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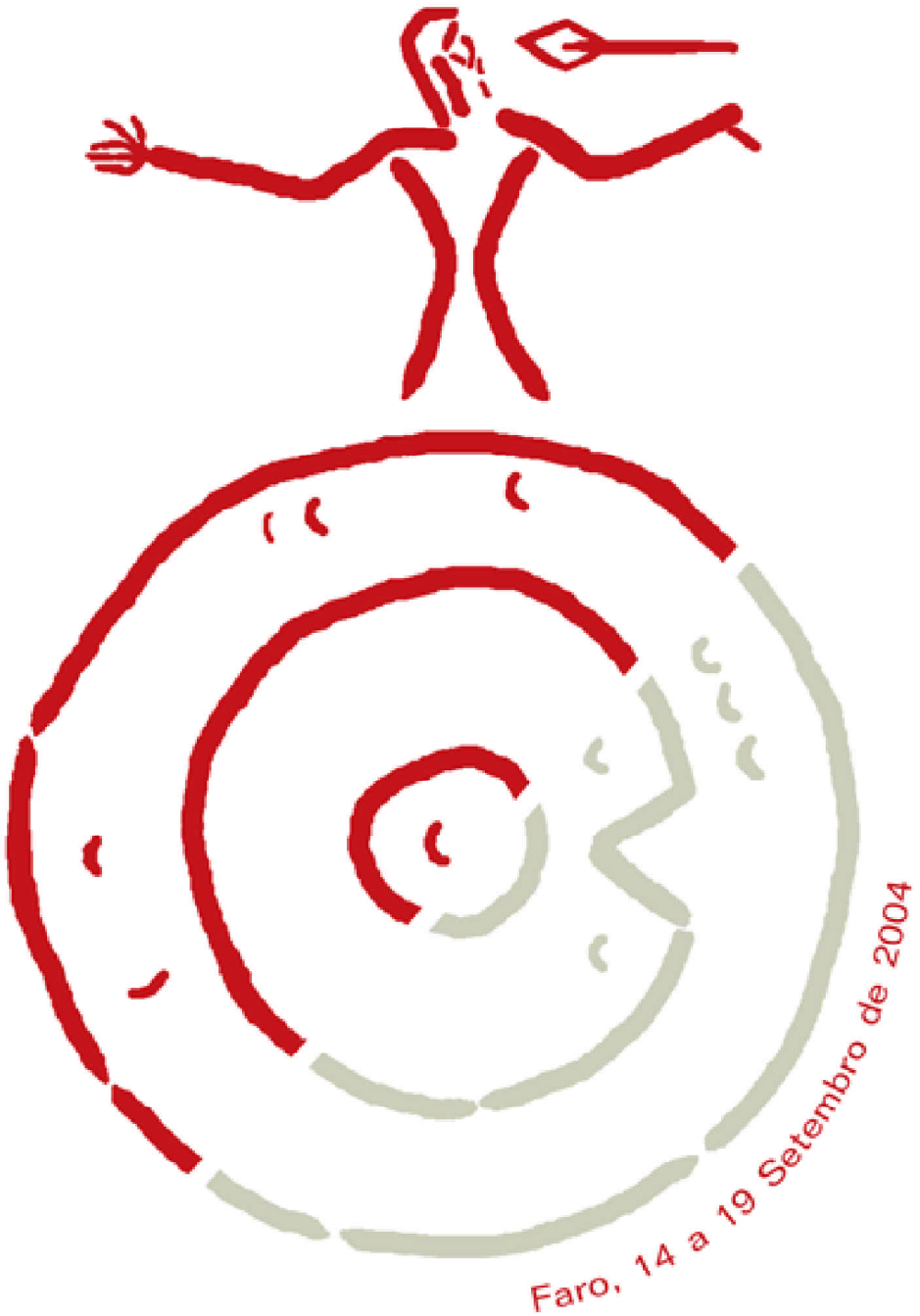

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An Upper Paleolithic Pompeii: Technology, Subsistence and Paleoethnography at Lapa do Anecrial

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ABSTRACT

Lapa do Anecrial is a small cave site located in central Portuguese Estremadura. Three field seasons (1992, 1993 and 1995) have provided a stratigraphic sequence spanning the transition from the Gravettian to the Solutrean, with three short-term occupations recognized (one in layer 1, and two in layer 2). In layer 2 (a surface which between ~23,500 BP and ~21,500 BP seems to have been stable, with scarce sediment input), the more extensively excavated, two Gravettian occupations were detected. The last of these (Terminal Gravettian – dated to ~21,500 BP) shows excellent post-depositional preservation, with several clusters of lithic artifacts and fauna (massively dominated by rabbit) organized around a hearth *en cuvette*. The lithic refitting studies, already concluded, reaffirm the excellent preservation of this occupation: almost 50% (92% in weight) of the assemblage was refitted, making possible an almost complete view of the reduction sequences and strategies applied to the lithics. This paper presents the results from the combined study of both faunal remains and lithic technology, with special focus on the advantages of multidisciplinary approaches to the study of short term occupations, including: taphonomic problems, spatial analysis of habitat organization, subsistence choices and the role of small prey, and lithic resources economy.

KEY WORDS

Lithic technology; Upper Paleolithic; Portugal

1. INTRODUCTION

Lapa do Anecrial is a cave site located in Portuguese Estremadura, on the south slope of the Alvados' polje, at an altitude of 340 meters above sea level (Zilhão, 1995, 1997; Zilhão & Almeida, 1996; Zilhão *et al.*, 1999; Almeida, 1998, 2000, 2001, in press a, in press b, in press c). The Alvados depression, along with the Minde one, forms one of the natural passageways between the Tagus basin and the Atlantic. The cave entrance, presently a narrow and small passageway, faces north. The main chamber (Figure 1) has a horizontal area of approximately 100 square meters, with an average height of 6 meters. The walls are covered with carbonate concretions, and most of the surface is composed of a stalagmitic crust of variable thickness. Speleothems are ubiquitous in the chamber roof, and also in some areas of the floor. At the southwest corner of the cavity, an erosive funnel with a diameter of 1 to 1.2 meters provides access to a lower chamber. This erosive feature seems to be a result of water activity coming from the surface through a shaft just above this part of the cave (see profile view in Figure 1).

The discovery of the archaeological potential of Lapa do Anecrial dates back to the Summer of 1991, when a small test-pit (~50 square centimeters) was excavated in the northern part of the previously described funnel. Three subsequent field seasons (1992, 1993, and 1995) have provided a stratigraphic sequence of importance for the transition from the Gravettian to the Solutrean in Central Portugal. The total excavated area was restricted to an area of c. 9.50 square meters (Figure 1). The respective stratigraphic succession presented the following characteristics (Figure 2):

Layer Sc: Stalagmitic crust. Its thickness increases to-

wards the erosive depression (south of the excavated area), as well as when approaching the center of the chamber, where several stalagmites sometimes reach a height of over one meter. In the easternmost part of the excavated area (unit M21), the crust reaches a thickness of 40 cm, and joins another stalagmitic crust that underlies layer 0 (Figure 2). The formation of the top stalagmitic crust probably dates to the Holocene, and represents a general increase in both temperature and humidity in the cave's environment.

Layer 0: This layer is composed of brownish sands and silts with small limestone fragments, for the most part slightly rolled. The thickness of layer 0 increases towards the cave entrance. It is likely that most of the finer sediments are a result of exogenous processes, either colluvional or aeolian. In the eastern half of unit K20, the base of layer 0 was brecciated (layer 0b in Figure 2). In units L-M20/21, this *breccia* gradually turns into a stalagmitic crust which, in the northwest corner of unit M21, reaches a thickness of c. 20 cm. Layer 0 was partially destroyed by rodent burrows. These were responsible not only for the disturbance of layers 0 and 0b, but also affected some areas of layers 1 and 3, especially in units K19 and L20. Both layers 0 and 0b are sterile in archaeological content, the first one having an average thickness of 30 cm, and the latter of 5 cm. A charcoal fragment of *Berberis* provided an absolute date of 130 ± 50 BP for layer 0 (Table 1).

Layer 1: This is a sparse yellowish-brown sandy matrix, inside dense limestone *eboulis sec* of medium size (5 to 10 cm) with sharp edges, which result from frost weathering of the cave roof and walls. On the top part of layer 1, several artifacts were recovered. These are organized around a small hearth centered on the SW corner of excavation unit M20 and extending to the bordering areas of units L20, L21, and M21. They date to the Solutrean. Both the sedimentary characteristics of the layer, the typological characteristics of the flint artifacts recovered (one flint Laurel Leaf preform, showing heat treatment, and one flint retouched blade, corresponding probably to a *Pointe a cran* preform) and an AMS absolute date of 20,520 ± 100 BP (Table 1) concur to date this last occupation of Anecrial to the Last Glacial Maximum. Associated with this minimal artifact sample, four marine shells of *Littorina obtusata*, one of which was perforated, were collected. The faunal sample is dominated by rabbit, although some ibex bones were also collected. The Solutrean occupation of the cave seems to have been a very short one both in time and intensity. The northern part of the hearth was partially truncated by the burrow system already described for layer 0. The average thickness of layer 1 is 25 cm. At its base it was already possible to collect some artifacts related to the underlying layer 2 archaeological occupations.

