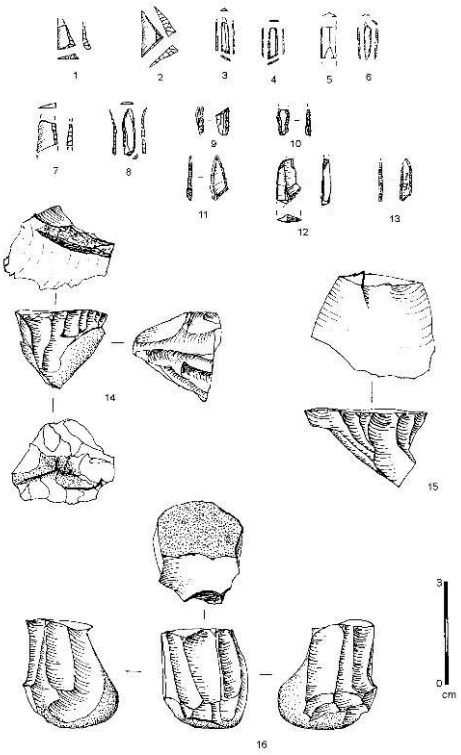
36 **Blades-bladelets blanks**. The 144 blades-bladelets blanks (fig. 5) include 37 blades and 107 bladelets. Only 16.7% are whole for 61.8% of mesio-proximal fragments, 10.4% of mesio-distal fragments and 11.1% of mesial fragments. Nevertheless, it was possible to observe enough butts to get an overview of the striking technique. Thus, the butts are often sub-millimetric or smooth with a strong abrasion of the overhang, even a grinding. The angles between the edge of the striking platform and the debitage table oscillate between 70° and 80°. The bulbs are very light. So it seems that soft direct percussion is dominant. Some objects show more characteristic features that allow précising the type of percussion. Indeed, the cone of percussion is sometimes clearly marked with star-shaped fissures, cracks, bulb scars and sometimes even multiple contact points. The soft mineral direct percussion is then proved. On all these products we could not identify indirect percussion.

Figure 5 - Vestibule. Production of blades and bladelets. 1 to 25: thin blades and bladelets (© J.-C. Merlet).



37 **Flakes, splinters, fragments**. There are 7,336 flakes, fragments and cupmarks, in the entrance, divided in substantially equal parts into objects smaller than 1 cm and objects over 1 cm. The sorting was done before the treatment of the calcareous concretions, which may explain the under-representation of the very fine fraction.

Figure 6 - Lithic industry of O16 pit. 1, 3, 4, 11, 12: Scalenes triangles. 2: Isoscele triangle. 5 and 10: Baked bladelets. 6: Oblique truncated point. 7 and 9: Fragments of microliths. 8 and 13: Backed points, similar at points of Sauveterre. 14 to 16: Flysch flint cores (1 à 8, 14 à 16 : © J.-C. Merlet ; 9 à 13 : © M. Dachary).



1.4 - Evidence of occupation in the back room: O16 (US 2002)

38 This series, although smaller, is homogeneous. It is therefore better able to provide quality information. It includes 1,894 products including seven cores, 15 blades, 40 bladelets, 29 retouched objects and 1,803 other debitage products.

39 **The projectile insets.** They include five scalene triangles and one isosceles (fig. 6). The blanks seem to be narrow bladelets as evidenced by the visible arris and the size. The evolved characteristics dominate insofar as four triangles have three retouched edges and a tendency to elongation as indicated by the elongation index, the symmetry index, and the angle done by the truncations. Three points are counted, two of which are comparable to Sauveterrian points and one point with oblique truncation. They have the same characteristics as those found in the entrance.

40 **The ten backed blades and bladelets** can be divided into three types: four blades with one backed edge, five bladelets with one backed edge with direct retouch, one bladelet with two backed edges with direct retouch. None is whole. The mesial and mesio-proximal parts were preserved. There are almost as many abrupt backed edges as semi-abrupt edges. Thus, only the size of the objects varies for this group otherwise very homogeneous.

41 **The tools of the common fund** are more limited: one side scraper and eight retouched undetermined elements, mostly on flake.

42 Among the seven **cores** (fig. 6, n° 14 to 16), six are whole and one fragmentary. Made of Flysch flint, they are small, not exceeding 35 mm high. Four were made from a thick

flake (between 5 and 36 mm thick). It is the scarring face that served as a striking platform. Out of the six whole cores, five are pyramidal in shape with a single debitage table. The number of negatives rarely exceeds six, with as an operating code 1-2-1-2-etc., or 1-2-3-2-1, or again 1-2-3-4. This means that the removals start whether from the sides towards the inside of the core, whether from one side to the other. This is therefore a semi-rotating debitage. The negatives of the last removals are elongated (blades/bladelets?). The seventh is multidirectional with four striking platforms and three debitage tables. The last removals are flakes. The burnt cores dominate the corpus.

43 There are 55 **lamino-lamellar blanks** (15 blades, 40 bladelets), fragmented in 75 % of the cases. Nevertheless, the observation of the existing butts gives an overview of the percussion technique. Thus, the long and thin butts are often sub-millimetric with a high abrasion of the overhang or even a grinding. The angles between the edge of the striking platform and the debitage table oscillate between 70° and 80°. It seems that soft direct percussion dominates. The whole objects do not exceed 30 mm long. The elongation index ranges between 2.5 and 3, so we have rather elongated blanks adapted to the making of triangles or backed bladelets. It seems therefore that the blanks of O16 are among the sought after modules for the manufacture of projectile insets. The negatives of the arris of the previous removals are sinuous. The negatives go by two or three or four exceptionally.

44 **Flakes, splinters, fragments**. O16 is the area that includes the largest number of fragments: 1,447 broken objects, among which 125 splinters, and 29 thermal cupmarks, for 322 full flakes. Almost 80% of them were heated up. 46.3% are less than 5 mm and 43.5 % are between 5 and 10 mm in their maximum dimension. It is likely that the small size and number of the fragments results from the action of heat, of which they bear the scars. Besides flint, other rocks are present: sandstone, as well as limestone, rock crystal, serpentine, quartzite, in the shape of small items. Out of the whole 322 flint flakes measured, over 60% are burnt/heated, the other being unaltered. Flakes 5 to 10 mm are the majority (40.4%) followed by those between 10 and 20 mm (23.7 %) and less than 5 mm (20.8 %). The thermal cupmarks are well below 10 mm. We can also add that there are no cortical objects. They are therefore full debitage products. The size of the products, the high level of fragmentation and their surface condition, as well as the presence of thermal cupmarks, encourage considering O16 as a pit of rejection.

