Los Neandertales del fin del mundo: resultados recientes

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Neandertals from World's End: results of recent research

ABSTRACT

The "Ebro Frontier" explains the persistence of the Middle Paleolithic and Neandertals in southern and western Iberia beyond 40 ka cal BP (thousands of calibrated years before present) as primarily related to paleoenvironmental factors imposing a temporary barrier to the diffusion of ideas and the circulation of persons. New data from the Portuguese cave sites of Columbeira, Oliveira and Figueira Brava indicate that some of the radiometric dates supporting this pattern may be minimum ages only, while others are independently corroborated by alternative techniques. Additionally, these data show that the importance of marine resource exploitation in late Neandertal subsistence is not novel, as the behavior goes back to at least MIS (Marine Isotope Stage) 4.

RESUMEN

La "frontera del Ebro" es un modelo que explica la persistencia del Paleolítico Medio y de los Neandertales en el sur y el oeste de la Península Ibérica más allá de 40 ka cal BP (miles de años antes del presente, calibrado) como relacionada con factores paleoambientales que habrían impuesto una barrera temporaria a la difusión de ideas y a la circulación de personas. Resultados recientes del estudio de los yacimientos en cueva de Columbeira, Oliveira y Figueira Brava, en Portugal, indican que algunas de las dataciones radiométricas que apoyan el modelo pueden no representar más que edades mínimas, pero otras han podido ser corroboradas de forma independiente mediante la aplicación de técnicas alternativas. Además, estos datos muestran que la explotación de los recursos marinos por los últimos neandertales no es una conducta nueva puesto que su importancia en las estrategias de subsistencia se documenta desde el Estadio Isotópico Marino (MIS) 4 por lo menos.

KEYWORDS: Neandertals, Modern humans, Iberia, Ebro, Middle Paleolithic, Marine resources
PALABRAS CLAVE: Neandertales, Humanos modernos, Iberia, Ebro, Paleolítico Medio, Recursos marinos

THE "EBRO FRONTIER"

The "Ebro Frontier" (Zilhão, 1993, 2000, 2009; Angelucci and Zilhão, 2009; Zilhão *et al.*, 2010, 2010b) is a model put forth to explain the persistence of Neandertals in southern and western Iberia after ~41.5 ka cal BP. It suggests that the pattern arises out of the temporary establishment at this time of an eco-geographic boundary broadly coincident with the lower Ebro basin. For the few millennia during which it existed, this boundary would have imposed an effective barrier to the diffusion of ideas, the circulation of persons and the migration of human groups. Such a barrier would explain the long-term contemporaneity between a modern human-associated Upper Paleolithic to the north of the Ebro divide and a Neandertal-associated Middle Paleolithic to the south.

The Neandertal persistence pattern is supported by a number of observations: (a) in Iberia, the Protoaurignacian and the Aurignacian I, the first technocomplexes of the Upper Paleolithic whose authorship conceivably involves anatomically modern humans, are only documented in northern Catalonia and the Cantabrian strip; (b) south of these regions, the corresponding chrono-stratigraphic slot is occupied by Middle Paleolithic assemblages; (c) in Murcia (Walker *et al.*, 2008), this late Middle Paleolithic has been shown to be associated with diagnostic Neandertal remains at the Sima de las Palomas de Cabezo Gordo.

The end of the persistence pattern, in turn, is signaled by the presence of an Evolved and/or a Later Aurignacian (Aurignacian II and III/IV) at a number of sites in Valencia, Alicante, Malaga and Portugal (Zilhão *et al.*, 2010b). Everywhere else in Europe, these phases of the Aurignacian are associated with modern humans; therefore, they can be used as a proxy for the disappearance of the Neandertals from the Iberian record, regardless of the mechanism by which it occurred (with assimilation being the parsimonious explanation, in light of the human paleontological and ancient DNA evidence; Smith *et al.*, 2005; Trinkaus, 2007). Given that the Aurignacian II begins ~37 ka cal BP (Higham *et al.*, 2011) and compatible radiometric results have been obtained for this phase at Gato Preto, in Portugal, and Bajondillo, in Malaga, the "Ebro Frontier" was thus in existence for some four to five millennia.