Layer 2: This layer is composed of yellowish-brown dry limestone fine sands, on top of a brownish sand/silt matrix that fills the voids of the underlying *eboulis* (layer 3a). With an average thickness of 10 cm, this layer seems to be the result of a stabilization of sedimentation processes affecting the cave sequence, as well as partial erosion. In fact, the four absolute dates available for layer 2 cluster around ~21,500 BP and ~23,400 BP (Table 1). Both the faunal analysis and the lithic study concur in reinforcing the hypothesis that at least two archaeological occupations took place on this surface. One, the older, Gravettian, represented by a slightly rolled set of flint artifacts and eroded ibex bones, and another dating to the Terminal Gravettian, with an excellent post-depositional preservation. The spatial patterning of both artifacts and fauna from this latter occupation, associated with a hearth *en cuvette*, clearly indicates they are in situ. Most of the post-depositional processes (if any) related to the Terminal Gravettian Occupation of layer 2 seem to have been limited to small-scale vertical movements of some artifacts and charcoal fragments. Nevertheless, the horizontal spatial distribution seems to represent exactly the one that was present at abandonment. Although a slight slope towards the west is visible in layer 2 (Figure 2), the artifact and faunal spatial distributions are independent of that inclination. The lithic spatial distribution shows how the different blocks of raw material are clustered in small and generally segregated areas. The percentage of refitting success for the Terminal Gravettian assemblage recovered in layer 2 is also concomitant with an excellent post-depositional condition: over 51% (92% by weight) of the artifact sample was refitted.

Layer 3a: Almost identical to layer 1, and archaeologically sterile, this layer contains medium sized limestone *eboulis* (5 to 10 cm), with sharp edges and showing ubiquitous voids filled at the top with a brown matrix of sands and silts. Average thickness: 15 cm.

Layer 3n: This represents a thin concentration of fine sediments structurally identical to layer 2. No evidence of archaeological remains was recovered, but some charcoal fragments were collected. One of the latter was AMS dated to 24,410 ± 110 BP (Table 1).

Layer 3b: This layer has limestone *eboulis* of large dimensions (sometimes over 35 cm), with sharp edges, including some broken stalactites. It represents the beginning of the main period of frost weathering of the cave roof. Towards the cave entrance and, hence, the main source of finer sediments, the "dry" characteristics of layer 3 tend to fade: while near the erosive funnel there is almost no matrix, at the northern part of the excavation, the various limestone blocks, although still showing sharp edges, are associated with a fine matrix of brown sands and silts. Average thickness: 30 cm. Sterile.

Layer 4: This layer contains rolled blocks of limestone (large dimensions – over 20 cm), inside a brown matrix of fine sands and silts. Average thickness: 18 cm. Sterile.

Layer 5: This red clay layer represents the geological substratum of the sequence. It lies directly on the cave floor. The general shape of this layer follows the cave floor morphology.

2. PALEOENVIRONMENTAL DATA

The sedimentary characteristics of the excavated sequence provide insightful clues concerning the general climatic conditions present at the time of deposition. Layers 3b to 1 were probably deposited during the Last Würm Pleniglacial (~24,000 to ~18,000 BP). The *eboulis sec* nature of these layers are a result of severe frost-weathering processes, a direct consequence of a very cold and humid climate, intercalated by milder and/or dryer episodes, of which perhaps the best example is the one represented by layer 2, composed of finer sediments. As aforementioned, the available absolute dates for layer 2 (Table 1) suggest a stabilization phase in sediment deposition, with an erosional phase between ~23,400 BP and ~21,500 BP. After layer 1, Solutrean, the general characteristics of the sediments change dramatically: the freezing and thawing processes virtually stop, and only finer sediments (sands and silts) accumulate. These sands and silts are a result of the erosion of soils outside and above the cave, as well as percolation. The absence of frost-weathering, associated with an erosional episode and deposition of fine sediments, is concomitant with a temperate and humid climate, probably dating to the Tardiglacial Period (16,000-10,000 BP). The transition to the Holocene is marked by a severe episode of erosion, and by the creation of the stalagmitic crust that presently covers the whole cave surface.

The interpretation of the sediments' characteristics is further supported by the data coming from Isabel Figueiral's studies (Unpublished Data, Figueiral, 1995; Figueiral & Terral, 2002; Figueiral & Carcaillet, in press) of the various floral species represented in the charcoal samples collected during the excavation. A total of 499 charcoal fragments were analyzed at the University of Montpellier. Table 2 shows the main occurrences by *taxa* and by layer. It is clear the main difference between the package of the Last Würm Pleniglacial (layers 3 to 1) and layer 0, representing the Tardiglacial and/or Holocene, respectively. It must be said that only the samples from layers 2 and 1 result from clear human features, and, thus, may and should be affected by a relative degree of human choice. The charcoal recovered in layers 0 and 3 probably resulted from natural fires in the cave surroundings, which eventually joined the sediments inside the cave.

Table 2 shows that, as pointed in other paleoenvironmental reconstructions for the region (Zilhão, 1995, 1997; Almeida, 2000; Zilhão & Almeida, 2002), the hilly limestone areas of Estremadura during the Last Pleniglaciar were mainly composed of scarce vegetation of sub-alpine characteristics, with scots pine dominant in Anecrial layers 3 to 1. As recently stated (Queiroz *et al.*, 2002), there are no present day parallels on Portuguese territory for the Last Pleniglacial pinewoods. Both Lapa do Anecrial and the recently studied charcoal samples from layers 6 and 9 of Lagar Velho's Hanging Remnant reveal the apparent absence of dense, Mediterranean like, shrub layers. The association of *Pinus sylvestris* with *Erica* and leguminoseous species (like those collected in Anecrial layer 2) finds a better parallel on the pinewoods found on the southern flanks of the Pyrenees, at altitudes between 1100 to 1800 m above sea level, with mean annual temperatures ranging from 7 to 10° C and annual precipitation varying between 800 and 1500 mm. They are generally characterized as open woodlands, with the ground layer rich in ericaceous species. The presence of such type of forest at low altitudes as those from Anecrial and Lagar Velho (c. 470 m and c. 210 m asl during the LGM) are surely indicative of the Last Glaciation's bioclimatic effects on Portuguese Estremadura. After the Solutrean, climatic changes occurred, which drastically affected the vegetation patterns, as shown sharp contrast on the spectrum of vegetable species represented in identifiable charcoal fragments from layer 0: most of these represent temperate or even Mediterranean species.

3. THE ARCHAEOLOGICAL DATA

Although in previous publications it has been stated that the Anecrial sequence contained only two archaeological occupations – the Solutrean from layer 1, and the Proto-Solutrean/Terminal Gravettian from layer 2 (Zilhão, 1995, 1997; Zilhão & Almeida, 1996; Almeida, 2000, 2001, in press a, in press b) – a revision of the lithic and faunal materials from layer 2 and recently obtained absolute dates (Table 1) have revealed the presence of a third archaeological context, Gravettian, which already stood at the surface of layer 2 when the Terminal Gravettian occupation took place. The three occupations, in spite of differences in their archaeological content and preservation degree, seem to share an ephemeral nature. Such character probably relates not only to the cave size and morphology (Figure 1) but also to its orientation (with the entrance facing North) and geographical setting (in one of the important natural passage ways between the coast and the Tagus basin – the Minde-Alvados-Alcobaça corridor).

3.1. The Gravettian Occupation (~23,400 BP) from layer 2

The first interpretations of layer 2 had considered the totality of the collected lithic and faunal materials as belonging

to a single occupation, dating to the Terminal Gravettian / Proto-Solutrean. Radical differences between the surface preservation of large mammal bones and rabbit ones (with most of the latter showing a much better condition) were firstly interpreted as a result of different behavioral aspects of a single occupation episode (Zilhão, 1995, 1997; Zilhão & Almeida, 1996): while the rabbit bone sample, for the most part associated with the hearth *en cuvette*, suggested the roasting of a small number of rabbits previously hunted on site vicinity, with the possible use of traps; the bad preservation of larger fauna bones was interpreted as a result of the transport of meat snacks by the small group of hunter-gatherers, or by different cooking procedures, with the use of bones or meat snacks as part of a grease soup.

In addition, the totality of the lithic artifacts from layer 2 was also previously considered as a closed sample. While most of the artifacts presented a pristine condition, with fresh edges, there was, however, a small sample of artifacts (Blocks PTF – Patina Translucent Flint – and LPF – Light Pink Flint, at least – Almeida, 2000, 2001, in press a, in press b) that presented weathering, with heavily to slightly rolled surfaces and edges. The fact that these artifacts were successfully reconstructed (Figures 3 and 4) led us to think initially that their respective blocks were also part of the well preserved Terminal Gravettian assemblage. The weathering remained to be explained, though.