1.5 - Summary of the lithic data

45 The technological analysis of the industry highlights a frequentation during the First Mesolithic, whose traces were recognized in the three excavated areas. The second Mesolithic/ early Neolithic only occurs discretely in the disturbed entrance. Remains from the hunting activities dominate.

1.5.1 – the First Mesolithic is dominant on the whole site

46 Isosceles and scalene triangles, which are rather slender and half of which bear retouches on the third edge, connect the three studied sectors to the First Mesolithic. They mobilize small module blanks, whose edges and arris are neither regular nor parallel. The presence of triangles with evolved characteristics evokes the early advanced Mesolithic (early or middle Mesolithic) even if all the usual criteria for this

period (notably the hypermicrolithism) are not gathered here. Thus, whole triangles have a length greater than 10 mm (between 10 and 18 mm) with the exception of three triangles between 8 and 10 mm long, and therefore they do not have a pygmy characteristic.

47 Points on truncation, narrow points with backed edges and narrow bladelets with backed edges support this determination.

48 While the microburins are few, they are indeed present. This method of obtaining projectiles insets was not of exclusive use, and other elements also reflect the shaping of the insets (bending of the notched bladelets). Observing the lamino-lamellar blanks indicates a rather soft direct percussion on narrow and thin objects. These types of blanks fit, like the cores, in the technical standards of the First Mesolithic.

1.5.2 The second Mesolithic is very discreet

49 Its indices are low and present only in the entrance: an asymmetrical trapezoid with direct retouches and an arrow of Montclus are indicating a very final phase of the Mesolithic or the early Neolithic. The salient characteristics of this phase are not found on any other retouched objects: no retouch of the Montbani style, no regular broad blanks, and no indirect percussion. Neither do we find “advanced" geometric projectile insets with low angled and inverse retouch, or points with transverse base. This absence contrasts with the good representation of this phase at the regional level (fig. 1), both in the Landes plain north of the Adour (Gaillèbes-2, Merlet and Miqueou 2009), in the Pyrenees, on the northern slope (Poëymau) and the southern one (Aizpea, Zatoya).

1.5.3 - Traces of an early Neolithic

50 Finally, the identification in the entrance of three Bétey segments marks a new frequentation of the cave in the Neolithic. Indeed, these double bevelled projectile insets appear with the Early Neolithic in a geographical area centred on the Aquitaine and the northwest of the Iberian Peninsula (Miqueou 2012).

2 - The large fauna and mesofauna (JBM)

2.1 - Material and Methods

51 The three archaeological Mesolithic groups of Bourrouilla yielded bone remains. Here the remains from the excavation of J25 and J26 as well as the material found in the pit O16 are presented in detail. The group of the objects of the entrance has been subjected to a rapid observation that demonstrated the diversity of the fauna. It includes not only similar taxa to those identified in the well-preserved areas, but also other taxa such as Bovine and Chamois, as well as remains of snowy owl, most likely Magdalenian. In fact, these remains have not been further studied.

52 All the fauna was analysed using the comparative collection of the PACEA laboratory (University of Bordeaux). The remains were observed using a monocular magnification (x 10 enlargement) to record a maximum of anthropogenic traces or post-depositional taphonomic agents. Everything was recorded in a database available on request.

2.2 - Results

53 In total, in the two studied loci, 217 remains were exhumed and mapped (table 3). They come for two thirds of the cases (NISP = 144) from the pit of square O16, the last third being found in squares J25 and J26. Most mapped remains could not be identified to the species level due to an intense fragmentation coupled with a poor overall state of conservation.

54 The identified remains are mainly the remains of ungulates from woodlands environments. Among the specifically identified remains, Red Deer (36%), Roe Deer (25.6 %) and Wild Boar (23.2 %) are found. One Horse remain is reported (J25 n° 253): its presence is unexpected without being totally unusual, as remains of this type are known in the Paris Basin at the same time (Ch. Leduc, pers. com. to MD). The mesofauna consists of remnants of badgers, martens, hedgehogs and beavers.

55 Despite the small size of the analysed sample, it was possible to identify different skeletal portions from the head to the bottom of the legs, for the studied excavation sectors (table 4). Thus we agree with the first results obtained by S. Costamagno (in Dachary et al. 2003); the bone assemblage of the pit does not match the deposit of meat quarters but rather seems to correspond to the deposition of butchery wastes.

56 Except for the hedgehogs, castors and remains of microfauna, all the analysed remains bear anthropogenic traces demonstrating a contribution by humans. These traces are in cut marks (33/ 217) showing the removal of meat, traces of scraping (3/ 217) reflecting the withdrawal of the last shreds of flesh and the tendons, percussion cones (8/ 217) to extract the marrow of the long bones, and burn marks (33/ 217). The last traces may result from cooking carcass portions or from the disposal of waste in a hearth. Here, the low number of remains does not allow us to retain a hypothesis rather than another.

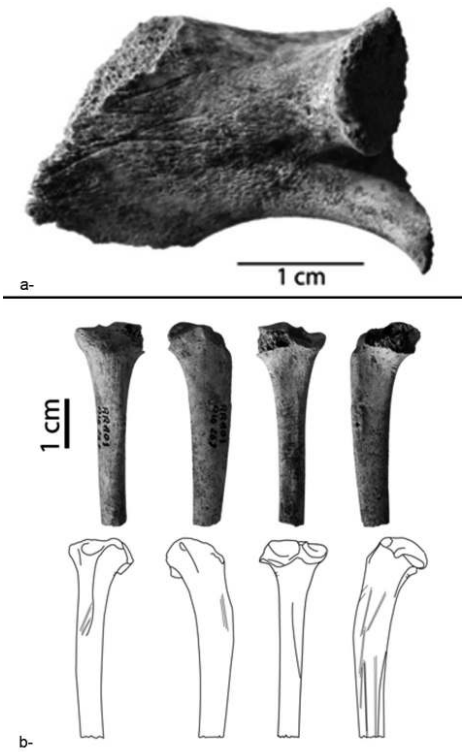
57 Among the remains that bear cutting traces, it is interesting to dwell on one of the remains of a badger. It is a fragment of right coxal of a young badger (fig. 7a). Compared with modern skeletons whose age at death is known, we will retain that the individual from Bourrouilla was killed around the months of May-June, that is to say in the middle of the good season. This observation seems to be supported by the estimation of the age that we have done on the remains of the three main ungulates (table 3).

Table 3 - Faunistic spectra and NMI for the main species.