SIGNIFICANCE AND PROBLEMS

The duration and causes of the pattern, however, remain controversial. The paleoenvironmental evidence from the deep sea cores off the Mediterranean and Atlantic coasts of Iberia indicates the presence of a biogeographical divide along the 40º parallel during Greenland Interstadial (GI-) 8, which lasted from ~38.2 to ~36.6 ka cal BP (d'Errico and Sánchez-Goñi, 2003; Fletcher *et al*,. 2010; Wolff et *al.*, 2010). This long period of climatic amelioration saw steppe-tundra landscapes continue to predominate to the north; southward, however, temperate (deciduous oaklands) and warm-temperate (Mediterranean woodlands) environments underwent a very significant expansion. This contrast fits the notion that a barrier to communication existed at this time along the Ebro and the mountain ranges of the Iberian System, but is insufficient to explain the initial setting of the pattern some two to three millennia before. A possibility to be considered is that (a) even if not as strongly expressed, the pattern already existed by the time of GI-10 (~41.4-40.7 ka cal BP), (b) the shortness of the following cold stadial (thee hundred years only) was not enough to affect it, and (c) under opposite climatic circumstances, for different reasons, but with the same consequences, the very cold and arid stadial that immediately preceded GI-8–Heinrich Stadial (HS-) 4, which began ~39.8 ka cal BP–strengthened rather than weakened the barrier to communication and diffusion by installing a belt of desert and semi-desert landscapes in the eastern and southeastern Mediterranean seaboard of Iberia.

Finally, it has to be borne in mind that the dearth of chronometric evidence has also led some to question the very reality and nature of the persistence pattern. It has been suggested, for instance, that the younger-than-expected radiometric dates used in support of the chrono-stratigraphic evidence for long-term contemporaneity across the Ebro divide between a Middle Paleolithic to the south and an Upper Paleolithic to the north could be minimum ages only and relate to the incomplete decontamination of samples too close to the limits of applicability of the radiocarbon method. If so, then Neandertals might have gone extinct ~42 ka cal BP and, when modern humans entered Iberia at a later time, they simply re-occupied a landscape that had been devoid of human settlement for several millennia (e.g., Bradtmöller *et al.*, 2012).

Alternatively (e.g., Jöris *et al.*, 2003), the punctuation in the spread of modern humans across Europe indicated by such younger-than-expected results would be apparent rather than real. The process could in fact have been rather fast and correspond to a gradual East-West spread (even if the large standard deviations of radiocarbon dates in this time range make for the Middle-to-Upper Paleolithic transition to appear as simultaneous across the entire continent).

Another school of thought (Finlayson *et al.*, 2008), finally, contends that Neandertals survived until as late as the Last Glacial Maximum (LGM) in parts of southwestern Iberia. This scenario envisages a long-term sympatry at the regional scale between two human "species" (Neandertals and moderns) that would have exploited separate niches within the same, diverse, mosaic environments.

A consensus does exist, however, on how to proceed in order to advance towards the settling of these differences of opinion. Clearly, additional and better dates are needed, including the cross-validation of results via the use of different dating techniques (namely, Radiocarbon, U-series, Luminescence). And, as the corpus of available evidence contains a proportion of sites that were excavated before the development of methods to detect stratigraphic disturbance via geoarcheological and taphonomical analysis, it is no less clear that new sites have to be found and appropriately excavated, while old ones need to be looked at anew and with a fresher perspective. Where the Portuguese territory is concerned, the last five years have witnessed significant progress along these lines. The results obtained for three important sites in this debate–the Gruta Nova da Columbeira, the Gruta da Oliveira and the Gruta da Figueira Brava–will be briefly summarized in the following.

GRUTA NOVA DA COLUMBEIRA

This site (Figs. 1-2), excavated by the Geological Survey of Portugal in 1962 (Veiga Ferreira, 1984), is often quoted as documenting the late persistence of a Neandertal-associated Mousterian, supported by conventional radiocarbon dates in the range of 33-31 ka cal BP (e.g., Raposo and Cardoso, 1998). Such results were obtained from samples of "carbonaceous earth" collected in 1972 by Jean Roche, dated the following year at the French laboratory of Gif-sur-Yvette, and eventually published in the 1908s (Delibrias *et al.*, 1986).

In order to assess the validity of these results, Zilhão *et al.* (2011) undertook to replicate them using samples of the same material and collected in the same, still extant profile situated at the back of the cave; additionally, they obtained an U-series age estimate for a flaked bone tool from the base of the Mousterian sequence excavated at the entrance of the cave in 1962. The new carbonaceous samples yielded results in the range of ~18-21 ka cal BP, while the bone tool was dated to ~87.1 ka. Cross-checking the stratigraphic and dating information assembled over the years against the original field documents, it became clear that the deposits at the back of the cave filled a subsidence depression and had accumulated in Tardiglacial times from the surface above, via now sediment-plugged shafts. Moreover, the anthropogenic component of these otherwise sterile deposits was in secondary position; the scarce bones and artifacts in question, as well as the carbonaceous material, derived, by erosion, from the inward talus of the Middle Paleolithic archeological sequence located at the entrance and at a higher elevation. The variation in the dating results for the deposits at the back could thus be explained as a function of random variation in the amount of inherited charcoal present in the samples.