The study of the faunal assemblage from layer 2 resulted in the revision of the aforementioned paleoanthropological hypothesis. The results of the analysis undertaken by JPB of the 75 large mammal bone fragments from layer 2 (Table 3) can be summarized as following:

1. Diagnostic elements are extremely rare: a distal humerus fragment, a fragment of a Pelvis cotyloide cavity, and a metatarse diaphysis (posterior face), all attributable to *Capra* (cf. *C. pyrenaica*);
2. No teeth are present on the sample;
3. Taking into consideration their size and physical condition, the remainder of the bone fragments can be considered as part of the same genus. Chips are dominant, with an average size of 37 mm (21 to 86 mm);
4. The fracture edges study suggests that most of the breaks took place when the bones were already dry (oblique and denticulated fractures, blunt edges, rough surfaces);
5. There are no burnt traces on the sample, and a single case of carnivore tooth mark was detected;
6. Cut marks (Table 3), on the other hand, are short and appear in chips (n = 3), rib fragments (n = 3) and on the three identifiable elements. Dissolution traces cover, in some cases, the anthropic traces.

These taphonomic observations indicate, on one hand, that the ibex bones where clearly a result of anthropic action, and, on the other, that they were exposed for a relatively long period of time on the cave surface. Such exposure resulted not only in weathering, but also by transport or trampling, as seen on the breaks on the dry bones. These characteristics neatly contrast with those present on the majority of rabbit bones from layer 2, much better preserved. In parallel, the spatial distribution of *Capra* bones (Figure 5) shows clear differences when compared with that from the rabbits, the latter clustering for the most part on the hearth or in its vicinity. Thus, the faunal analyses infirmed the hypothesis that all the bones collected in layer 2 were the result of a single occupation episode: the young adult ibex represented by 75 bone fragments was probably the result of an older human occupation of the cave.

In order to test this revision of layer 2 contextual interpretation, a new AMS date was undertaken on one of the *Capra* bones that presented cut marks. The obtained result of 23,410 ± 170 BP (OxA-11235 – Table 1) parallels one previously obtained for a charcoal fragment (although with a large standard deviation, ICEN-963, Table 1) and confirms that layer 2 represents a surface that stood relatively stable, at least topographically, for ~2000 years. In this surface at least two human occupations took place. The patina and rolled edges from blocks PTF and LPF could, therefore, also be parsimoniously explained if these blocks belonged to the older occupation from layer 2. Together with the weathered ibex bones, they represent what was left of a short-term Gravettian occupation of Lapa do Anecrial, the older attested human use of the cave, at around 23,400 BP.

If, as it seems, layer 2 detained not one but two archaeological contexts, the discerning of which artifacts and ecofacts belonged to the Gravettian occupation, in one hand, and to the Terminal Gravettian occupation, on the other, became obvious and necessary. The previously published interpretations of the spatial patterning from layer 2 concomitantly needed revision. Although this endeavor is still undergoing, it is already possible to present here some of the recognized patterns.

As a way of figuring out if it was possible to discern the elements of the two occupations from a depth perspective (even taking into account the limited thickness of the layer – Figure 2), partial vertical scatter plots of the piece plotted materials were elaborated, following the two main axes of the excavation grid (Figures 6 and 7). Because of the general inclination of layer 2 to Southwest, and as a way of avoiding eventual lumping, each projection was limited to a lateral thickness of 25 cm. The combined reading of figures 6 and 7 allowed the recognition of the following patterns:

1. The ibex bones vertical distribution is in agreement with an older occupation attribution. They appear, for most of the excavated area, in the base of layer 2. Their Z values underlie almost all the other collected

elements and, specially, the vast majority of lithic materials;

2. In the area of the hearth (units J21 and K21, X 350 to 450, Y 900 to 1010), however, the rabbit bones show Z values lower or identical to those of Ibex. This may indicate that the construction/excavation of the *en cuvette* feature in Terminal Gravettian times crossed the earlier occupation in all its depth, probably moving some of the faunal and lithic artifacts therein;
3. Close inspection of the exceptions in the depth relation between the ibex bones and the lithic materials reveals that the artifacts with lowest Z values are precisely those from blocks PTF and LPF, which, as previously stated, show surface weathering. The artifacts from the first block were collected West of the Terminal Gravettian hearth – with Z values identical to the nearby ibex bones – and in the Southeast area of the excavation (units L21 and L22). As to what concerns the second block (Figure 4), and having into consideration the location of the respective artifacts in the area of the hearth, it is possible that the reutilization of the original sidescraper fragments as bladelet cores dates already to Terminal Gravettian times. The excavation of the *cuvette* for the hearth might have revealed the presence of some flint fragments that served the general purpose of the knapping activities from the Terminal Gravettian occupants: the massive production of small elongated blanks;
4. Another area where artifacts show low Z values is the southeast corner of unit K21 and northeast corner of unit K22 (X 450 to 500 and Y 875 to 925). In this case, however, most of the artifacts are in quartz and both their fresh edge conditions and technological characteristics indicate that they belong to the Terminal Gravettian occupation. The absence of both ibex bones and weathered artifacts in this small area suggests a heavier (total) erosion of the earlier Gravettian occupation, and probably related to the Erosive funnel, located immediately to the South;
5. The majority of elements collected in unit L22 (X 500 to 600 and Y 800 to 900) seems to relate to the early Gravettian occupation: Ibex bones dominate the faunal sample, and lithic materials are extremely rare.

To sum up, the older attested human use of Lapa do Anecrial seems to be a very ephemeral occupation which took place c. 23,400 BP, within the Gravettian technocomplex, and represented by the bones of a single young adult ibex (clearly consumed, as evidenced by the presence of cut marks) and a very small lithic sample (for the moment only blocks PTF and LPF can be securely attributed to this occupation – Table 4), which undoubtedly was knapped at the site, as proved by the existent reconstructions (with a refitting success, in weight, of 96%). These suggest the use and possible resharpening of a side scraper, and the production of small flakes on a prismatic core. The absence of elongated blanks, although seldom detected in other Gravettian contexts of Portuguese Estremadura, is not a single case, as the recently excavated occupation surface EE15 (dated to c. 22,500 BP) from the Lagar Velho rockshelter has shown (Zilhão and Trinkaus, 2002; Almeida, 2003).

After this occupation, the sedimentation of the cave seems to have stopped, and a certain degree of erosion took place, especially on the central part of the occupied area, where both faunal remains and lithic artifacts are absent. This erosional episode, most likely associated with very humid conditions, weathered the two remain types. Approximately two thousand years later, another very ephemeral occupation took place in the same area of the cave. The purpose of the activities seems, however, to have been quite different, at least in what lithic production is concerned.

3.2. The Terminal Gravettian Occupation (~21,500 BP) from layer 2

The Terminal Gravettian occupation from Anecrial layer 2 has been already object of several studies (Zilhão, 1995, 1997; Zilhão *et al.*, 1999; Almeida, 1998, 2000, in press a, in press b). This assemblage was the first Upper Paleolithic one from Portuguese Estremadura where the refitting method was systematically applied, as a way to evaluate three main archaeological problems:

- Firstly, to study the degree of post-depositional movement of artifacts. Although the spatial distribution of both artifacts and fauna seemed to be completely independent of the slight slope of layer 2, only the vertical scatter of conjoins would assure us that the post-depositional condition was pristine. As aforementioned, this procedure allowed us to separate, at least partially, the Terminal Gravettian elements from those of the earlier Gravettian occupation.
- Secondly, to clearly describe the technological characteristics of the assemblage, in the dynamic perspective that only refitting can provide. Through the reconstructions, we had the opportunity of clearly evaluate the reduction sequences and strategies of the various blocks of raw material, to analyze which stages of their respective *chaînes opératoires* were represented, in which state of exploitation did the blocks of raw material entered the cave, which artifacts were exported at abandonment, and if there were any "phantom tools" (Hofman, 1992; Cahen & Keeley, 1980), or "phantom cores". Last but not least, and since the assemblage was rich in carinated and thick-nosed elements, we had the chance to apply refitting to test the hypothesis

that these types of artifacts might have served as bladelet cores (e.g., Sonneville-Bordes, 1963; Delporte, 1968; Bordes, 1968; Tixier & Inizan, 1981; Ferring, 1980, 1988; Rigaud, 1993; Lucas, 1997; Zilhão, 1995, 1997; Almeida, 1998, 2000, 2001, in press a, in press b, in press c; Zilhão *et al.*, 1999).

– Finally, the reconstructions allowed us to undertake the spatial patterns study much further than the single recognition of clusters or concentrations, allowing the detection of artifact movements between the various small clusters. This endeavor permitted us to detect some past organizational patterns at a very precise scale, a precision quite difficult to achieve if refitting had not been applied to the assemblage.