Taxons	NISP	NMI
Cheval	1	1 adulte
Cerf	31	1 adulte, 1 jeune adulte
Chevreuil	22	1 adulte, 1 jeune adulte
Sanglier	20	1 adulte, 1 jeune adulte
Blaireau	8	1 adulte, 1 jeune adulte
Martre	2	1 adulte
Hérisson	1	1 jeune adulte
Castor	1	1 adulte
Microfaune	3	-
Ongulé 1	3	-
Ongulé 1/2	7	-
Ongulé 2	19	-
Ongulé 2/3	5	-
Ongulé 3/4	1	-
Mammifère indét.	93	-
Total	217	12 individus

58 About the cut marks observed on both the marten on the badger, by comparison with a butchery referential (Mallye 2007, 2011), the hypothesis of the use of these animals for their fur can be rejected; these traces correspond to de-fleshing actions (fig. 7b). Therefore, as the meat was consumed, it is not possible to decide on the conservation of fur or not.

Figure 7 - a- Fragment de coxal droit de blaireautin portant des traces de décharnement. b- Tibia gauche de Martre portant plusieurs traces anthropogéniques. Le relevé de ces traces (bas) indique des gestes de décarnisation (© J.-B. Mallye). Figure 7 - a- Fragment of right coxal of young badger with butchery marks. b- Left tibia of marten with cutmarks. Records of the cutmarks indicate butchery activities (© J.-B. Mallye).



59 To conclude, although the material is excavated is not numerous, it allows us to show the anthropic origin of the remains of the Mesolithic fauna from Bourrouilla. The count of the remains indicates the presence of at least 12 individuals, mostly related to species occurring in forest environments. It has been demonstrated that the remains exhumed from the pit match the deposit of butchery waste. Finally, based on the age at death of the identified individuals, an occupation of the site in the middle of the good season is highly probable.

3 - The ichthyofauna of the pit O16 (OLG)

3.1 - The site in its current hydro-geographic context

60 The site of Arancou dominates the right bank of the Lauhirasse; this creek is a tributary of the right bank of the Bidouze. In the area of interest, a ca. 25 meters wide shallow bed characterizes this river today. The fish found there are basically white fish (chub, dace, barbel, roach). The eel is of course present. The fact that the mullet (agamadromous amphibiotic and migratory) goes back there is noteworthy. It demonstrates that the Bidouze is a convenient axis of migration. However, nowadays the Atlantic salmon does not use it. The Bidouze joins the left bank of the Adour facing the Mirepech Island, a short distance downstream of the confluence Adour- United Gaves.

61 In addition, the Arancou site is not far from the Gave d' Oloron. The shortest way to get there leads to the left bank of the Gave, around Escos, a few kilometres upstream of the Magdalenian sites of the Pastou cliff in Sorde-l'Abbaye.

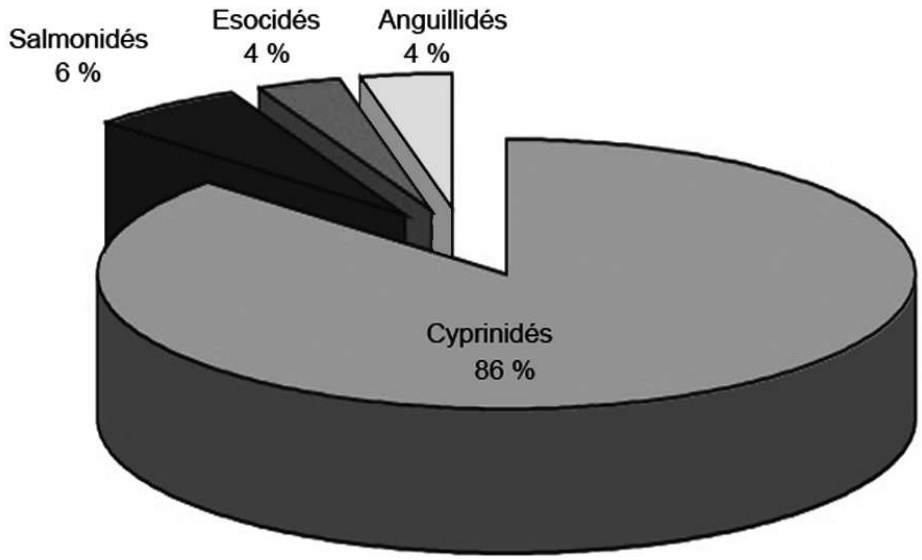
Table 4 - Identified skeletal elements for red deer, roe deer and wild boar from outdoor location (J 25-26) and O16 pit.

	Secteur entrée			Fosse O16			Total
Anatomie	**Cerf**	**Chevreuil**	**Sanglier**	**Cerf**	**Chevreuil**	**Sanglier**	
Bois	1	-	-	-	-	-	1
Fragments crâniens	-	-	-	1	-	3	4
Mandibule	-	-	-	1	2	-	3
Dents isolées	2	-	6	1	1	1	11
Vertèbres	-	-	-	2	4	2	8
Côtes	-	-	-	3	-	-	3
Scapula	1	-	-	1	-	-	2
Humérus	-	-	1	2	1	-	4
Radius	1	-	-	-	-	-	1
Radio-ulna	-	-	-	1	-	-	1
Carpiens	1	1	-	-	-	2	4
Métacarpiens	-	-	-	-	2	2	4
Coxal	1	-	-	-	1	1	3
Fémurs	-	-	-	2	3	-	5
Tibia	1	1	-	2	2	-	6
Tarsiens	1	-	-	-	-	1	2
Métatarsiens	1	-	-	-	2	-	3
Phalange 1	-	-	-	1	1	-	2
Phalange 2	-	-	-	-	-	1	1
Phalange 3	-	-	-	-	1	-	1
Phalange	-	-	-	1	-	-	1
Sésamoïde	-	-	-	2	-	-	2
Métapode	1	-	-	-	-	-	1
Total	**11**	**2**	**7**	**20**	**20**	**13**	**73**

3.2 - Description of the ichthyofauna remains

62 The pit contained 134 fish remains out of which 114 (80%) were determinable (fig. 8). They are divided between Cyprinidae (97 remains, that is to say 86% of the determined remains), salmonidae (seven remains, that is to say 6% of the determined remains), Esocidae (four remains, or 4% of determined remains) and Anguillidae (four remains, or 4% of the determined remains). The vast majority of the remains were composed of vertebrae plus some pharyngeal arches from complete or fragmentary Cyprinidae. The fragments of cranial bones and the pieces of ribs remained undetermined.

Figure 8 - Ichtyofauna from O16 pit.



