The extinction of Neanderthals and the emergence of the Upper Paleolithic in Portugal

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Preâmbulo

Este trabalho foi apresentado no âmbito de Provas de Agregação na área de Arqueologia. Estas provas académicas, constituídas por 3 fases, são de carácter público. Para cada fase existe um arguente, sendo as fases, respectivamente, a discussão do currículo do candidato, a análise de um relatório de uma disciplina do ensino universitário e uma lição-síntese, seguida de discussão. Esta última prova consiste numa apresentação de uma hora de um tema à escolha e, como parte constituinte das Provas de Agregação, pode ser pensada de duas formas essencialmente opostas: uma de entre as várias lições do programa da disciplina apresentado no relatório acima mencionado, fazendo por isso a descrição de uma qualquer parte do conteúdo desse mesmo programa; ou, pelo contrário, respeitar o título da prova e fazer-se uma verdadeira lição síntese, de carácter inédito.

O trabalho ora apresentado situa-se, com toda a certeza, no segundo plano acima descrito – é um trabalho inédito, mas que foca aspectos específicos do âmbito do programa da disciplina, exemplificando a sua aplicação. Note-se, contudo, que o seu tema geral é de Pré-História – a questão da extinção dos neandertais e a emergência do Paleolítico Superior no território português – e que, portanto, pode, à primeira vista, parecer que o tema da lição foge completamente ao do relatório da disciplina – *Arqueologia Pré-Histórica* que foca questões metodológicas da arqueologia quando aplicada à Pré-História – apresentado no âmbito das referidas Provas.

A sua escolha foi, no entanto, reflectida cuidadosamente de forma a que se pudesse exemplificar um caso onde a *aplicação dos métodos arqueológicos ao estudo da Pré-História Antiga* (tema central da disciplina apresentada em relatório) é fundamental para se poder desenvolver uma crítica das fontes e, assim, interpretar cientificamente os dados históricos e antropológicos existentes. Com esta perspectiva em vista, os dados existentes sobre o assunto foram re-analisados segundo uma linha de pensamento metodológico, assente num quadro teórico de referência, claramente *cognitivo-processual*, e que assenta, neste caso, numa crítica detalhada do registo arqueológico e respectiva interpretação; isto é, o registo arqueológico e a sua formação são a base de construção histórico-antropológica que se apresentou no final da Lição Síntese.

A questão da extinção dos Neandertais e do aparecimento dos primeiros homens modernos, isto é, dos primeiros *Homo sapiens sapiens*, é um dos temas da Pré-História e da investigação científica relacionada com a evolução humana que mais debate tem suscitado no mundo académico. Este mesmo tema é de grande interesse para o público não especializado, provavelmente fomentado pela curiosidade, natural, sobre a composição da sua ancestralidade, mormente o facto de existir a possibilidade de na sua linha de antepassados existir um elemento que é diferente da modernidade física humana, exótico e, talvez mesmo, enigmático, algo arcaico e ligeiramente simiesco, posição esta oposta à perspectiva criacionista da Igreja Cristã desenvolvida e consolidada pela ideia do Arcebispo de Usher de que o Mundo teria tido a sua criação a 23 de Outubro de 4004 a.C.

Como é evidente, o interesse científico arqueológico e a relevância deste tópico no contexto da Pré-História residem, principalmente, no facto de este processo ser um dos fenómenos de transição mais complexos da História Humana, não só por razões culturais, mas também por razões no âmbito da Bioantropologia e da própria Arqueologia, onde a interdisciplinariedade é a chave da resposta (ou respostas) do problema.

No que concerne o aspecto físico desta transição (ou evolução, dependendo do posicionamento teórico do investigador), e numa perspectiva darwiniana evolucionista, o problema reside num aspecto fundamental: é o Neandertal um *sapiens*, fazendo isso com que Neandertais e homens modernos sejam sub-espécies dentro da espécie *Homo sapiens*, podendo, dessa forma, haver trocas genéticas entre os dois grupos? Ou, pelo contrário, o Neandertal não pertence à espécie *sapiens*, formando assim a espécie *neanderthalensis*, não podendo, por isso, haver trocas genéticas entre os dois grupos?