The age of the bone tool shows that the Middle Paleolithic sequence at the entrance formed between MIS-5 and early MIS-3. Its assignment to a much later date assumed lateral continuity between the two areas of the site and that the lenses of displaced ash and charcoal whence came the 1970s samples corresponded to *in situ* hearths. This is unsupported. Thus, the site can no longer be used to argue a case (e.g., Bicho, 2005) for the Upper Paleolithic of Portugal to have begun no earlier than the Middle Gravettian (~30 ka cal BP).

GRUTA DA OLIVEIRA

Overlain by the k/7 flowstone and, above the latter, by archaeologically sterile layer 7, which only contains carnivore-accumulated faunal remains, the uppermost human occupations of the Gruta da Oliveira sequence are in Middle Paleolithic layers 9 and 8 (Marks *et al.* 2001; Zilhão *et al.* 2010c; Figs. 3-4). A sedimentation hiatus and a microfauna breccia mark their interface, with available radiocarbon dates suggesting that this hiatus was millennia-long and relates to the GI-8 interstadial, in agreement with the temperate woodland signal of that microfauna (where *Elyomis quercinus* and *Apodemus sylvaticus* represent >95% of the MNI).

However, the radiocarbon results placing the layer 8 occupation at ~37 ka cal BP had been obtained on burnt bone, a type of sample whose reliability has been questioned (e.g., Higham *et al.*, 2011). In order to test their validity, samples of flowstone capping the archeological sequence in different areas of the site were dated by U-series, while three bones from layer 8 were also dated by the same method but using the D/A (Diffusion/Adsorption) approach (Hoffmann *et al.*, n.d.). Due to high detritical contamination, one of the speleothem samples did not yield an age, but the other provided a *terminus ante quem* of ~23 ka for the accumulation of the sequence. This result is stratigraphically consistent with those obtained by radiocarbon for the underlying deposits. The three bone samples, in turn, place the accumulation of layer 8 in the time interval (95% probability) comprised between 34.6 and 39.3 ka, i.e., broadly the same interval as that indicated by the radiocarbon dates. This evidence confirms that the Middle Paleolithic did persist in Portugal into the time range of GI-8.

GRUTA DA FIGUEIRA BRAVA

Figueira Brava (Figs. 5-6) opens in an outcrop of Miocene biocalcarenites on the southern slope of the Serra da Arrábida. The excavation of the cave system, located some 5 m amsl, bears relation to an abrasion platform and cobble beach of MIS-5 age. But for a few remnants cemented against the walls, no Upper Pleistocene sediments are preserved inside of Entrance 1, which connects via a shaft to the sea below and may have been emptied by Holocene marine erosion. From the outside, Entrances 2 and 3 appear speleothem-cluttered, but the interior areas behind can be accessed via Entrance 1; their sediment fill is preserved under thick flowstone.

In 1987-88, a paleontological excavation of the deposits behind Entrance 2 yielded a Mousterian context and Neandertal tooth associated with a date of ~35 ka cal BP (ICEN-387) (Antunes, 2000). In order to assess the significance of this result, obtained on a bulk sample of *Patella* shells, research along the following lines was initiated in 2006: (a) AMS dating of individual shell samples from the area of the 1987-88 dig; (b) U-series dating of flowstones capping the deposits; (c) geoarcheological description, sampling and dating of the brecciated Upper Pleistocene sequence preserved in the exterior area of Entrance 3; and (d) excavation of a test trench in the latter's interior area.

Four *Patella* samples from the 1987-88 dig have been dated to 36.4-44.9 ka ^{14}C BP and one to 2.7 ka ^{14}C BP; the ICEN-387 result probably reflects, therefore, the undetected presence of a minor component of recent Holocene age in the bulk shell sample dated and should be seen as a minimum age only. However, the ages obtained for the capping flowstone indicate a *terminus ante quem* for the deposits of ~37 ka cal BP, and the new radiocarbon dates on individual shell samples from the same area date the contents of the underlying deposits to the ~48-41 ka cal BP interval. The persistence of the Middle Paleolithic occupation of this site until GI-8 times thus remains possible—but not demonstrated.