3.2.1 - Cyprinidae

The Leuciscus sp. (chub, dace)

63 The remains of the genus Leuciscus carve the lion's share with 93 bones. They relate to the chub (Leuciscus cephalus) for their great majority, the presence of some dace vertebrae (Leuciscus leuciscus) however, is not ruled out. Fish of this type are a classic of the Pleistocene and Holocene ichtyofaunas. Very ubiquitous, they live in areas with trouts, graylings, barbels and Huet Bream. Consequently, they have little significance with regards to the environment. They prefer running water to still water. Reproduction in the months of May-June brings together many individuals and gives rise to noisy antics (Spillmann 1961 - p.136).

64 Seventy-two vertebrae allowed me to make assessments as to the length of the subjects. Most Leuciscus sp. were taken when they reached sizes varying between 15 cm and 25 cm, the greatest number approaching a length close to 20 cm.

65 Thirty-nine vertebrae allowed reading of the season of the catch by comparison with a reference series (Le Gall 1999, 2003). For use in archaeology, and given the uncertainty about the duration of each season, it is difficult to determine beyond good or bad season (easily sequenced as beginning, full and ending). Indications in terms of months should therefore be considered as an indication, facilitating the comparison of the observations in our current time scales.

66 Almost all the Leuciscus were captured during the good season (April- November). The bad season (November to March) is represented only by one element, perhaps from a pathological individual. The beginning of the good season (April-June) and the full good season (June to September) are respectively represented by 24 and 8 elements.

Barbus sp. (river Barbel and southern Barbel)

67 Resident species, these fish are characterized, among other things, by massive vertebrae with strong upper pre-and post- zygapophysis (Le Gall 1982, 1984, 1999). Unfortunately, these elements resist poorly to being buried. Anyway, six vertebrae strongly suggest the presence of this genus.

68 Considering the geographical position of the site (north- western slope of the Pyrenees), it is probably the river barbel here (Barbus barbus). Its presence in the Holocene is not really surprising: it has already been reported in layer 5 of the cave of Pégourié (Lot) in an "evolved Azilian " context (Le Gall 1995, 1999). However, its presence is interesting because it marks the return of the “warm” ichtyofaunas on our territory (Le Gall 2008, 2010) and the establishment of our current populations of freshwater fish. The river Barbel is found in areas with graylings, barbels and Huet Bream. However, it prefers pure water, relatively flowing, with stony or sandy bottoms. At spawning time in late April - mid June, the barbels migrate, sometimes quite widely, to find suitable substrates.

69 Out of the six vertebrae attributable to this genus, only four made it possible to evaluate individual size. Compared to the species, presumably the river Barbel (Barbus barbus), these fish are small (common sizes between 20 and 60 cm, but they can reach 80 to 100 cm). In the Mesolithic of Bourrouilla, the most common length is 20 cm. This sorting in dimensions appears to be the same as that in the Leuciscus that can also achieve larger sizes (easily 50-60 cm).

70 Only three vertebrae have allowed reading the catching season. The indications of a capture early in the good season may, as in the Leuciscus, correspond to the spawning period, or to the upstream movement done by the barbels on this occasion.

71 A question remains, however: why so few catches while barbels travel in shoals during their migration to the spawning grounds?

3.2.2 - Salmonidae; the Salmo genus

72 Very rare in this Mesolithic pit, their bones are seven in number, all attributable to the river trout (Salmo trutta fario). This resident fish enjoys flowing well-oxygenated waters. It is found in areas with trouts, graylings and Huet barbels. Before spawning, in November-December, the breeders engage in migration to access ideal substrates, often at the head of the basin. Only four vertebrae have allowed an assessment of the length of the fish and only two that of the capture season: two remains come from 20 to 25 cm long fish, one of which was caught at the beginning of the good season, the other from a 30 to 35 cm long trout. The largest was 45 to 50 cm, which indicates the presence of a large breeder. It is also interesting to note that it was caught at the end of the good season, a time when these fish are engaged in migration upstream toward their spawning grounds.

3.2.3 - Esocidae

73 They are represented in our country by a single genus and one species: the pike (Esox lucius). This carnivorous fish is a resident of our freshwaters. It migrates before spawning and reproduces, according to the regions, at the very end of the cold season (March) or early in the good season (April). The optimum temperature for egg laying is

around 7 to 10 degrees. Pikes are found in many places; slightly salted environments of the Baltic and the “flounder area.” However, this is mostly a classic fish of the area of Huet Bream. It does not, however, fear the cold water and its only handicap is not standing violent currents. It is, however, frequently found in the "Barbel area," sometimes in the “grayling zone.” Some individuals even manage to survive in quiet corners of the “Trout area” but this is a recent phenomenon subsequent to the creation of recreational ponds from small streams from the " trout area."

74 Of the four vertebrae attributed to this genus, three provided indications of dimensions: one around 40 cm and two corresponding to one or two fish, 50 to 55 cm long. In the latter category, one remain indicates the beginning of the good season. Was it a breeder going downstream after spawning?

3.2.4 - Anguillidae

75 The only representative in our freshwater, the eel (Anguilla Anguilla), is represented by four vertebrae found in the pit.

76 The Eel, a catadromous genesic amphihaline migratory, was born in the Sargasso Sea. In larval forms (leptocephali), the eels get carried up our coasts. Their transatlantic travel is provided by the Gulf Stream and the North Atlantic drift, which, divided into several branches, determine three populations: a northern one for Iceland and Norway, a central one for the British Isles and the French Atlantic coast, and a southern one for Portugal, Morocco and the Strait of Gibraltar. The Leptocephali transform into glass eels when entering rivers, at the very beginning of their anadromous migration (upriver). In it, the glass eels become elvers then yellow eels. Going upstream in fresh waters (October-April), as well as the multiple simultaneous transformations undergone by the elvers, are conditioned by many factors. The key factor is still the temperature: if they are looking for cool water, eels respect "thresholds", 7-9° C in Northern Europe, 11 to 22° C for the Arno (Bruslé and Quignard 2001).

77 It seems that the eels determine their gender in freshwater and that the males are characterized by a smaller size than females. In addition, the gender distribution along the streams shows that males remain frequently near estuarine areas while females, at the height of the rheotropism, go upstream up to the " trout area." The duration of their stay in fresh water is variable from 8 to 15 years for males and 10-18 years for females. In the spring, they are preparing to migrate to reach the downstream watercourses. This is the time when individuals that have taken refuge in enclosed waters are seeking to join the flowing waters. For this, they are able to move on land, in wet meadows. At the end of the summer, the eels are in the downstream parts of the streams and undergo physiological changes. It is the transformation of yellow eels in silver eels. Eels leave the rivers to go to sea in late fall and early winter. They then measure 30 to 50 cm for males and 40 to 100 cm for females.