Este problema coloca-se num contexto regional de variação e evolução filogenética da espécie humana e dos seus traços ancestrais que resultaram no chamado Homem moderno. A investigação deste fenómeno reside não só no estudo detalhado morfométrico e morfológico do conjunto de restos fósseis Neandertais e *sapiens sapiens*, mas também no estudo de populações humanas actuais no sentido de caracterizar a evolução genética com base no estudo da transmissão e variabilidade da Mitocôndria do ADN (ácido desoxirribonucleico). Infelizmente, o conjunto dos dados da antropologia física nem é homogéneo nem é completo, dando assim azo a fenómenos marcados pela contradição das perspectivas teóricas da evolução humana.

No âmbito do fenómeno cultural, a diferença entre Neandertais e *sapiens sapiens*, pelo menos tradicionalmente, é vista em vários domínios, designadamente a tecnologia, a organização social, a capacidade intelectual e, finalmente, a capacidade simbólica, sendo estas últimas tidas como representantes da cultura moderna encontrada, pelo menos na Europa e segundo perspectivas tradicionais, no Paleolítico Superior.

O conjunto de domínios anteriormente referidos é particularmente difícil de ser investigado, já que as inferências de ordem cultural a partir dos dados arqueológicos do Paleolítico, seja ele Médio ou Superior, assenta principalmente na interpretação desses mesmos dados pelo arqueólogo. Este aspecto é verdadeiramente problemático, na medida em que esses dados são muitas vezes inadequados, insuficientes ou mesmo errados. Por outro lado, as interpretações arqueológicas são muito raramente inequívocas e pacíficas sobre estes temas.

Ainda no que concerne os aspectos culturais, vários problemas se levantam devido a questões relacionadas com os fenómenos de aculturação e transmissão de cultura, seja ela abstracta ou material, entre as duas comunidades, principalmente quando se evidenciam modelos de trocas genéticas, já mencionados anteriormente.

Todos os elementos acima descritos tornam-se mais complexos quando observados à lupa arqueológica, isto é, quando se dá a crítica das fontes arqueológicas, nomeadamente no que respeita a resultados de escavações, análises de materiais e a todo o processo de formação do registo arqueológico, assim como ao conjunto das metodologias usadas. Quando os vários conjuntos de dados (os da bioantropologia, tais como os dados da morfologia, da biologia molecular, da paleopatologia e filogenia, os da arqueologia, nomeadamente a formação dos sítios arqueológicos, e a sua cronologia, e os da interpretação cultural) se relacionam, começa a encontrar-se e a identificar-se incongruências e contradições entre os resultados dos vários tipos de análises dos diversos campos científicos, levando, por vezes, o estudo a becos sem saída, cuja clarificação só pode ser conseguida com a introdução de novos dados e a reanálise de toda a informação existente.

É exactamente este o objectivo da lição síntese destas Provas de Agregação, sendo o tema específico o caso da extinção dos Neandertais e o aparecimento dos primeiros Homens modernos no território português. Contudo, deve deixar-se claro que em diversos momentos desta lição, o suporte, claramente factual dando lugar a uma crítica severa do registo arqueológico (como no caso da questão do Aurignacense português), permite um trabalho científico. Noutros (como no caso das datações do território espanhol em que não houve uma revisão crítica dos elementos) o trabalho assemelha-se mais a um ensaio do que a um texto científico.

Finalmente, deve fazer-se notar que o texto foi preparado para ser lido, pelo que se apresenta de uma forma simples e escorreita para que fosse facilmente apreendido pela audiência, principalmente porque a sua apresentação foi feita em inglês. Assim, o texto agora publicado foi o mesmo que se apresentou no momento das provas, com a excepção da inclusão de referências bibliográficas e com a eliminação de algumas figuras apresentadas nas Provas.

1. Introduction

Clearly, one of the most interesting topics of European Prehistory is the process of Neanderthal extinction and their replacement by the Modern Human population. This is not, by any means, a simple or agreed upon topic. It seems that since the origins of the debate there are two main positions, both still standing, since, at least, the early 20th century.

The problems in this topic are related to a set of different variables that, depending on the researcher, may have completely different or even opposite meanings – that is, although the data are the same, the interpretations are very diverse since the scientific critique of the data and of their sources is based on very different paradigms.

One of the major problems stems from the fact that the main theoretical positions on the Neanderthal-Modern Human transition in Europe see this as a single process, although taking place in different areas at different times. Contrarily to this position, in my view, the transition question should be tackled in a regional manner, since the answer to the problem resides, not on the uniformity of the process, but on the diversity.