The flowstone covering the interior area behind Entrance 3 has been dated to ~60 ka. The correlation with the 1987-88 sequence assumed in the project's planning stage is therefore invalid—the Middle Paleolithic sequence in this part of the site dates to MIS-4 at the top and may extend back into MIS-5 at the bottom. It contains abundant Mousterian lithics in a midden of marine mollusc, sea urchin and large crab shell fragments that also contains significant amounts of mammal (red deer, ibex) remains. As the 50 m bathymetric line was ~at least 0.5 km away, the massive accumulation of marine animal remains characteristic of these levels must reflect human activity.

The composition of the sea-eroded, brecciated deposits sampled for geoarcheological analysis in the exterior area of Entrance 3 confirms the anthropogenic nature of the Figueira Brava faunal accumulations. Layer 3 of the succession observed in this exterior area corresponds to a thick lens of charcoal, burnt bone and burnt mussel shells associated with numerous artifacts (mostly quartz). Correlation with the interior deposits has yet to be established, and preliminary radiocarbon dates on individual shells of both limpets and mussels collected for the geoarcheological study indicate a MIS-3 age. If confirmed, these dates imply discontinuity between the interior and exterior sequences of Entrance 3, but it remains possible that the radiocarbon dates for the exterior samples are affected by diagenetic alteration of the original carbonate contents of the shells. The issue is currently being investigated via the U-Th dating of speleothems interstratified in the exterior deposits.

CONCLUSION

The results obtained at these three sites warrant the following conclusions:

(1) It is possible that, as shown for Gruta Nova da Columbeira, a number of supposedly late Mousterian occurrences in southern and western Iberia are indeed an artefact of dating error. All such occurrences therefore need to be further investigated with radiocarbon samples whose relation to the context they are intended to date is unambiguous and for which enhanced pretreatment techniques are used; whenever feasible, corroboration via alternative dating techniques (U-series and/or Luminescence) should be attempted.

(2) Adding to similar evidence from Cueva Antón, in Murcia (Zilhão *et al.*, 2010a), the persistence of the Mousterian into the time range of the Protoaurignacian and the Aurignacian I of Cantabria and northern Catalonia is confirmed, in Portugal, at Gruta da Oliveira, and remains conceivable at Gruta da Figueira Brava.

(3) After ~50 ka cal BP, shell-rich deposits are a feature of most Middle Paleolithic sites located along the littoral of southern and western Iberia, suggesting that marine resources may have become of significant importance in late Neandertal adaptations; the evidence from Figueira Brava, however, shows that the exploitation of such resources goes back in time to at least the beginning of the Upper Pleistocene. Its importance may have been vastly underestimated so far due to the fact that very few sites sufficiently close to the then extant coast lines have been spared by the post-glacial rise in sea level.

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Figure 1. Gruta Nova da Columbeira. Top: view of the site in sectors 4 to 6 taken during the 1962 excavations; note the black color of level 8. Bottom: the flaked bone tool from level 8 that was U-series-dated to ~87,000 years ago (the small rectangle in the full view denotes the area sampled for dating). After Zilhão *et al.* (2011).