The combining of the three aforementioned objectives provided a precise understanding of the technological behavior, and of the habitat organization of a small hunter-gatherer group, during a very ephemeral logistical occupation of a cave, during the beginning stages of the Last Glacial Maximum.

The degree of refitting success at Anecrial Terminal Gravettian occupation lithic sample is among the highest for archaeological assemblages in Portugal (only Lagar Velho occupation surface EE15 has yielded a higher success – Almeida, 2003), and among the higher in Upper Paleolithic European studies. As shown in Table 5, the degree of refitting success in number of artifacts is of almost 50%, representing 92% in weight. In other words, the majority of non-refitted artifacts were either chips or small bladelets.

Such a high degree of refitting success establishes that the layer 2 occupation of Anecrial was extremely well preserved, a pattern reinforced with the combined spatial data. In addition, it allowed an almost complete view of the reduction strategies applied to the lithic artifacts from the site: from raw material acquisition to tool discard.

The reconstructions show that at least fourteen different blocks of raw material were imported into the cave. Of these, nine were on flint, four on quartz, and one on quartzite. The application of refitting allowed us to clearly understand the states in which the different volumes entered the cave. There is a wide variability, which suggests a Terminal Gravettian extremely versatile traveling kit: it contained unknapped quartz cobbles and flint nodules, preformed cores, and unretouched blanks. Also, the refitting results show that, at abandonment, several artifact types were curated; bladelets and cores, both in flint and in quartz. Independent of the state under which the various flint blocks entered the site, the main goal of the knapping procedures was the production of bladelets. This production was carried out through an optimized exploitation of almost all the available blocks, from cores to recycled tools from the older occupation. Block GF1 (Figure 8), the most comprehensive reconstruction from Anecrial, shows a high core to cobble ratio: four by-products of an original bladelet prismatic core were re-exploited as bladelet cores, through carinated or thick-nosed technology. The association of a high core to cobble ratio and the combination of various reduction strategies in single blocks of raw material is perhaps the best defining characteristic of the Anecrial sample, and one that only through the reconstructions was possible to detect. The quartz reconstructions show a pattern completely identical to the one seen in the flint: they show a high core to cobble ratio, and the association of prismatic and carinated/thick-nosed technology for bladelet and small flake production.

The reconstructions entirely confirm the hypothesis that carinated technology and thick-nosed technology were extremely efficient ways to produce bladelets (Zilhão, 1995, 1997; Almeida, 1998, 2000, 2001, in press a, in press b, in press c; Zilhão *et al.*, 1999). Also, the refitting shows that such technological reduction strategies allow an immediate way of maintaining the debitage surface convexity and, thus, avoiding, for a longer period, the problems of hinging which often afflict prismatic technology. Last, but not least, as the reconstruction of Block GF1 perfectly exemplifies, bladelets produced through carinated/ thick-nosed strategy tend to be more standardized than those produced through prismatic technology: in general shape, in distal tips, in thickness, and in length.

Although the refitting results from Lapa do Anecrial were successful in showing that the carinated elements were bladelet cores, it became necessary to demonstrate that those elements were never used as tools. A use wear study became, as a consequence, significant. Hughes Plisson's analysis' results are consistent with the interpretation of the carinated "scrapers" as cores and not as tools. Of the 36 artifacts analyzed only one showed use wear traces: a flint composite "tool" which consisted of a double scraper – burin. The two "scraper fronts" of this particular piece had different characteristics: while one was clearly carinated and was possible to refit bladelets onto this part, the other front was clearly a typical thin scraper. As expected, only the thin scraper front showed use wear, probably related to hide scraping. The absence of use wear traces on most of the flint carinated materials from Anecrial could be questioned, however, by the fact that a major part of the sample presented some sort of chemical alteration that could have erased original use wear traces. The analysis of the quartz materials with no chemical alteration, however, presented no such doubts: the edges of the quartz carinated cores are as fresh as if they have been knapped in this precise moment: no use wear whatsoever.

In sum, the study of the lithic assemblage from Lapa do Anecrial, through a combined use of attribute analysis and refitting, provided exceptional data on the lithic reduction strategies of the Estremaduran Terminal Gravettian. For raw ma-

terial acquisition and transport strategies, the study of Anecrial lithic assemblage leads to the conclusion that there were differences in how the different materials were curated. While flint entered the cave, for the most part, already decortified (either as core performs, blanks or finished tools), quartz was transported essentially unmodified (with the exception of thin removals for raw material testing at the source). The difference between the two main raw materials exploited at Anecrial, however, was exclusively related to the conditions under which they entered the site.

The platform preparation strategies were identical for both quartz and flint, with an almost exclusive use of flat (unfacetted) platforms. The maintenance of cores of both materials (required mainly due to hinging) was carried out through the renewal of the platforms by core tablet removals. The main technological characteristics of the Anecrial sample, as seen through refitting, are: a high core to cobble ratio, that is, for each block of raw material more than one core was exploited; and the association of different reduction strategies. Of these, the dominant were Unidirectional Prismatic, Carinated, and Thick-Nosed for Bladelets. The resulting abandoned cores show characteristics that could be easily misleading, if a traditional typological study had been done on the assemblage. Such a study would have classified the Anecrial assemblage as "Aurignacian", because of the dominance of thick "scrapers". These scrapers, as the reconstructions have clearly demonstrated, were instead bladelet cores and, as the microwear study has shown, were never used as real "tools". The differences in the presence of quartz and flint bladelets in the studied sample relates mostly to the fact that the former were exported to a higher degree than were the latter. In addition, the refitting data show that, although the main exported artifacts were bladelets, the Terminal Gravettian people took also some cores (prismatic and thick-nosed) when they left the site. The almost complete absence of retouched bladelets indicates that this type of blank was probably never retouched, or, when it was, only through marginal retouch, real backing being extremely rare (which was a characteristic of the earlier stages of the Gravettian complex). Lapa do Anecrial lithic sample is thus coherent with a rational and optimized exploitation of the available raw materials, in order to produce bladelets.

As to what concerns the spatial analysis, the data from the reconstructions has provided interesting insights into the micro-scale past organization of a small hunter-gatherer group. The combining of the reconstructions with the clustering of the abandoned artifacts made possible the attribution of the various blocks of raw material to at least three knappers, located in different areas around the *en cuvette* hearth, which served as a common toss zone. Figure 9 shows the overall result of the spatial analysis of the reconstructed blocks, and includes a brief description of each knappers' activity. Besides the common toss zone of the hearth, the ongoing detailed study of clusters enabled us to detect a drop zone of individual # 2 (B), composed essentially of flint chips and small bladelets. It also permitted the detection of one other interesting concentration, located between individuals # 1 and # 2, very rich in bladelets not only produced by individual # 2, but also by individuals # 1 and # 3. It seems as though the knappers, after choosing which bladelets were good enough to be exported, abandoned the remaining bladelets in a single concentration. Individual # 3, on the other hand, as the reconstructions have shown, exploited exclusively quartz.

All the industrial activities from the Terminal Gravettian occupation were thus exclusively related to bladelet and small flake production, probably in order to be used as barbs in composite tools. The knapping procedures were carried around a small *en cuvette* hearth that had hundreds of rabbit bones on its interior.

The *Oryctolagus cuniculus* sample from layer 2 is constituted of 1487 bones, which correspond to over 98% of the total faunal remains, after having removed the wild goat bones (the remainder of the sample is comprised of 6 bird bones, 1 amphibian bone, 3 fish vertebra, and 14 land snails). The faunal study indicates the presence of at least 15 individuals (2 juveniles and 13 adults).

As opposed to the aforementioned goat bones from the earlier Gravettian occupation, the rabbit bones present a good preservation, with non or only slightly altered surfaces. The taphonomic study of the latter suggests a short term surface exposition, where the rare action of micro and macroscopic organisms took place but for a short time, thus not affecting the surface of the majority of the sample.

Several characteristics of the sample concur in attributing the vast majority of the sample to anthropic action. Carnivore presence is negligible, with a single case detected. On the other hand, 17% of the bones show traces of burning, present in all the spectrum of anatomical parts (skull fragments, isolated teeth, vertebra, and short and long bones). Cut marks are rare (a single case regarding a metapodial), but there are at least 4 cases of possible human chewing evidence on pelvis fragments (a probable under frequency for such discrete marks). The main criteria for human action, however, stand on the anatomical constitution of the sample (Perez Ripoll, 1993; Hockett, 1991, 1994; Cochard, 2004; Cochard & Brugal, 2004; Hockett & Bicho, 2000). Although all the skeletal parts are represented (thus the animals were completed when entering the cave), the percentual disparities between some of the elements suggest differential human consumption. The skeleton axial parts, as well as the distal parts of the members are quite under-represented on the sample. Since such low presence cannot be explained by differential preservation or excavation bias, the most parsi-

monious explanations are of anthropic character. The absence of distal member parts can be explained by hide curation, the extremities of the legs being transported together with the rabbit hides. The low presence of axial parts, however, is harder to explain. A possible hypothesis, that deserves further ethnographic research, could be a different consumption technique, like smashing of the bones and inner parts into a greasy rich mass. The dominance of cylinders over extremities on the humerus, tibia, and especially on the femur, suggests, in addiction, the activity of marrow extraction during the Terminal Gravettian short term occupation of Anecrial. This is further reinforced by the complete absence, with the exception of some metaphodes, of complete long bones.