Thus, to understand the phenomenon of the Neanderthal-Modern Human transition it seems important to study each region separately. This is the reason why the chosen topic is the Extinction of Neanderthals and the Emergence of the Upper Paleolithic in Portugal.

Finally, it should be noted that this lesson is related to the Course Prehistoric Archaeology. Thus, it is also the objective of this study to show the importance of the archaeological methodology in the explanation of Prehistory, and, more specifically, in an extended and deep critical review of data.

2. Presentation plan

Today's lesson is divided in three main points. The first point will focus on the theoretical matrix. It will briefly describe the two main general paradigms, respectively the replacement and continuity models, followed by a review of the present perspectives for Portugal.

The second point will discuss the Iberian data base, with a short description of some of the Portuguese sites and dates.

A review of the dating methods and the problem of the calibration system for Radio-carbon will follow the description. After, I will evaluate the present data concerning the taphonomic and site formation processes of the various sites and dates, specifically the Aurignacian sites of Pego do Diabo and Vale de Porcos.

The final point of this presentation is the development of a new model of Neanderthal extinction and the emergence of modern humans in Iberia with specific references to Portugal.

3. The theoretical matrix

It seems clear that since, at least, 150,000 years ago, Neanderthal populations occupied the landscape from the Portuguese Atlantic coast all the way to the Near East. During that period, Modern humans, with an origin somewhere in Sub-saharan Africa, crossed that region, leaving clear evidence of their presence at sites such as Qafzeh in Israel some 90,000 years ago (Bar-Yosef, 1998, 2001). They moved into Europe around 43,000 years ago, although they occupied all of the North Africa at sites such as Gebel Irhoud (Hublin, 1992), Haua Fteah (McBurney, 1967), Dar es Sultan and Mugharet el'Aliya (Minugh-Purvis, 1993) since, at least, 130,000 years ago (Bar-Yosef, 1998: 152).

Contrarily to what is known from North Africa and the Near East, traditionally in Europe it is believed that the two populations of Neanderthals and Modern Humans represented two different cultural phases, respectively the Middle and Upper Paleolithic. The Middle Paleolithic was marked by the Mousterian, while the early Upper Paleolithic was represented by the Chatelperronian, Aurignacian and the Gravettian lithic industries. This neat two phase evolutionary organization of the Middle to Upper Paleolithic transition, where Neanderthals existed in the Middle Paleolithic and made flake tools, while *Homo sapiens sapiens* appeared during the Upper Paleolithic making blade tools, was the origin of the model of the so called Upper Paleolithic revolution (Bar-Yosef, 2002). This revolution as well as their carriers, the Modern Humans, came as a wave from the East, replacing the entire Neanderthal population between 43 and 28,000 years ago.

Traditionally, this revolution was structured on one of the two opposite paradigms of the origins of modern humans – the Replacement Paradigm (Clark, 1992, 2001, 2002). This paradigm defends a genetic distinction between the *Homo sapiens* and the Neanderthals as two different species. On the extreme theoretical position, one can see Neanderthals as a bunch of brutish, lesser people, randomly walking the landscape looking for dead animals as food, while the intelligent *Homo sapiens sapiens* produced beautiful art and buried their dead. Typologies are one of the tools that are used to mark the difference between the two cultures, based mostly on type-fossils. This model emphasizes cladogenesis over anagenesis, resulting in an evolutionary dendritic phylogeny. Also, it sees the existence of a series of adaptive radiations out of Africa, with the replacement of Neanderthals and archaic *Homo sapiens* by the new Modern Humans. Naturally, the followers of this paradigm believe in a large gap in the culture, both material and cognitive, of the two groups. The general belief is that of a lack of admixture, genetic or cultural, between the two groups.

One of the fields that gave strength to the replacement model was the development of the Mitochondrial DNA in the mid 1980's with the work of Rebecca Cann, Mark Stoneking and Allan Wilson (Cann et al., 1987 and 1994). Their work came to show that human origins were African (what the press called the black Eve) and that those origins came from a single mother about 200,000 years ago and, thus, Neanderthals had no contribution to our genes.

Although for the last two decades, Mitochondrial DNA studies improved immensely, data are never clear cut. In fact, the new data reinforced the opposite paradigm – the continuity or multiregional hypothesis (Clark, 1992, 2001, 2002). On one hand, Mitochondrial DNA points to a single origin for modern humans, leaving Neanderthals outside our evolution line (Krings et al, 1999; Caramelli et al., 2003). On the other, DNA studies (Gagneux et al., 1999) show a much higher diversity within subspecies of other close related species such as the Chimpanzee, than the difference between Neanderthals and Modern humans. This fact implies that the genetic difference between the two Homo groups is within the known diversity for a mammalian species similar to ours. The corollary is that modern humans and Neanderthals belong to the same species.