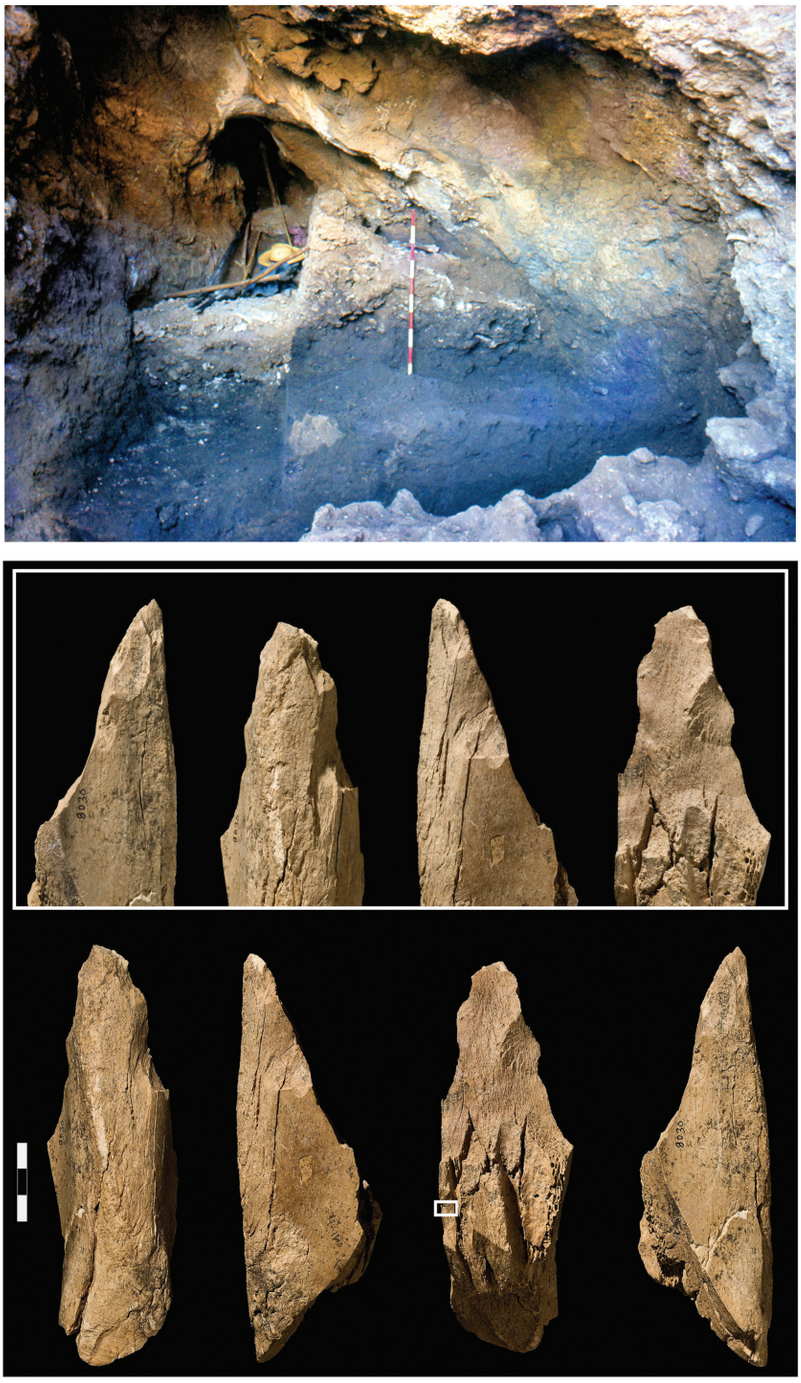


Figure 2. Gruta Nova da Columbeira. Composite longitudinal stratigraphic profile with summary description of the deposits, spatial positioning of key finds and features, and indication of the areas where stratigraphically relevant field observations were made. Note the discontinuity between the sequence at the entrance, of Middle Paleolithic age, and the deposits at the back of the cave that stratigraphically overlie it and where the radiocarbon-dated samples of "carbonaceous earth" come from. After Zilhão *et al.* (2011).