The faunal study of the rabbit bones from the Terminal Gravettian occupation of Anecrial has thus confirmed the anthropic nature of the sample:

1. By the presence of cylinders, clearly dominant on the long bone fragment sample;
2. By the presence of burned elements;
3. And by the clear dominance of adults over juveniles, clearly indicating human selection.

The previous paleoetnographic interpretations of the Terminal Gravettian occupation from Anecrial, where a short-term occupation was hypothesized, were thus not infirmed by the faunal analysis, which further suggests, although with some caution, an occupation either in the beginning of the winter, or the beginning of the summer.

In sum, and after the sorting of the earlier Gravettian occupation items, the Terminal Gravettian occupation from Anecrial layer 2 can be considered one of the best preserved contexts from the European Upper Paleolithic. It reflects the activities of a small group (at least 3 individuals) within a possible logistical crossing of the Estremaduran limestone massif, during a very ephemeral occupation. Inside the cave, they roasted and consumed the meat and the marrow of at least 15 rabbits, whose hides were transported at abandonment. In addition, they undertook knapping activities which had as a main goal the production of lithic barbs, either as a preparation or maintenance of composite hunting tools. The fact that the original blocks of raw material (either as cores, cobbles, blanks, or tools) were transported for over 8 kms further suggests a mobility system where anticipation took an essential role.

3.3. The Solutrean Occupation (~20,520 BP) from layer 1

While in the earlier occupations at Anecrial left lithic remains that attest local knapping activities, the occupation from the top of layer 1, dating to the Solutrean, seems to have been even more ephemeral in nature, with no knapping clusters, and with the use of a hearth which did not imply the excavation of a *cuvette*, standing thus directly of the *eboulis sec* limestone fragments of the cave surface at that time.

Centered on the southwest corner of M20, and with an average diameter of 70 cm, the hearth from layer 1 from which a charcoal fragment yielded an AMS absolute date of 20,520 ± 100 BP (GrA-12019), showed a flat profile, and an average thickness of 5 cm. As was the case of the Terminal Gravettian hearth, its interior was filled with rabbit bones and charcoal fragments, the vast majority of which from Scots Pine.

Directly to the south of the feature, a set of 15 mammal bone fragments was collected, with surface conditions similar to those present on the bones from the layer 2 oldest Gravettian occupation. The fact that the identifiable large mammal bones from layer 1 can similarly be attributed to ibex can in fact suggest that they also belonged to the oldest human occupation of the cave. The differences in Z values between the caprid bones from layers 1 and 2, however, are not negligible, with almost 20 cm of sterile sediments separating the two layers. While such hypothesis could only be tested by new C14 dates on layer 1 ibex bones, it is certain that such an explanation would consequently imply a different erosional phase from the one already described for layer 2, and chronologically placed between c. 21,500 and 20,520 BP.

As was the case in layer 2, the sample of rabbit bones shows a mush better surface preservation. The total of bones attributable to *Oryctolagus cuniculus* in layer 1 is 184, corresponding to a minimal number of 4 individuals (a juvenile, a young adult, and two adults). In spite of the striking differences in the total number of rabbit bones from layers 1 and 2, the general anatomical conservation profiles are similar between the two contexts and reveal that the majority of rabbit bones from the Solutrean occupation results from human consumption. The single difference detected between layer 1 and the Terminal Gravettian is a higher presence of cranial fragments in the latter. Such difference could suggest the consumption of brain parts during Solutrean times.

The sample of archaeological materials from layer 1 is extremely limited and can be seen in Figure 10. It is composed of two lithic artifacts (a retouched overpassed blade – possibly a *point a cran* preform – and a heat treated bifacial preform) and 4 shells of the marine species *Littorina obtusata*, one of which perforated (and broken, and burnt – found inside the hearth).

While clearly not as rich as the samples from the Gravettian and specially the Terminal Gravettian occupations from Anecrial, this small sample provides still some information of relevance for the human adaptations in Portuguese Estremadura during the Last Glacial Maximum. The fact that the only two lithic elements are possible Solutrean projectile pre-

forms not only is in agreement with the absolute dating of the occupation, but easily integrates it into hunting activities or expeditions. The marine shells, on the other hand, are a direct indicator of coastal exploitation, either through direct or indirect contact. Moreover, they strongly suggest, if doubts still existed, that the Minde-Alvados corridor was an alternative passage way between the Tagus basin and the coast, and possibly a faster way to get into the Nazaré canyon, as opposed to the traditionally mentioned Rio Maior corridor.

4. DISCUSSION

From the aforementioned descriptions, it becomes clear that Lapa do Anecrial was never a site with very dense human occupation. Its archaeological richness stands exactly on the opposite fact that the human occupations detected therein are of ephemeral character, but, on the other hand, show much better preservation conditions than other "richer" sites.

The stratigraphic sequence is extremely relevant for Last Pleniglacial paleoenvironmental reconstructions, both at the local and regional level. Both the paleovegetational and sedimentological data of the excavated area are in close agreement with other sequences from the same age. For instance, the erosion phase detected in layer 2, between the Gravettian occupation and the Terminal Gravettian one encounters clear parallels on the Hanging Remnant from the recently published rock shelter site of Lagar Velho (Angelucci, 2002; Zilhão & Almeida, 2002).

From the paleoetnographic point of view, the three detected occupations reveal an ephemeral character, not surprising in an area which during the harsh conditions of the Last Glaciation was quite inhospitable, and which might have been exploited mostly during logistical expeditions. The faunal samples suggest the consumption of locally available animals, ibex during the Gravettian, and rabbit during the Terminal Gravettian and Solutrean times. Such pattern is also indicative of the logistical character of this occupations, especially when compared with other sites located at the edge of the limestone massif, like Lagar Velho, to the North, and Lapa dos Coelhos (Almeida *et al*., 2002), to the South. On the latter site, a small cave located just a few kilometers to the south but on a completely different geographical setting, a recently detected Solutrean occupation evidences a wider faunal spectrum, dominated by ibex and deer, with the rabbits being clearly minoritary.

Overall, Lapa do Anecrial seems to have served, during the Last Pleniglacial, as a small shelter place for groups who were either exploiting logistically the central part of the limestone massif, or on their expeditions between the coast and the Tagus basin. Such endeavors implied necessarily a high degree of anticipation which, on the Anecrial sequence, is especially evidenced by the lithic assemblages:

- During Gravettian times, with the transport of decortified flint cores and finished tools;
- In the Terminal Gravettian, with a lithic kit composed of tested quartz cobbles, flint core preforms, unretouched blanks, and finished tools.
- And at the Last Glacial Maximum, with hunting tools preforms.

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TABLE 1. Lapa do Anecrial Absolute Dating.

Layer	Material	Method	Lab. #	Result BP	Delta C13
0	*Berberis* Charcoal	AMS 14C	GrA-12014	130 ± 50	
1	Charcoal	AMS 14C	GrA-12019	20520 ± 100	
1b-2a	Charcoal	14C	ICEN-963	23450/+1470/-1240	-24.01
2b	Charcoal	14C	ICEN-964	21560 ± 680	-24.14
2b	*Erica* Charcoal	AMS 14C	OxA-5526	21560 ± 220	-26.1
2b	*Capra* sp. Bone	AMS 14C	OxA-11235	23410 ± 170	-19.5
3n	Charcoal	AMS 14C	GrA-12016	24410 ± 110	
4	Bone	AMS 14C	GrA-10922	15640 ± 140	

TABLE 2. Species Identification of the Charcoal Samples from Lapa do Anecrial (Figueiral, Unpublished Data).

SPECIES	Layer 0 (n = 90)	Layer 1 (n = 20)	Layer 2 (n = 273)	Layer 3 (n = 83)	Layer 3n (n = 33)	TOTAL
Ind. *Angiosperma*	7					7
Leguminosae	2		153			155
Maritime Pine	4					4
Pine	5	3	1	4	5	18
Olive	8					8
Helm Oak	25					25
Strawberry Tree	33					33
Barberry	2					2
Oak	3					3
Ind. *Gimnosperma*		6	6	10	6	28
Scots Pine		9	92	62	17	180
Heath			9			9
White Heath			2			2
Indeterminate	1	2	10	7	5	25
Total	90	20	273	83	33	499

TABLE 3. Ibex bone Inventory from Lapa do Anecrial.

	Layer 1	**Layer 2**	***n* with cut marks (Layer 2)**	**Young adult (Layer 2)**
Rib	1	26	3	
Right Humerus		1	1	
Metatarsal (shaft frgt)		1	1	
Sesamoid	1			
Pelvis (cotyloid cav. Frgt.)		2	1	
Épiphyse	2	2		2
Splinters	11	43	3	
TOTAL	15	75	9	2

TABLE 4. Lapa do Anecrial Layer 2 Gravettian Occupation. Refitting success by raw material.