The supporters of the continuity paradigm don't make a distinction between the archaic *Homo sapiens* and the Neanderthal (Clark, 1992, 2001, 2002). Unlike the replacement advocates, they believe that there was a single, but prolonged hominid radiation out of Africa with *Homo erectus*. This means that the biological evolution to reach the modern humans morphology happened within the geographical distribution of the *Homo erectus*, evolving through the archaic *Homo sapiens*. Based on this assumption, and contrarily to the Replacement paradigm, the continuity model sees a slow mitochondrial DNA substitution rate, starting sometime around 850,000 years ago. Since there is no distinction between Neanderthals and the archaic forms of *Homo sapiens*, speciation is seen as anagenic instead of cladogenic and, thus, is represented by a reticulate phylogeny. In this view, there was necessarily a great genetic admixture among all the different regional and chronological subspecies of *Homo sapiens*, and, of course, a biological continuity and not a replacement of one species, that is the Neanderthal, by another – the *Homo sapiens sapiens*.

Interestingly, in Portugal, if not all, most Paleolithic archaeologists defend the continuity paradigm, although very rarely they do apply it to our own country.

There seems to be two main perspectives. One, headed by Zilhão, defends an initial separate cultural evolution for the late Neanderthals of the Southwestern France – Northern Spain core area (Zilhão, 1998, 2000, 2002; Zilhão and d'Errico, 1999, 2000;

d'Errico et al., 1998). Neanderthals became the actors of the Upper Paleolithic Revolution in the area, with the transformation from the Middle Paleolithic material culture, the Mousterian, to the Upper Paleolithic with the Chatelperronian. That is, the extensive use of a flake tradition to that of a blade technology to which the development of art was added. Slightly later, around 35,000 BP, the modern humans arrived to the northern most region of Iberia bringing the Aurignacian culture. With the arrival of the *Homo sapiens sapiens* either the local Neanderthal population went extinct or was pushed down to the South, creating the so-called Ebro Frontier. Sometime during this period or immediately after, there was a genetic admixture between the Aurignacian modern humans and the southern Mousterian Neanderthal people, creating a hybrid group that gave place to the Gravettian people of Portugal, such as the specimen found in Lagar Velho, Leiria, known as the Lapedo child (Duarte et al., 1999; Zilhão and Trinkaus (eds.), 2002). This process was a gradual, linear wave of advance in 3 steps, starting sometime around 30,000 BP (Zilhão and Trinkaus, 2002). The first step is marked by a hybrid zone, showing a gradient increase in Neanderthal features towards the southwest. A second phase sees this gradient compressed to Portugal and southwestern Spain. Finally, a third phase when modern humans with Neanderthal traits are present only in Portugal, probably between 28 and 23,000 BP, corresponding to the presence of the Gravettian. The interesting aspect that should be noted in this model is that though there was genetic mixture, there was no impact on the modern human culture coming from the Neanderthal Mousterian material culture.

On the opposite side, we can find Raposo´s perspective (Raposo, 2000; Raposo and Cardoso, 1998a). In his model, the contact between Neanderthals and Modern Humans happened very early. The model defends an advance of modern humans in Europe through a central corridor starting around 43,000 BP. On the edges of this corridor, there are contacts between the populations of modern humans and Neanderthals, located both to the North and to the South of the corridor. These contacts result in the appearance of new Neanderthal cultures, thought to be transitional, such as the Ulluzian in Italy or the Szeletian in central Europe. In the core area the contact between the two populations develops the Chatelperronian, culture with Upper Paleolithic characteristics but made by Neanderthals. The Chatelperronian, like the other transitional industries, are the result of different levels of acculturation by the Neanderthals, which, of course, may have had also an impact on the genetic pool of both populations. Though this model defends an admixture between the two populations, both at the cultural and genetic levels for most of Europe, in Portugal there seems to have been no contact between Neanderthals and modern humans. The result is that Neanderthals still had a Middle Paleolithic Culture, that is, the Mousterian, at the moment of their extinction sometime around 27,000 years ago, while the first modern humans (with an Upper Paleolithic culture) in Portugal are represented by the Gravettian (Raposo 2000). In this model there is no Aurignacian phase in Portugal (Bicho, 2000a, 2000b).