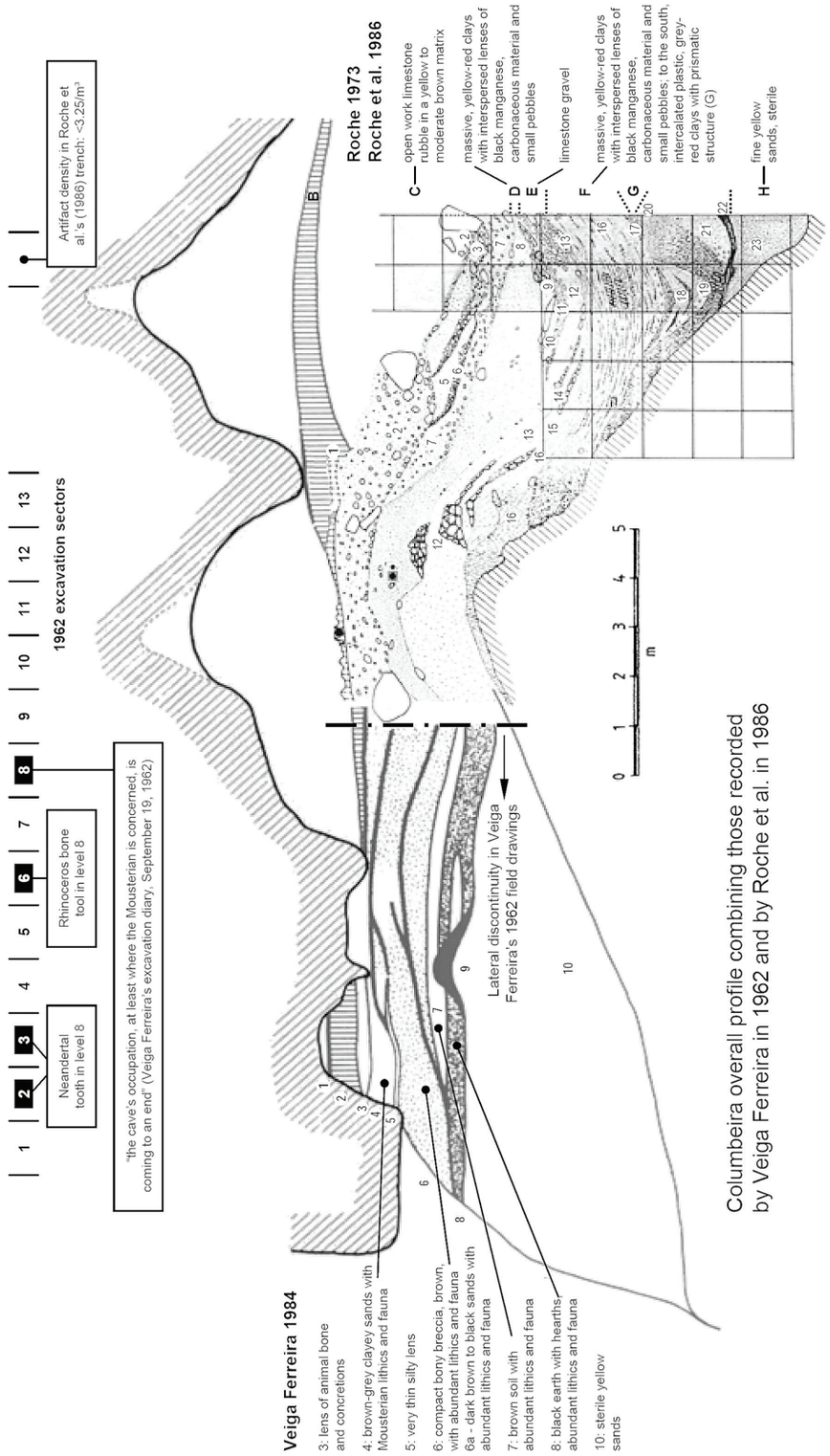


Figure 3. Gruta da Oliveira. Above: left, location of the Gruta da Oliveira in western Iberia; right, the Almonda escarpment in the southern edge of the Estremadura Limestone Massif (elevation 1.5x); bottom, the Almonda escarpment from the South, the circles indicating the Gruta da Aroeira/Galerias Pesadas at the top of the escarpment and the Gruta da Oliveira at mid-slope. Below: interior view of the Gruta da Oliveira (2006 field season) over the areas where layers 7-15 were principally excavated; the reference profile P-R18/19 stands in the middle, the 27-S Chamber extends to the left of it and the Side Passage to its right. After Zilhão *et al.* 2010c.