	ARTIFACT TOTAL			**REFITTED ARTIFACTS**			
	N	**Weight (g)**	**% of total sample**	***n***	**%**	**Weight g)**	**%**
Patinated Translucent flint (PTF)	12	36	63.15	10	83	35	97
Light Pink flint (LPF)	7	21	36.84	6	85	20	95
TOTAL	19	57	100	16	84	55	96

TABLE 5. Lapa do Anecrial Layer 2 Terminal Gravettian Occupation. Refitting success by raw material.

	ARTIFACT TOTAL			**REFITTED ARTIFACTS**			
	N	**Weight (g)**	**% of total sample**	***n***	**%**	**Weight (g)**	**%**
Yellowish Orange Banded Flint (OBF)	3	8	0.52	2	67	3	38
Yellowish Pink Flint (YPF1, 2, 3, 4)	37	119	6.46	24	65	100	84
Grey Flint (GF1, 2, 3)	257	310	44.93	141	55	290	94
Pink Flint (PF)	105	34	18.35	30	29	21	62
Indeterminate flint (F)	20	30	3.49	3	15	11	37
Quartzite (QZI)	10	113	1.74	9	90	113	100
Quartz (QZ1, 2, 3, 4)	140	524	24.47	76	54	504	96
TOTAL	572	1138	100	285	49.82	1042	92

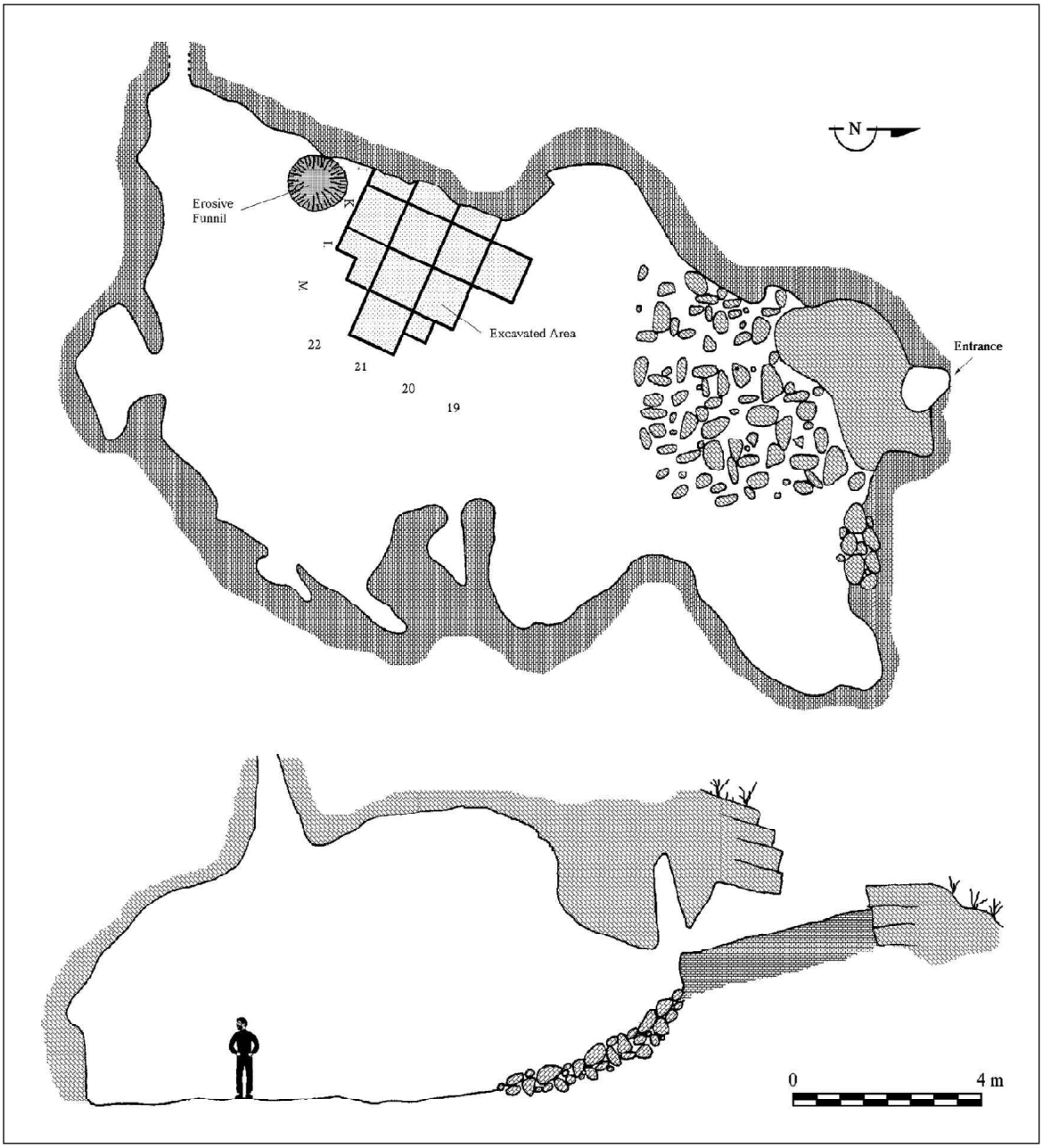

FIGURE 1. Lapa do Anecrial: Plan and Profile views of the cave.

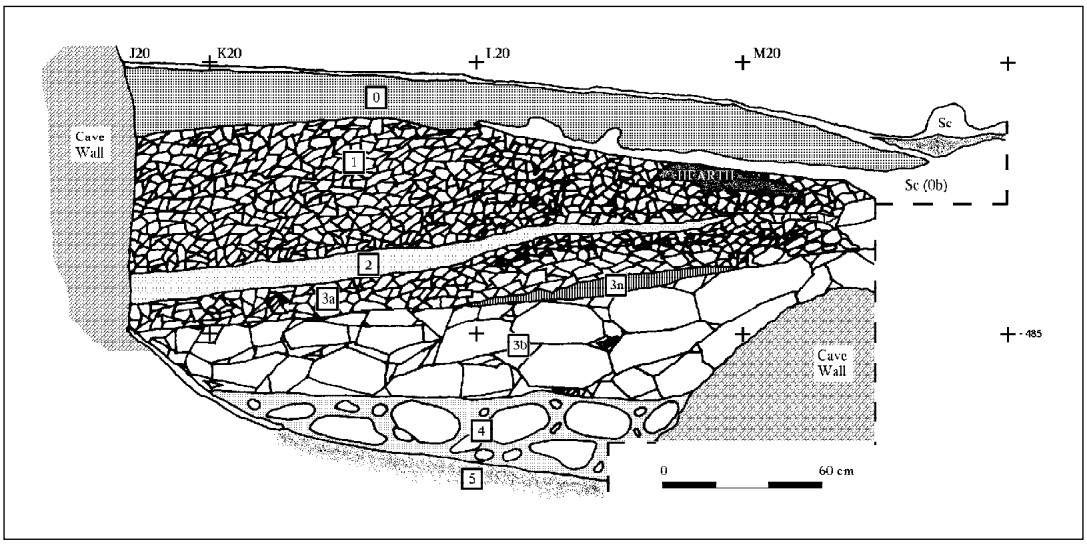

FIGURE 2. Lapa do Anecrial. Section J-M20/21.

FIGURE 3. Lapa do Anecrial. Layer 2 Gravettian occupation:
Block PTF refitted set. Photo José Paulo Ruas.