To resolve the question of the transition or replacement of Neanderthals by modern humans in Portugal and, thus, test the two models, one needs to focus on a set of specific assumptions and data, basic to the rational of each model just presented before.

There seems to be three key elements to resolve the debate: one is the dating results and methods; the second is the existence or not of an Aurignacian phase in Portugal; and the third are the patterns seen in the dating results from Iberian sites. All these key features can be examined through a critical review of site formation processes and the dating results.

4. Critical review of Portuguese chronology, sites and data

The chronology for the period of transition from the Neanderthal to modern humans can be considered, in a general way, ranging from 45,000 to 25,000 BP. For Iberia there are more than 260 dates, mostly by Radiocarbon (both standard and AMS), Uranium series, ESR, and Luminescence, both TL and OSL (appendix 1). For Portugal only, we have a total of near 60 dates. Some have to be rejected for reasons that we don't understand, but it is clear that the results are incorrect. Sometimes, some of these dates, though wrong, clue us in on the preservation of the site.

This section will focus on two major aspects: the problems in the use of different methods; and the questions relative to the chronological meaning of dates and their association to cultural horizons.

Most dates for Portugal, as for Iberia during this period, are results of radiocarbon dating. There are, however, a few sites with Uranium series, TL and OSL. The radiocarbon dates come from 12 sites, spreading from Algarve up to Pombal. Other methods were used at 9 sites, ranging in the same general geographical area, but extended northeast to the Côa Valley. While a few dates are visibly wrong, likely due to sample contamination, and should be discard, the rest are in good accordance with the stratigraphy and the cultural context. A few aspects, however, should be mentioned. These are the dates from Pego do Diabo, Caldeirão, Conceição, Lagoa do Bordoal and, in general, the relation between radiocarbon results and those obtained from other methods.

The dates from Pego do Diabo will be mentioned later, when I address the problem of the Portuguese Aurignacian. The site of Caldeirão is one of the most important prehistoric sites in Portugal (Zilhão, 1995). It has a very long sequence but, unfortunately, it has also been the center of some stratigraphical disturbance as it can be seen by some strange dating results in most Paleolithic levels. In any case, it seems fairly accepted that the radiocarbon dates point to a late Mousterian sometime around 27,500 BP in layer K, followed by an early Gravettian from layer Jb dated to 26,000 BP.

The dates from the sites of Lagoa do Bordoal and Conceição, both OSL results, although for different reasons, should be considered as minimum ages. In the first case (Forrest et al., 2003), the results show that there are some vertical migration of single quartz grains from top to bottom, which likely decreased the age of the sample.

In the case of Conceição (Raposo and Cardoso, 1998b), there are two dates, one below the archaeological level of 74,000 BP, and one above with a date of 27,000. Thus, they give respectively *terminus post quem* and *terminus ante quem* for the Mousterian occupation.

The other sites that have interesting results are Cardina I and Olga Grande 4, that date by TL the local Gravettian to between 29 and 28,000 BP (Aubry et al., 2002; Mercier et al., 2001). Attending to the difference between calendric and radioncarbon years, these results seem to agree when compared to the radiocarbon dates for the Gravettian and the very late Mousterian in other areas of Portugal. The latter seem to put the end of the Middle Paleolithic sometime around 27,000 and the start of Gravettian around 26,500 BP in the area from Pombal to the Algarve, at least in radiocarbon years. However, these OSL results need to be compared to those uncalibrated radiocarbon dates. And this fact brings us to the problem related to the Radiocarbon calibration.

Unlike what was thought for decades after Willard Libby discovered the C14 method, the radiocarbon calendar is not identical to the astronomical calendar. The reason for this is that one of the premises developed by Libby, that the concentration of the isotope carbon 14 in the atmosphere remained constant through time, is incorrect. In fact, there have been major oscillations in the atmospheric content of C14, which is dependent on the fluctuations of the earth's geomagnetic field. These oscillations are known as secular variations of the radiocarbon and are better known for the Holocene. In any case, the development of calibration curves was based first on dendrochronology, and then on Uranium series. The dendrochronological data reach, at present, a date around 12,000 Cal BP, while the U-series helped to construct a calibration curve that is internationally accepted back to around 25,000 years after the international conference in 2003 in Nagoya. Before that the accepted calibration curve ranged to about 20,000 years.