78 During the second part of the last Ice Age, the Late Glacial and Holocene, the going up river of the eel to northern Europe probably reflects a gradual warming affecting ocean waters (Kettle et al. 2008), finalizing the setting up of the Gulf Stream and, successively, the three branches of the North Atlantic Drift (southern, central and northern).

79 Out of the four eel vertebrae discovered in O16, three allowed to highlight the presence of an individual 25 to 30 cm long caught in the good season and the two others,

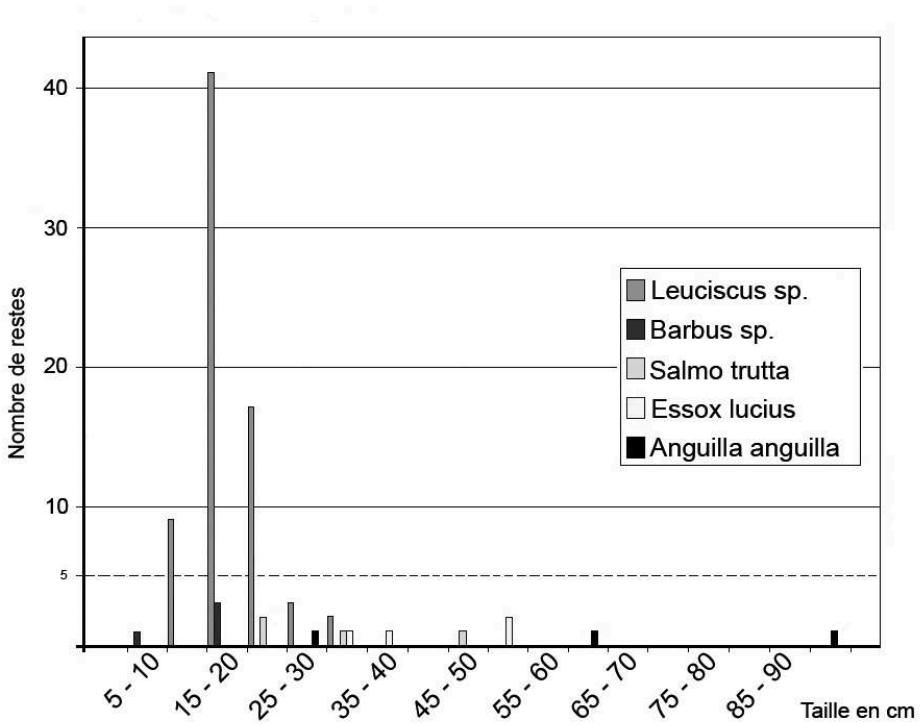
respectively of 60 to 65 cm and 90 to 95 cm. The latter was captured early in the good season.

3.3 - Which accumulating agent? Which mode of capture?

80 The observation of "picking" (traces of rounded dissolutions, often attributed to the action of animal digestive juices) on the articular surfaces of certain vertebrae pushed us to wonder about the origin of the discovered remains of fish.

81 Mammals can be the cause of some accumulations of fish remains. This is particularly the case of otters, but the site is too far from the river to have been occupied by this animal.

Figure 9 - Size of the fishes from mesolithic pit (O16).



82 The western Jackdaw (Corvus monedula) may be responsible for accumulating remains of fish (Le Gall 2011), but it nests in cliffs and it rejects waste perpendicularly. The location of the pit of square O16, about ten yards from the entrance porch, is incompatible with this hypothesis. Similarly, if the Mesolithic ichthyofauna discovered at Arancou is very similar to that consumed by the eagle owl, with a predominance of Cyprinidae, the dimensions of the Mesolithic fish of Bourrouilla do not agree with those of the preys of this nocturnal bird of prey.

83 Besides many arguments go in the direction of an accumulation of anthropogenic origin:

- The entire contents of the pit are strongly anthropised. The tools as well as the debitage products are numerous.
- The associated megafauna is rich, always taking into account the small size of the pit, in number of species and number of remains. It is also characteristic of the faunal spectrum

exploited by Mesolithic people (red deer, roe deer, wild boar...) and these remains correspond to butchery remains.

- Observing the stages of dental eruption indicate the hunting seasons as good seasons that are broadly consistent with results from the ichthyofauna.

84 The fish size corresponds to the "lower" limit of those found in Azilian context (Pont d'Ambon, for example) where the use of fish traps had been mentioned.

85 We can recall the mode of operation of these traps: a fish trap is an object made from soft plant material assembled by basketry. It consists of a basket for holding captive fish that have fallen into the trap, and of an entrance bottleneck, usually cone-shaped. This bottleneck is designed to allow fish passage towards the inside of the basket and to prevent their release. The catches will therefore be “calibrated” according to the smallest opening of the bottleneck. The key element of this selection will be the thickness of the fish. This last criterion is variable depending on the season and to be directly related to the richness of food in the aquatic environment. Even if the "thickness" criterion is variable, it remains quite closely related to the "length" character that is accessible to us. In short, a fish trap will “fish" by sorting the size of the preys.

86 This is exactly what we observe in the Mesolithic of "Bourrouilla" (fig. 9). This graph shows that the majority of fish are Cyprinidae of the Barbus and Leuciscus genera. For these fish, the vast majority of individuals displayed length of 15 to 25-30 cm, that is to say, average size. Large individuals (40-50 cm) were not captured although they were necessarily present in the stream. As regards to eels, slender fish if there was one, they are quite capable of penetrating into very tight places. All arguments are in the sense of the use of such traps by the Mesolithic people of the cave of Bourrouilla.

87 However, if the existence of nets (use unknown up to date) seems to date back to the Gravettian (Adovasio et al. 1999; Soffer et al. 2000), the appearance of fish traps is probably a little older than the Azilian. Evidence is provided by a set of engravings done in the Upper Magdalenian. The quartzite pebble that serves as a support was discovered on the open-air site of La Honteyre (Le Tuzan, Hautes Landes Gironde). One of the engravings (Le Gall et al. 2006) on the pebble figures a likely Cyprinidae. The anterior part of the body seems contained in a set of lines done subsequently. Simple around the fish's head, it is extremely complicated towards its middle part, constituting a real mesh network. Shown by diamonds on the sides of the fish, it is made of curved lines interlaced at the back. Such interlacing could, in a fairly schematic yet speaking manner, evoke an object made of basketry (fish trap, fishing basket...).