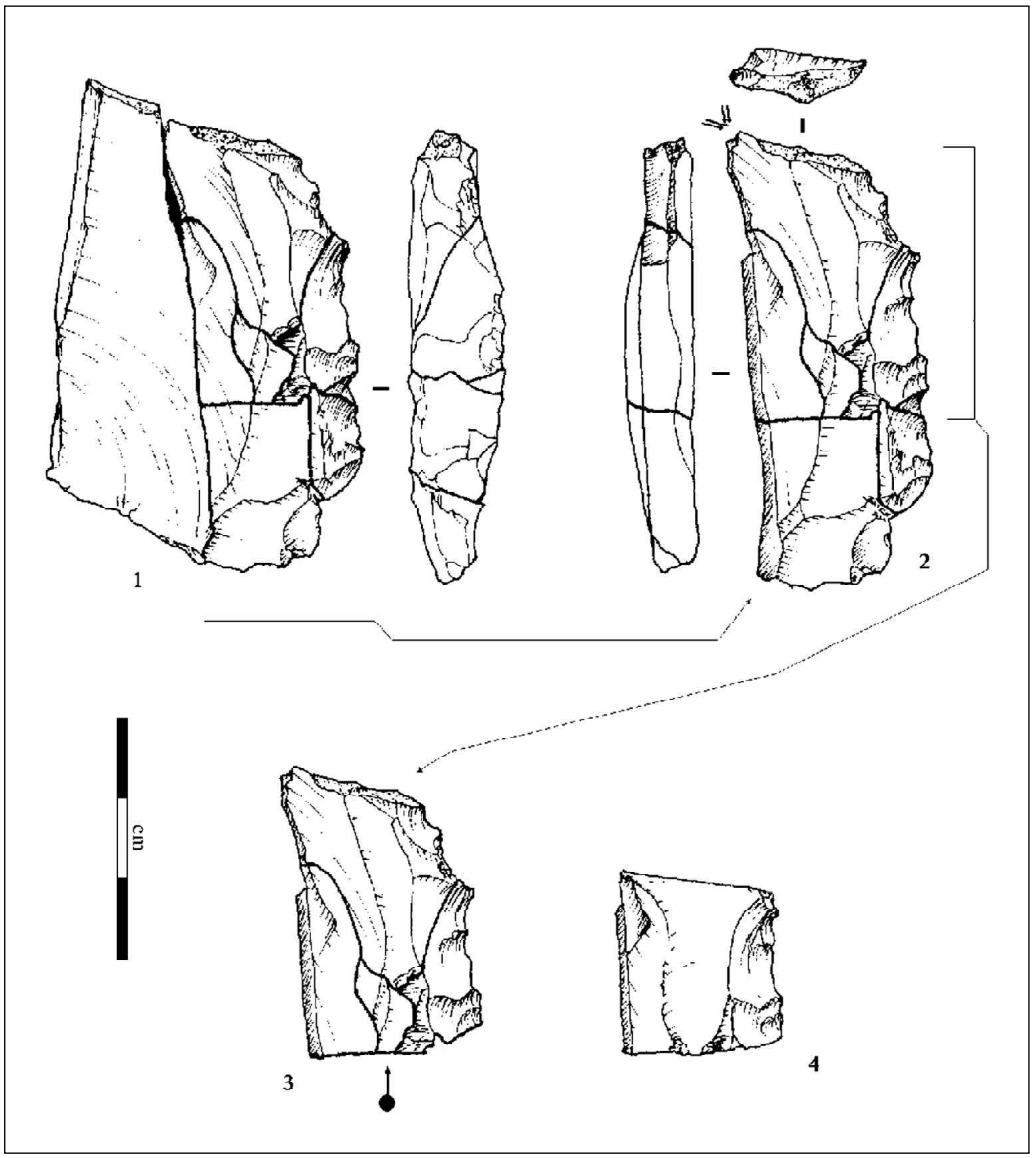

FIGURE 4. Lapa do Anecrial. Layer 2 Terminal Gravettian re-exploitation of an earlier Gravettian occupation abandoned tool? The re-exploitation of a side-scraper as a bladelet core. (Block LPF). After fracture (1), bladelets were produced through a burin technique. After a second fracture, bladelet production was still attempted in one of the fragments (3). 4 – Abandoned "core". Illustration by Katherine Monigal.

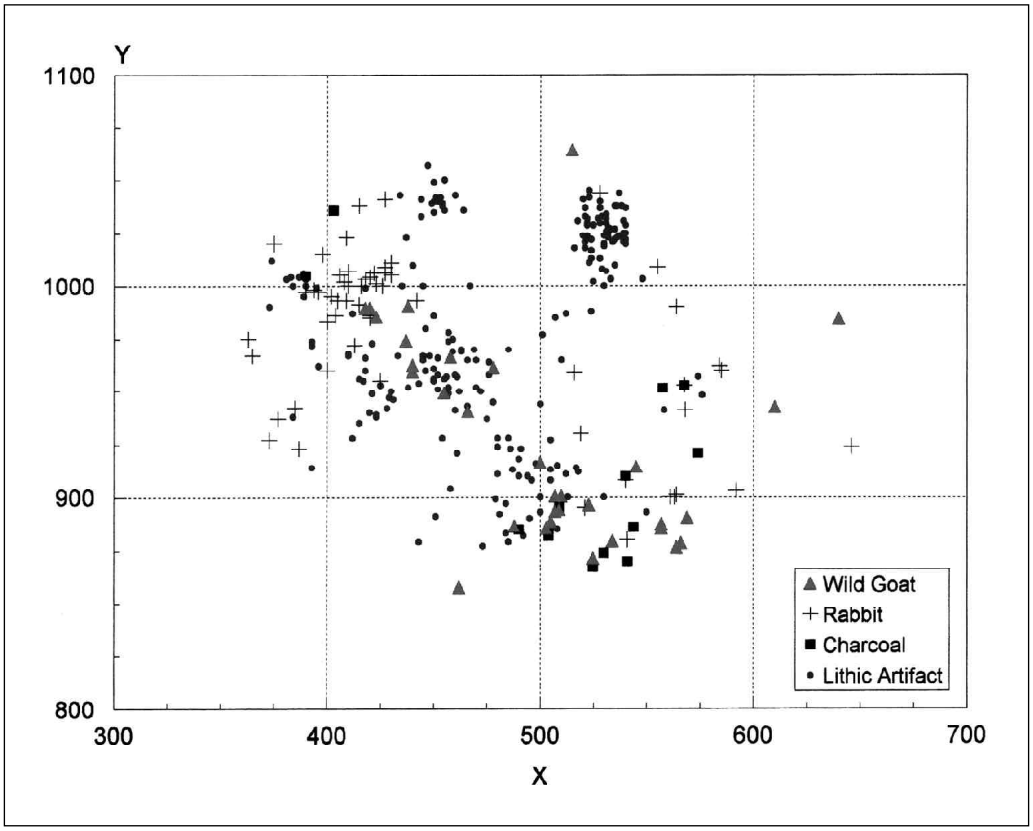

FIGURE 5. Lapa do Anecrial. Layer 2 Spatial Distribution of remains.

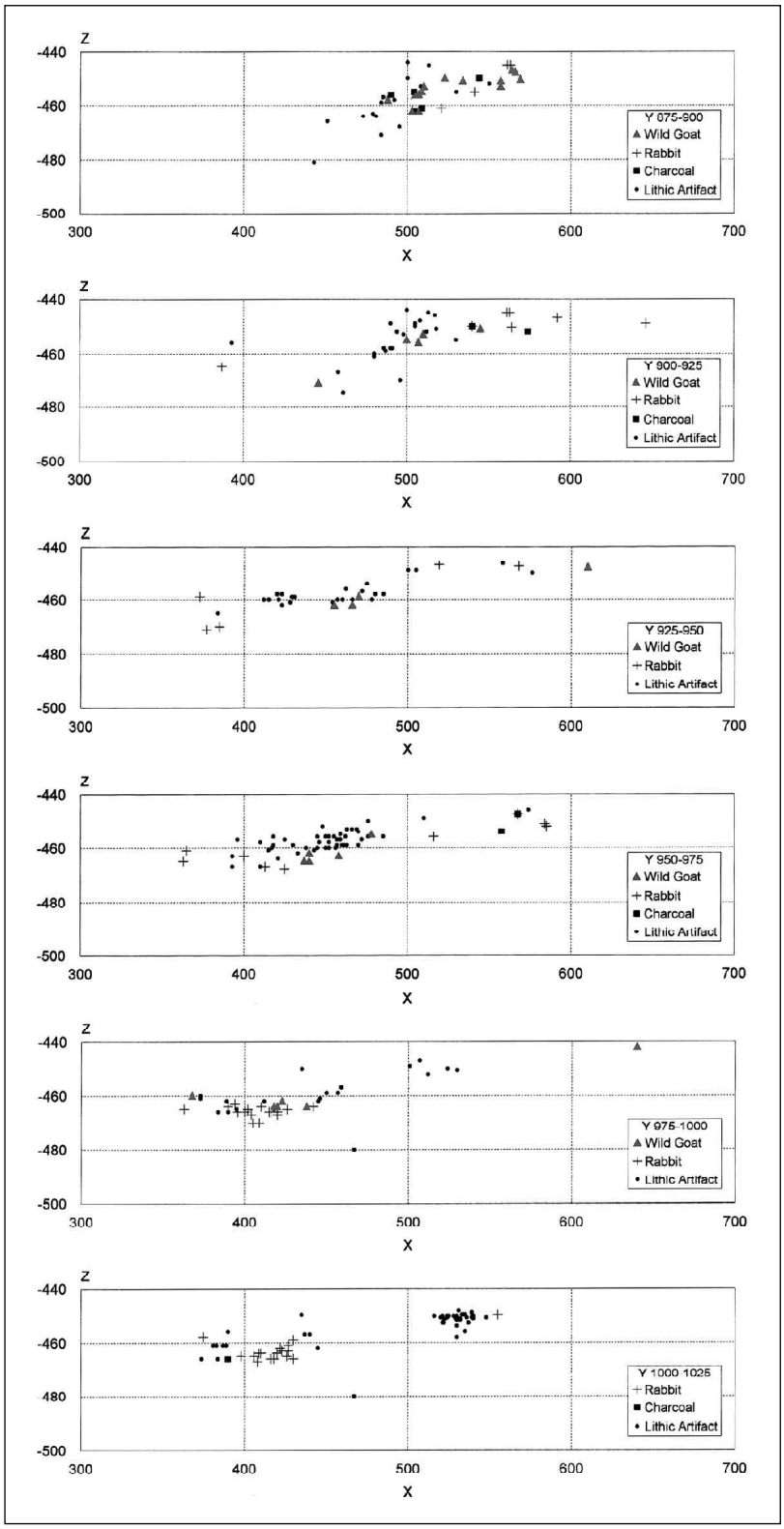

FIGURE 6. Lapa do Anecrial. Layer 2. Vertical scatter of remains (E-W axis).