The critical period for the understanding of the Neanderthal-modern human transition between 45 and 25,000 BP is completely outside of the calibration range just mentioned. What is then the situation for that period? In 1998, Tjeerd Van Andel published a paper in Antiquity, following the work of Laj and his colleagues (1996), where he proposed that it was possible to carry a correction of the radiocarbon calendar curve. This correction was based on a curve of geomagnetic intensity.

This type of correction has been severely criticized by different authors, from which Van Der Plicht (1999) is the most notorious. This radiocarbon expert argued for the presence of two main problems in Van Andel's model: the geomagnetic data used for the correction are not suitable for such enterprise; and that the available data are not yet coherent or large enough for a solid and significant calibration.

Since then, however, various laboratories have developed calibration curves that extend the procedure to more than 45,000 BP. That is the case of the Cologne Radiocarbon Calibration & Paleoclimate Research Package, that allows both download of the software package as well as online calibrations of dates up to 50,000 BP (Jöris and Weninger, 1998, 2003). This method is based on paleoclimate and geomagnetic proxies.

Since the transition period is on the limit of the radiocarbon dating range, the other methods are used more and more frequently to fill the gaps whenever it is necessary. The main positive aspect of the calibration for this period is the fact that different methods could be compared.

Life, however, is never simple, and the fact is that data on calibration between 25 and 40,000 BP show some serious problems that need to be resolved before we can calibrate C14 and be able to compare the different methods (Van der Plicht, in print). There are two main sequences dated that have been used to analyze the difference between the radiocarbon and calendric years. These are the long dated sequence from the Lake Suigetsu in Japan and the AMS dated speleothem from the Bahamas. The sequence from the Suigetsu Lake is composed of 330 radiocarbon dates from a floating varve stratigraphy that dates to between 8,800 and 38,000 calibrated years BP. The possible error is estimated on no more than 2,000 years, and it exists due to miscounting the varves.

The Bahamas speleothem has also close to 300 radiocarbon dates that are paired with Uranium series dates. Since the samples are not terrestrial, there is the need to correct for the reservoir ocean effect, which is known to be close to 1,500 years. Also, there is a gap in the dates due to a slower speleothem formation around 27 K.

The data from the two calibration sequences agree fairly well to about 25,000 years Cal BP (Figure 1). However, data after that moment are in complete disagreement, for reasons that are still unknown. As you can see here in Figure 2, the data from Suigetsu show a trend of an increased radiocarbon age of about 3,000 years after 25,000 to about 35 K and a decrease to zero 10,000 years earlier (suggesting that the radiocarbon atmospheric content was very similar to that of the present).

The Bahamas speleothem data, however, indicate a steady increase in the difference, marked at certain points by major oscillations. These are likely to be the result of changes in the planet's magnetic field intensity or in the solar electromagnetic field (Van der Plicht, in print).

In conclusion, the two curves do not agree after 25,000 Cal BP – the practical result is that no calibration curves can be produced at this time. Consequently, U-series, TL and OSL, and ESR dates cannot be combined with those from Radiocarbon to pinpoint the moments of extinction of the Neanderthals, the disappearance of Mousterian and Chatelperronian, or the emergence of Modern Humans, of the Aurignacian or the Gravettian. Each set of dates should be analyzed by itself and any link between the two, that is radiocarbon and the other methods, basically leads to a compounded error with very negative results. It is evident that to be able to compare the various methods there has to be a calibration of the Radiocarbon back to at least 45,000, as well as the confirmation that the atomic clock for the other methods is identical to that of the astronomical calendar. These are yet to be determined or developed!

The question of the Aurignacian in Portugal

The question of the Aurignacian in Portugal is a very interesting one. Zilhão in his dissertation has argued for the presence of Aurignacian in Portugal based on a set of sites and lithic assemblages (Zilhão 1995). There are a total of 5 sites, namely, Pego do Diabo, Salemas and Escoural caves, and the two open air sites in Rio Maior, Vale de Porcos and Vascas. Recently, Thacker (2001) excavated another open air site, also in the Rio Maior area that is identical to Vale de Porcos. According to Zilhão (1995: 4: 36 and quadro 4.6; 5.2 – vol. 1), there are two functional facies, corresponding to the two types of sites. The cave sites are logistic camps with very short occupations where projectile points were discarded, while the open air camps are the locales where those bladelets were produced. The Aurignacian chronology in Portugal is late, around 28,000 BP as it is indicated by both a date from Pego do Diabo and the typology of the weaponry. This is a type of Dufour bladelet that in Southern France and Northern Spain, are one of the type-fossils of the late Aurignacian. In Portugal, although in a variety of forms, they are present through out the Upper Paleolithic with a higher incidence during the Magdalenian and immediately after, during the Epipaleolithic.