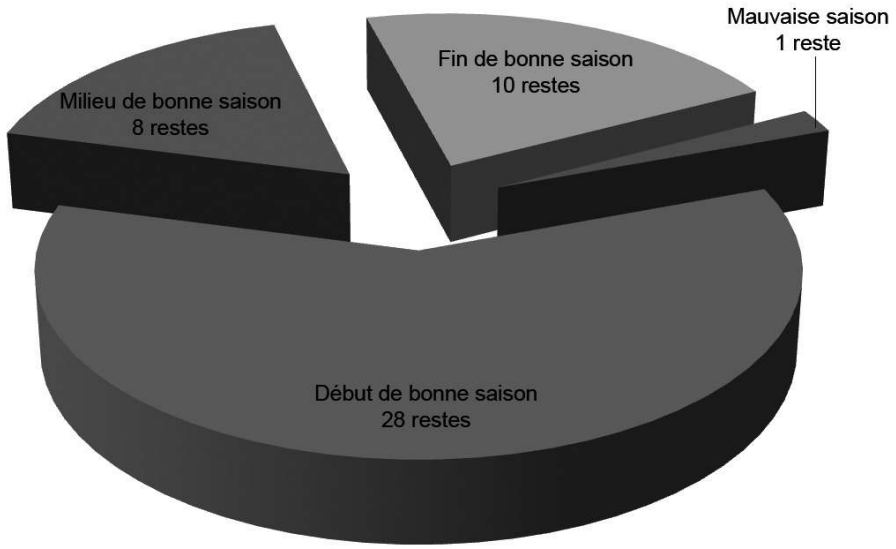
88 If capture with fish traps seems likely in the case of the Mesolithic of Bourrouilla, it remains to explain the predominance of Cyprinidae in the spectrum of the catches. This specialization is probably a seasonal option. Indeed, chubs (Leuciscus cephalus cephalus) reach and exceed 60 cm long and spawn in May-June during noisy gatherings of many individuals. Daces (Leuciscus leuciscus) measure 15 to 25 cm long and spawn by night from February to May after a slight migration.

89 Finally, the river Barbels (Barbus barbus) are fish 20 to 60 cm long (sometimes up to 1 m) that spawn from April to mid-June after migrations of a few kilometres. If we look at the graph gathering the catching seasons of fish fauna of the pit O16 (fig. 10), it appears that the majority of the catches was taken at the beginning of the good season for 20 to

25 cm long Leuciscus and Barbus. They are therefore barbels in migration and daces in full reproduction. To do this, the best technique is the fish trap used at night, which is also confirmed by the capture of eels.

90 In total, it seems that the ichthyofauna of the Mesolithic pit of Bourrouilla cave has an anthropogenic origin. The use of fish traps is highly likely if we consider the regularity of the lengths of the fish caught mainly in the beginning of the good season. In addition, the diversity of the states of the surfaces of the material calls for an accumulation in several stages.

Figure 10 - Seasons of fishing of mesolithic ichtyofauna from O16.



4 - The avifauna of the pit O16 (A. E.)

91 The excavation of the Mesolithic pit of square O16 yielded 13 remains of birds, out of which 12 were determinable. The common buzzard (Buteo buteo) is the dominant taxon with

92 11 remains. These remains represent at least two individuals, out of which one unusually large female.

93 The zooarchaeological study of these remains shows that only one bears anthropogenic traces. It is a fragment of a radius with visible cut-marks. This remain make us think that the buzzard was hunted by the Mesolithic people. However, it is not possible to determine whether this animal is involved in a food, technical and/or symbolic context.

94 The last determinable remain is due to the snowy owl (Nyctea scandiaca). This taxon is very well represented in the Magdalenian levels of Bourrouilla, but its presence in the Pyrenean foothills during the Holocene is highly unlikely. The Mesolithic pit was dug in a sediment contemporary of the Magdalenian occupations, it is likely that this remain is intrusive.

5 - Radiocarbon dating

95 We chose to do two radiocarbon dates on charcoals from the square O16. Sent to the laboratory Beta Analytic, the two samples followed the standard Acid-Base-Acid protocol. The results are summarized in Table 5.

96 Reading these results leads to two immediate observations: firstly, both dates are admissible for the Mesolithic; on the other hand, while the two samples come from the same stratigraphic unit, interpreted as a pit of rejection, the dates are different and the two sigma confidence intervals do not overlap. It is even the deepest sample (O16 317) that provides the youngest dates.

97 However, comparison with other Mesolithic dating in the southwest of France (table 6 and fig. 11) requires recognizing that industries with triangles constituting the First Mesolithic are generally a little older than indicated by the two dates presented here. However, the top of the Mesolithic sequence of La Lède du Gurp in Grayan-et-L'Hôpital is dated to 7,360 ± 85 and 7,350 ± 130 BP (Roussot-Larroque 2011) while the First Mesolithic of Boar Cave in Reilhac extends up to 7,500 BP (Séronie -Vivien et al. 2001). Also note the date obtained at Roc Allan (Sauveterre-La-Lémance) of 7,625 ± 80 BP (Detrain et al. 2006), very close of the Arancou results.

98 In total, without denying that a slightly older age was likely given by the lithic material unearthed, the dates produced are perfectly acceptable, especially as we sorely lack a point of comparison for the western Pyrenees.

Table 5 - Radiocarbon dating of O16 pit.

Désignation	Numéro de laboratoire	Age BP	Age Cal BC
O 16 87	Beta-307295	7650 ± 40	6590/6580 ou 6570/6440
O 16 317	Beta-307296	7410 ± 40	6480/6220

6 - Discussion

6.1 - Summary of the occupations

99 The techno-typological study of the lithic industries shows that the First Mesolithic is represented in all the sectors. Triangles, by their morphology, evoke an early evolved or middle Mesolithic. Points on truncation, narrow points with backed edges and some narrow bladelets with backed edges support this hypothesis, as the absence of a hypermicrolithism is surprising. Similarly, microburins are few, but present, and other wastes also reflect the fashioning of projectile insets (notched fractured bladelets).

100 The Second Mesolithic is reported only in the entrance, notably by the presence of artefacts on large blanks and a Montclus arrow. The latter, defined in Languedoc, is found in the south of France over a range corresponding to the Late Mesolithic/Early Neolithic. In the southeast Mediterranean, it is usually associated with the Cardial and Epicardial. Thus it is mainly found in the early Neolithic. But more recently, it was reported in the Late Mesolithic context of Escabasses in the Quercy (Valdeyron et al. 2009) and in l'Essart in Poitou (Marchand and Manen 2006). However, this series

provides no example of a retouch of the Montbani style and does not document the production of large blanks.