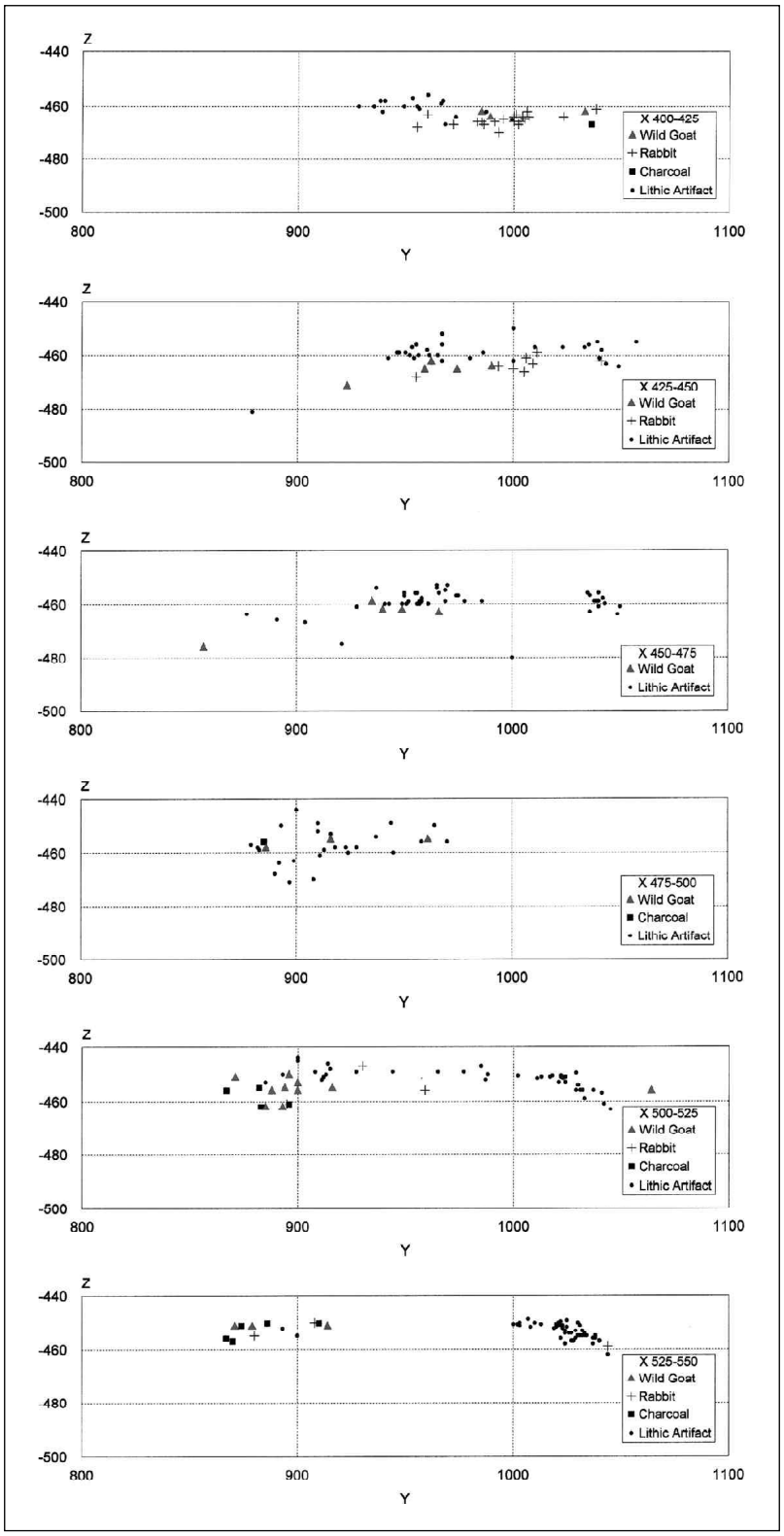

FIGURE 7. Lapa do Anecrial. Layer 2. Vertical scatter of remains (N-S axis).

FIGURE 8. Lapa do Anecrial. Block GF1. Photo José Paulo Ruas.

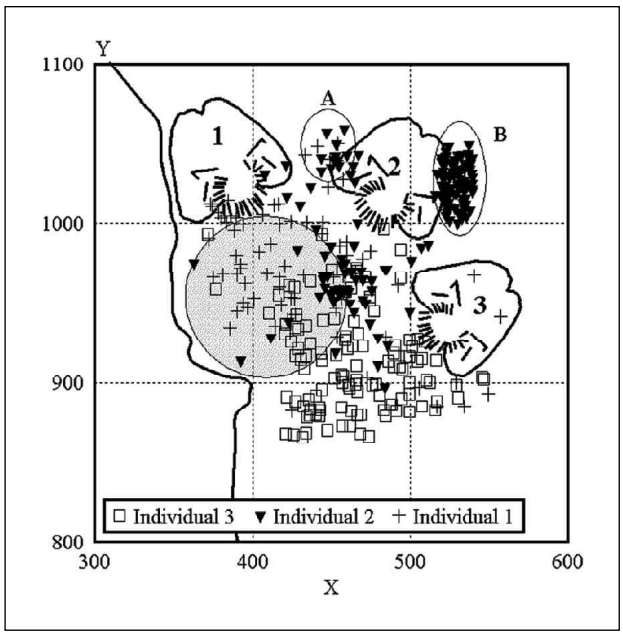

FIGURE 9. Detecting the Knapper's place… and activity. General interpretation of Lapa do Anecrial Layer 2 Terminal Gravettian lithic scatters, after combining the spatial data with the refitting results.

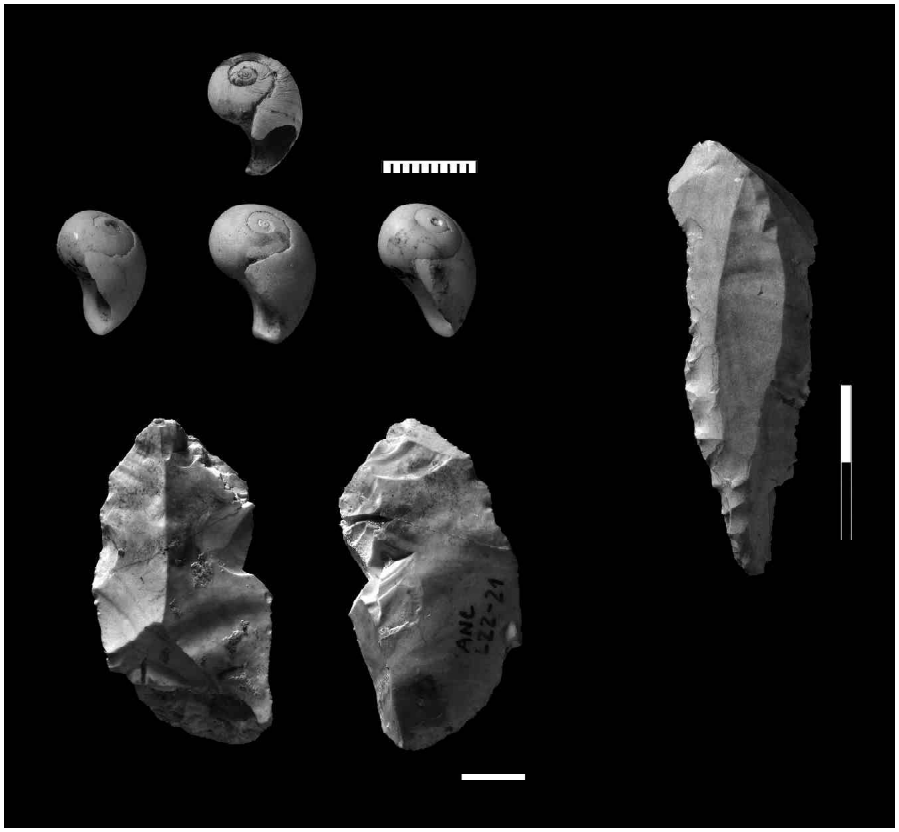

FIGURE 10. Lapa do Anecrial. Lithic Artifacts and Ornaments from Layer 1 (Solutrean). Scales = 1 cm. Photo José Paulo Ruas.