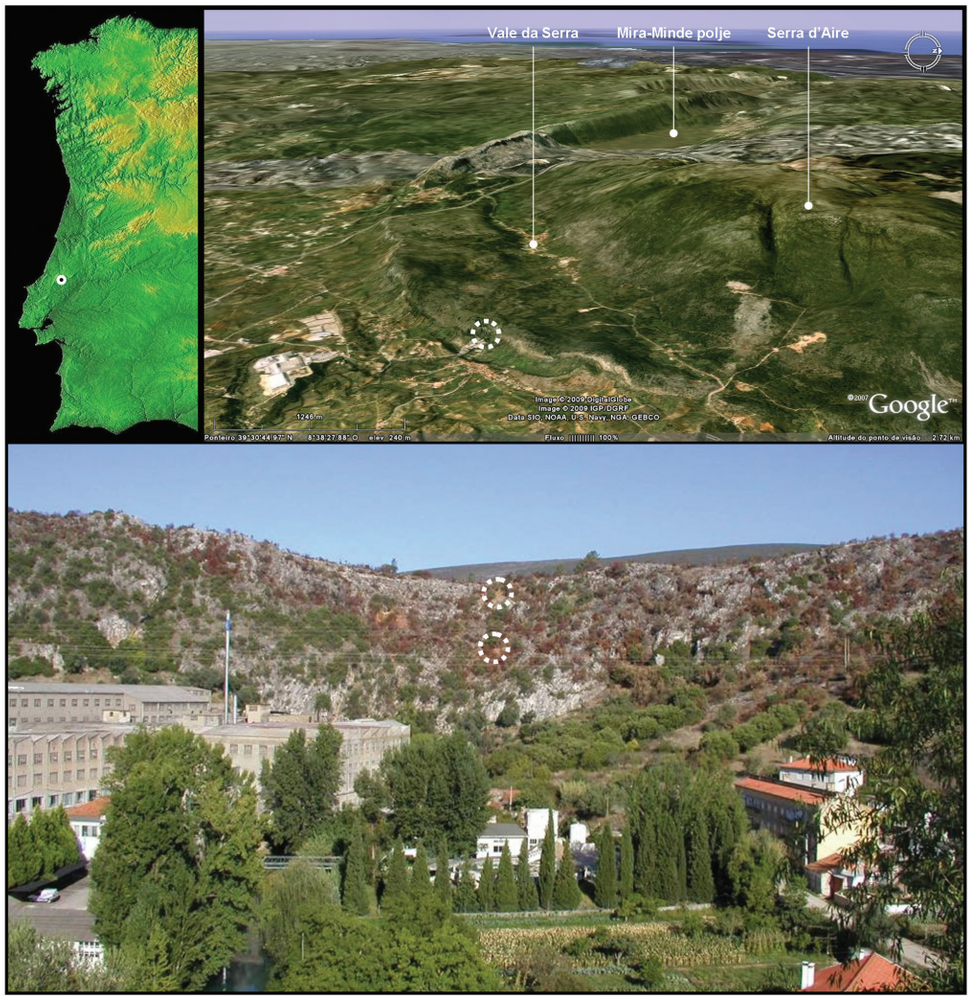
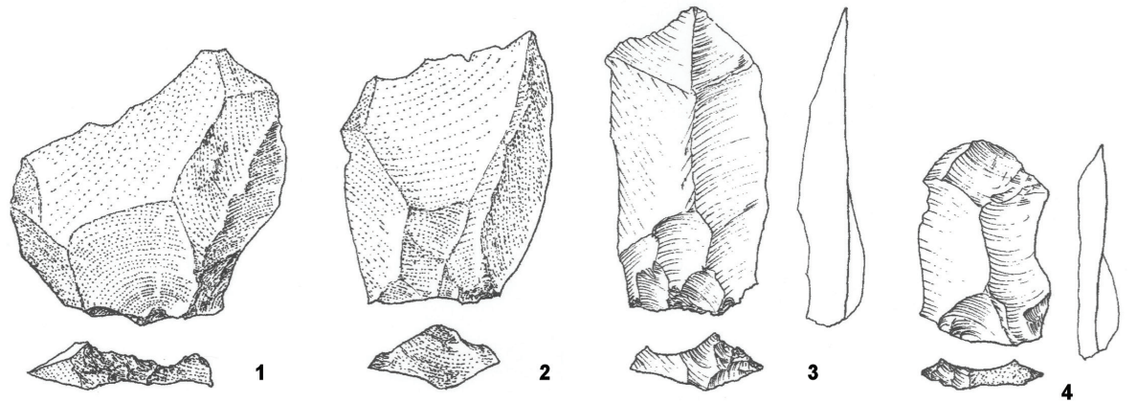
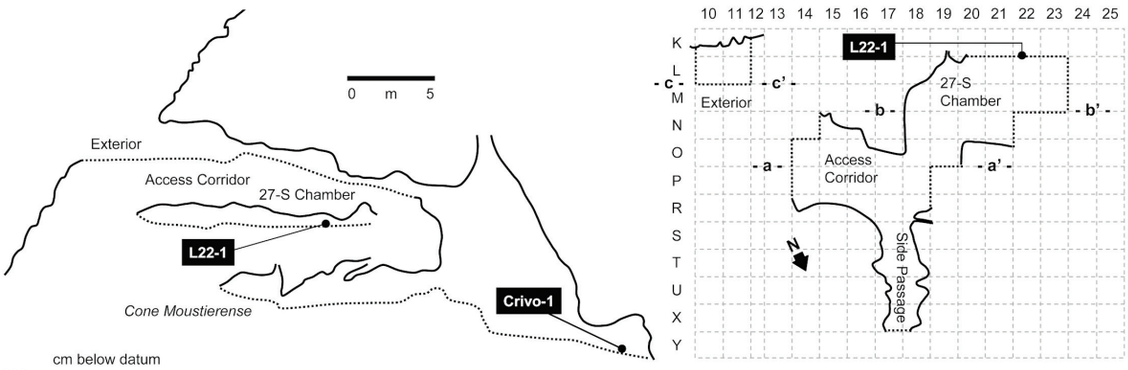
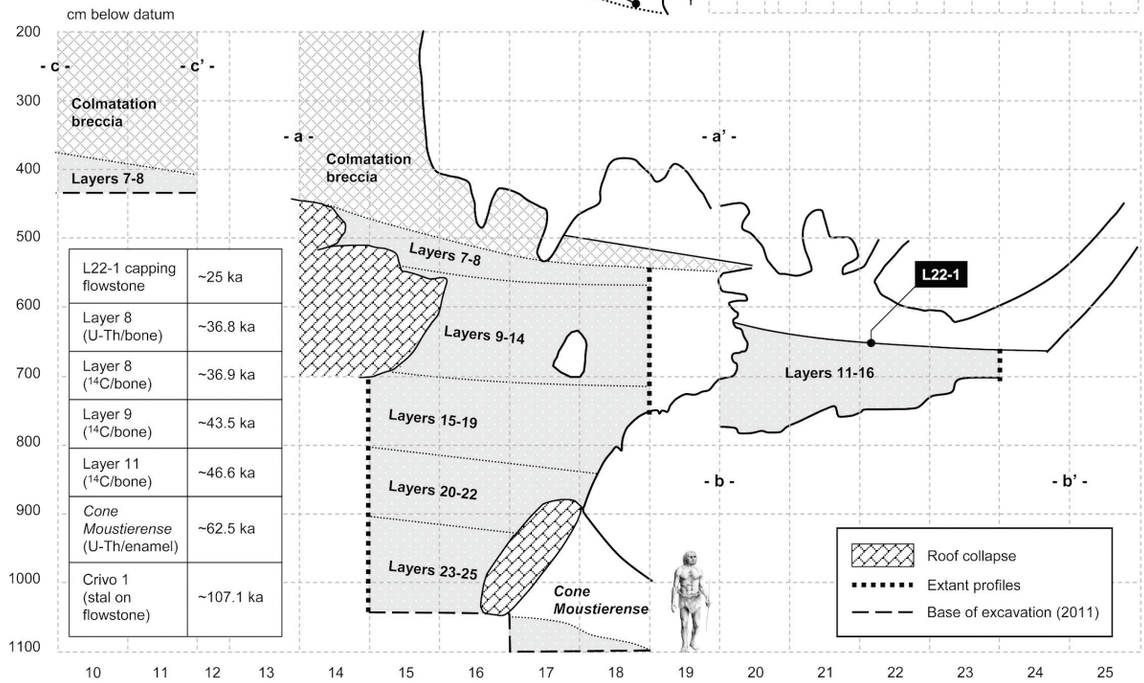