According to Zilhão (Zilhão 1995: parte 1 – vol. 2), there is a total of five fragments and a complete Dufour bladelet in Pego do Diabo, out of 11 retouched tools and 32 lithic artifacts. The other Dufour bladelets are coming from Salemas and Escoural. Salemas cave is a multicomponent site with Mousterian, Gravettian, Proto-Solutrean and Solutrean. The Aurignacian artifacts are only 3 Dufour bladelet fragments removed from the Gravettian levels where backed bladelets are present. Escoural cave is also a multicomponent site with Mousterian, Solutrean and Neolithic human occupations. Zilhão found 1 complete and 3 fragments of Dufour bladelets among the hundreds of artifact boxes filled with artifacts from the excavations in the 1960's and 1970's.

Vascas open air site was excavated in 1952 and 1953 by Manuel Heleno. The artifacts are in the National Museum of Archaeology in Lisbon. The site was a multicomponent site with Early and Late Gravettian, Proto-solutrean, Solutrean and Magdalenian with a total of close to 4000 artifacts. From these, Zilhão (1995: cap. 3 – vol. 2) attributed about 3200 pieces to the Aurignacian based on patination, presence/absence of manganese and iron concretions, typology, and size of the artifacts. The latter two criteria, and the most important, were used because of the similarities with Vale de Porcos material. No Dufour bladelets were found at this site.

Vale de Porcos was excavated in the same years as Vascas, also by Heleno. In 1975, GEPP relocated the site and found another locus, known as Vale de Porcos II. The materials from the original site total close to 800 artifacts with less than 150 retouched tools (Zilhão, 1995: cap. 4 – vol. 2). No Dufour bladelets or backed bladelets were found in this collection. The assemblage from Vale de Porcos II is basically identical to the old collection. The attribution of Vale de Porcos to the Aurignacian is based on the presence of carinated endscrapers, and certain technological atributes that separate this collection from the other Upper Paleolithic assemblages studied by Zilhão. These technological aspects are related to the production and size of the blades. In what concerns the size, it is clear that the blades from Vale de Porcos (and from Vascas) are larger than the other Upper Paleolithic assemblages, not only from the statistical point of view, but also from a visual point of view. When one holds a blade from Vale de Porcos (or Vascas or Chainça, the site excavated by Paul Thacker), it is clearly very different from any other blade coming from other assemblages. Other distinctive attributes are the presence of lipped platforms, the use of core edge abrasion, and abnormal high frequency in the production of crested blades (Zilhão, 1995: 5.2 a 5.4 – vol. 1). This latter attribute is identified through the ratio crested / non crested blades in the so called Aurignacian assemblages.

The frequency of the former two characteristics, that is the lipped platform and the abrasion of the core edge, is very high and distinctive when compared to other Upper Paleolithic assemblages, except for the case of the Fontesantian, a late Gravettian facies from Portuguese Estremadura. According to Zilhão (1995: 3.14 and quadro 3.5), the ratio between the blades with lipped platform and core edge abrasion and the other blades show a clear difference between the Aurignacian and the other Upper Paleolithic industries.

In fact, Zilhão's argument for the presence of the Aurignacian stands on 3 key elements: the 28,000 year old date from Pego do Diabo, the Dufour bladelets thought to be associated with the date, and the technological characteristics of the blade production from Vale de Porcos, when compared to the other Upper Paleolithic assemblages.

Thus, his model arguing for the presence of Aurignacian in Portugal should be able to stand an evaluation of the site formation processes of Pego do Diabo as well as a review of the main blade technological attributes from Vale de Porcos and Vascas.