101 The Early Neolithic is present as traces, visible in the lithic industry through Bétey segments.

102 The radiocarbon dates obtained on the pit of square O16 are unexpected, that is to say very low compared to the industry associated with them. This finding opens up three possible interpretations:

- The dated charcoals are polluted by infiltrations of water and give an erroneous dating. This hypothesis is unlikely since other dates obtained on the Magdalenian levels in squares adjacent to O16 are quite consistent with what one might expect (Szmidt et al 2009).
- The association between one industry of the First Mesolithic and the dated charcoals reflects a more recent occupation of the site and a redevelopment of the habitat floor that led to the filling the pit with materials of different ages. The differences in surface condition among the ichtyofauna could then find an explanation, as well as the fact that the deepest sample (O16 317) is the one that provides the youngest dates. The absence of any trace of a Second Mesolithic in the pit in this case is very surprising.
- The dates actually correspond to one or more occupations dating from the First Mesolithic. The dates, very low, would then indicate a "delay" in the adoption of techno-typological characteristics behaviours of the Second Mesolithic, according to the model recently proposed by T. Perrin et al. (2009). We can recall, moreover, that dates from the southwest of France that may be mentioned for comparison come from either the northern Aquitaine or the Quercy.

103 It can be noted that the last two assumptions are not totally incompatible. One can consider a passage in the Second Mesolithic, later here than in other regions, as well as a filling of the pit gathering the remains of Mesolithic occupations spread over time.

6.2 - Difficult data to place in their regional context

104 The Mesolithic levels of the cave of Bourrouilla deliver significant data, especially as the knowledge of the Mesolithic in the region still suffers from under-documentation. The precision of the excavation, which included a systematic fine screening, and the presence of bone remains, which are sorely lacking on open air sites allow the perception of some of the strategies developed by the last hunter-gatherer of the North Western piedmont of the Pyrenees.

105 There is no physical link between the three loci, which prevents discussing a spatial distribution of the occupations. However, the discovery of a "hollow structure" inside the cave allows a comparison with developments highlighted in the north of France in the last twenty years (see Ch. Verjux in Guesquière and Marchand 2010 - p. 112-113). The narrowness of the excavated area has failed to provide sufficient documentation to discuss the re-use of an earlier structure or the rate of its filling, while the absence of data on equivalent structures in a close geographical area limit the discussion.

106 This series is also an interesting milestone in the distribution of Mesolithic sites in southern and western Aquitaine, due to the geographical location of the cave between the mountainous areas of the Pyrenees to the south, the hills of Chalosse and the plain of the Landes at the north.

107 The Mesolithic people certainly developed strategies allowing them to exploit alternately, depending on the season, the resources of different habitats: those of the forest, rivers, mountains or the ocean coastline. Bourrouilla is only one very punctual step (May-June) in a territory covered according to seasonal movements. The good state of conservation of the fauna allows demonstrating the exploitation of two complementary environments: the forest environment where the avifauna is hunted, and the aquatic environment (fish but also freshwater mussels present in pit O16).

108 Paleontological data indicating the hunting of forest ungulates and, quite logically, the lithic industry, mostly composed of projectile insets, reflect these hunting activities. In addition, we know that these projectile insets require more renewal and repair. Of course, the question is asked of the tools for cutting carcasses and scraping meat and other domestic activities. However, the techno-typological study highlighted the lack of certain characteristic typological elements of the First and Second Mesolithic. However, other gaps must be noted, despite the proven nomadic lifestyle of the occupants of the cave:

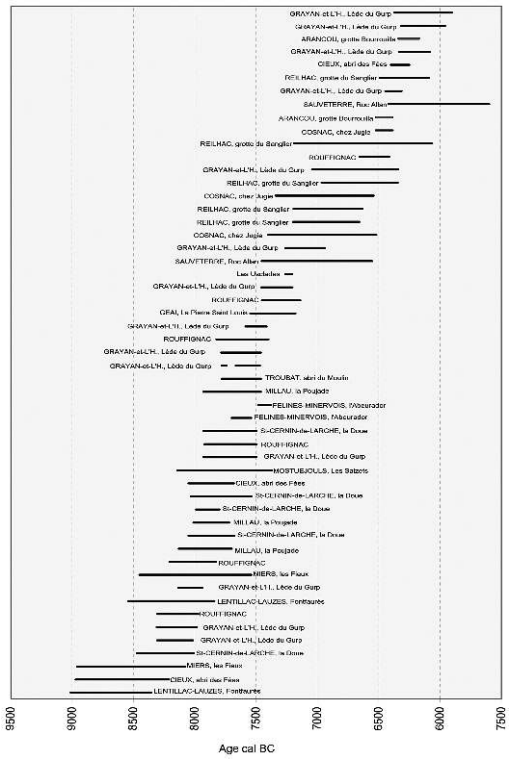
- the absence of lithic materials other than Flysch flint, collected a short distance of the site;
- the scarcity of tools of the common fund compared to the abundance of projectile insets. These are flakes and fragments that dominate in the number of artefacts, those less than 5 mm are also very numerous.

109 Understanding the mobility of hunter- gatherers groups in the foothills of the Pyrenees in the early stages of the Mesolithic will thus require excavating other sites to get a vision at the scale of a life-size territory.

Table 6 - Reviewing of radiocarbon dating of Mesolithic occupations in southwest of France (after Roussot-Larroque 2009).