Figure 4. Gruta da Oliveira. Above: Middle Paleolithic artifacts from layer 8 (1-2. Levallois flakes, quartzite; 3-4. Levallois flakes, flint). Middle: left, schematic topographic profile of the site's collapsed entrance and the passages leading to it; right, site plan at the elevation of layer 10 with excavation grid, location of relevant speleothem samples and designation of the different excavated areas. Below: schematic stratigraphic profile with indication of the main stratigraphic blocks and available dating results. After Marks *et al.* 2001 and Zilhão *et al.* 2010c.







L22-1 capping flowstone	~25 ka
Layer 8 (U-Th/bone)	~36.8 ka
Layer 8 (^{14}C/bone)	~36.9 ka
Layer 9 (^{14}C/bone)	~43.5 ka
Layer 11 (^{14}C/bone)	~46.6 ka
Cone Moustierense (U-Th/enamel)	~62.5 ka
Crivo 1 (stal on flowstone)	~107.1 ka

Figure 5. Gruta da Figueira Brava. Left: view of the exterior area of Entrance 3 in 2010 and its eroded, brecciated fill; the fresh scars left by the geoarcheological sampling work are well apparent, and the position of samples 1002 indicated. Right: face of sample 1002 as cut in the field with a rock saw, prior to polishing and further processing for micromorphological analysis; note the ~2 cm-thick lens of ash, charcoal and burnt mussel shell forming the base of level 3 of the succession.

Figure 6. Gruta da Figueira Brava. Stone tools from the deposits underlying the >60 ka flowstone capping the interior area of Entrance 3 (1 m² test trench excavated in 2011): 1. broken Kombewa core (flint); 2. denticulate (siliceous rock); 3. centripetal core (quartz); 4. Levallois blade (flint); 5. micro-Levallois core (flint); 6.sidescraper (siliceous rock); 7. notch (quartz).