Site	Couche	Référence	Date BP	Date cal BC
ARANCOU, grotte Bourrouilla		Beta-307295	7650 ± 40	6440/6570
ARANCOU, grotte Bourrouilla		Beta-307296	7410 ± 40	6220/6390
CIEUX, abri des Fées	B4	Ly-4534	9490 ± 240	8260/9020
CIEUX, abri des Fées	B4	Ly-4707	8850 ± 270	7730/8100
CIEUX, abri des Fées	B4 sommet	Ly-4706	7535 ± 110	6300/6450
COSNAC, chez Jugie	3b base	Ly-1652	8080 ± 280	6570/7450
COSNAC, chez Jugie	3b base	Ly-1331	8040 ± 260	6590/7390
COSNAC, chez Jugie	3b base	Ly-1651	7650 ± 510	6438/6573
FELINES-MINERVOIS, l'Abeurador	5	MC-2144	8740 ± 90	7590/7750
FELINES-MINERVOIS, l'Abeurador	X	Gif-5745	8740 ± 90	7430/7530
GEAI, La Pierre Saint Louis	5b		8420 ± 110	7230/7597
GRAYAN-et-L'H., Lède du Gurp	11a	Ly-5322	9200 ± 70	8065/8357
GRAYAN-et-L'H., Lède du Gurp	11b	Ly-5321	9180 ± 90	8033/8359
GRAYAN-et-L'H., Lède du Gurp		Beta-118447	9070 ± 70	7990/8185
GRAYAN-et-L'H., Lède du Gurp	11c	Ly-5325	8760 ± 100	7549/7978
GRAYAN-et-L'H., Lède du Gurp	US 411	Beta-118446	8620 ± 60	7520/7715 ou 7815/7870
GRAYAN-et-L'H., Lède du Gurp	Basebrûlé	Ly-7969	8600 ± 55	7511/7834
GRAYAN-et-L'H., Lède du Gurp	US 113b	Beta-118450	8540 ± 70	7465/7635
GRAYAN-et-L'H., Lède du Gurp	11d	Ly-6048	8360 ± 60	7255/7508
GRAYAN-et-L'H., Lède du Gurp	brûlé	Ly-6043	8125 ± 70	6991/7310
GRAYAN-et-L'H., Lède du Gurp	"VIII"	Gif- 5465	7870 ± 150	6391/7092
GRAYAN-et-L'H., Lède du Gurp	US 413	Bêta-118445	7620 ± 60	6365/6495
GRAYAN-et-L'H., Lède du Gurp	US 410	Bêta-118451	7420 ± 60	6135/6385
GRAYAN-et-L'H., Lède du Gurp	9	Ly-6045	7360 ± 85	6010/6366
GRAYAN-et-L'H., Lède du Gurp	10	Ly-6046	7350 ± 130	5954/6421
LENTILLAC-LAUZES, Fontfaurès	6b	Ly-4449	9650 ± 130	8407/9060
LENTILLAC-LAUZES, Fontfaurès	5b	Ly-4448	9140 ± 160	7891/8593
Les Usclades	4a	Gif-8744	8220 ± 70	7255/7310
MIERS, les Fieux	D3 base	Gif -1807	9450 ± 190	8128/9009
MIERS, les Fieux	plancher	Gif-4281	9060 ± 190	7589/8500
MILLAU, la Poujade	8D	Gif-3631	8990 ± 200	7750/8180
MILLAU, la Poujade	10B/C	MC-1240	8910 ± 145	7770/8060
MILLAU, la Poujade	10c	Gif-3418	8710 ± 190	7510/7980
MOSTUEJOULS, Les Salzets	C	Gif-443	8770 ± 200	7423/8191
REILHAC, grotte du Sanglier	6	Ly 7792	8075 ± 75	6708/7249
REILHAC, grotte du Sanglier	6	Ly-7793	8065 ± 80	6682/7244
REILHAC, grotte du Sanglier	6 base	Ly-6162	7943 ± 76	6396/7015
REILHAC, grotte du Sanglier	6	Ly-5687	7753 ± 235	6115/7241
REILHAC, grotte du Sanglier	5b	Ly-6510	7557 ± 104	6143/6542
ROUFFIGNAC	5b	GrN-5514	9150 ± 90	8019/8356
ROUFFIGNAC	4c	GrN-2880	8995 ± 105	7877/8256
ROUFFIGNAC	5a	GrN-5513	8750 ± 75	7547/7972
ROUFFIGNAC	4b	GrN-2895	8590 ± 100	7497/7701 ou 7436/7908
ROUFFIGNAC	4a	GrN-2913	8370 ± 100	7283/7504 ou 7194/7546
ROUFFIGNAC	3 base	GrN-2889	7800 ± 50	6464/6706
SAUVETERRE, Roc Allan	T1	Ly-4545	8160 ± 90	6604/7505
SAUVETERRE, Roc Allan		Ly-4931	7625 ± 80	5650/6470
St-CERNIN-de-LARCHE, la Doue	2b	Ly-2819	9260 ± 200	8060/8520
St-CERNIN-de-LARCHE, la Doue	2b	Ly-2820	8980 ± 210	7730/8100
St-CERNIN-de-LARCHE, la Doue		Ly-2834	8880 ± 1 60	7850/8040
St-CERNIN-de-LARCHE, la Doue	2a	Ly-2821	8860 ± 210	7590/8080
St-CERNIN-de-LARCHE, la Doue	2a	Ly-2233	8750 ± 150	7550/7980
TROUBAT, abri du Moulin	3c	Ly-5273	8625 ± 80	7510/7830

Figure 11 - Radiocarbon dating of Mesolithic occupations in southwest of France (after Roussot-Larroque 2009).



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ABSTRACTS

The Mesolithic of the extreme southwest of France is still poorly understood because there are few sites that provide reliable data between the region of the southern Landes and the Spanish border. Bourrouilla cave at Arancou (Pyrénées-Atlantiques) has revealed some interesting information, following the discovery of occupation levels with evidence of Mesolithic lithic artefacts and fauna (mammal, fish, and bird).
Three locations, producing material in differing states of preservation, have provided data about a late, early Mesolithic occupation, a later Mesolithic with trapezoid microliths and an early Neolithic with segments of Betey.
The archaeozoological studies allow us to assess the exploitation of two biotopes : the forest and the rivers. The spectrum of hunted fauna is dominated by red deer, roe deer and wild boar, in association with badger, marten and common buzzard, while the fish remains are mainly cyprinids. The data on the seasonal occupation of the site converges on a time at the beginning or middle of the good season. In addition, there are two radiocarbon dates relevant to a discussion about the transition between the early and later Mesolithic occupations

Le Mésolithique de l'extrême sud-ouest de la France est aujourd'hui encore mal connu puisque que peu de gisements ont fourni des données fiables entre le sud des Landes et la frontière espagnole. La grotte de Bourrouilla à Arancou (Pyrénées-Atlantiques) apporte de précieuses données grâce à la découverte de témoins d'occupations associant vestiges lithiques et faune (mammifères, poissons et oiseaux).
Trois locus, offrant des degrés de conservation différents, documentent inégalement un Premier Mésolithique avancé, un Second Mésolithique à trapèzes et un Néolithique ancien à segments du Bétey. Les études archéozoologiques permettent de percevoir l'exploitation de deux biotopes : la forêt et les cours d'eau. Le spectre de la faune chassée est dominé par le Cerf, le Chevreuil et le Sanglier, auxquels sont associés le Blaireau, la Martre et la Buse variable tandis que l'ichtyofaune est surtout représentée par les cyprinidés. Les données de saisonnalité convergent vers des occupations au début/milieu de la bonne saison. En outre, deux datations radiocarbone contribuent au débat sur la transition entre Premier et Second Mésolithique.

INDEX

Keywords: Mesolithic, early Neolithic, Pyrénées-Atlantiques, lithic typo-technology, archaeozoology, seasonality, radiocarbon dating
Mots-clés: Mésolithique, Néolithique ancien, Pyrénées-Atlantiques, typo-technologie lithique, archéozoologie, saisonnalité, datation radiocarbone

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