From within the Vale de Porcos and Vascas blade assemblages, perhaps the most distinct one is the crested blade labeled 1 in Figure 3. The distinctiveness comes from its size, both length and width, as well as by the fact that it is crested, simultaneously reflecting the use of that technique and the very large size so frequent and statistically different in these assemblages. This same piece resembles in many details another crested blade (blade 2 in Figure 3) from a site excavated in 1992 – Quinta do Sanguinhal. The resemblance was so great that it was decided to study both Vale de Porcos and Quinta do Sanguinhal and compare the results. It should be noted that because of the presence of a series of Microgravette points (and also the presence of high numbers of blades and burins) during the excavation, Quinta do Sanguinhal was attributed to the Gravettian. Thus, if the two lithic assemblages were identical, one could argue for a new cultural classification of Vascas, Vale de Porcos and Chainça, that of the Gravettian.

Sanguinhal is a very small site, corresponding to a short occupation. It is located, like Vale de Porcos and Vascas, on top of good quality flint nodules of large dimensions. From the functional point of view, Quinta do Sanguinhal was a small quarry and workshop to produce blades and bladelets. The site is spread over only 4 sq. meters and has a few thousand pieces, 8 cores and 8 retouched tools. From these, it should be noted the presence of 2 microgravettes and 4 burins. Few blades are complete and extensive refitting, most of it carried out by Francisco Almeida (2000), shows that high numbers of blanks were taken from the site. The refitting also shows that although typologically these retouched tools are burins, technologically speaking they are cores and follow a similar reduction sequence to that of the cores, producing bladelets.

When the technological data is compared between Quinta do Sanguinhal and Vale de Porcos the results could not be any clearer. Two types of attributes were compared: numerical and categorical. In the first set, length, width and thickness were compared. The sample size was different, but still valid. Both width and thickness samples were larger with a total of close to 200 blades from Vale de Porcos and 60 from Quinta do Sanguinhal. The length sample was slightly smaller due to blade brakeage. One Way Analysis of Variance, also known as ANOVA, was run on all three variables. The results were explained on the basis of the P Values, with three levels of significance (Bicho, 2000c: 107): between .000 and .01 were considered significantly different, between .01 and .05 as moderately different and above .05 as not different. The results are clear. The P Values (Table 1) were respectively for length, width and thickness of .75, .25 and .52, thus indicating that the two assemblages are statistically identical, aspect that the visual analysis had already suggested.

The categorical variables were those pointed out by Zilhão (1995: 3.14 and quadro 3.5) as the key elements that isolated the Aurignacian assemblages from the other Upper Paleolithic lithic collections – ratio of blades-crested blades, frequency of lipped platform and of core edge abrasion on both total and non-cortical blades and, finally, frequency of blades with lipped platform and platform edge abrasion during the full blade production stages of the reduction sequence. To compare these variables between the two assemblages I ran chi-square tests of independence for each variable (Table 2). Again, the P values were used to explain the significance of the numerical outcome. The results are again very significant, suggesting identical assemblages in what concerns all categorical variables except for the presence of lipped platforms. The statistical test shows a significant difference between the two assemblages, due to the higher frequency of lipped butts in Quinta do Sanguinhal. That is, lipping in Quinta do Sanguinhal is even more frequent than in Vale de Porcos or in the rest of the known Upper Paleolithic assemblages.

TABLE 1. ANOVA results – blades from Vale de Porcos and Quinta do Sanguinhal

Length						
Source	Sum squares	df	Mean square	F	***P value***	Critical F
Between assemblages	41,11102	1	41,11102	0,104467	**0,747366**	3,95886
Within assemblages	31875,96	81	393,5304			
Total	31917,07	82				
Width						
Source	Sum squares	df	Mean square	F	***P value***	Critical F
Between assemblages	60,01264	1	60,01264	1,313246	**0,252917**	3,879379
Within assemblages	11287,39	247	45,69794			
Total	11347,4	248				
Thickness						
Source	Sum squares	df	Mean square	F	***P value***	Critical F
Between assemblages	6,068018	1	6,068018	0,423687	**0,51571**	3,879535
Within assemblages	3523,194	246	14,32193			
Total	3529,262	247				

TABLE 2. χ^2 results from Vale de Porcos e Quinta do Sanguinhal

Variables	χ^2	gl	**P Value**
Lipping	6.78	1	**.01 > P > .0075**
Core edge abrasion	1.76	1	**.9 > P > .1**
Ratio blades/crested blades	.0002	1	**.99 > P > .975**
Lipping in non cortical blades	.156	1	**.9 > P > .1**
Core edge abrasion in non cortical blades	.312	1	**.1 > P > .05**
Non cortical blades with lipping and core edge abrasion	.056	1	**.9 > P >. 05**

Although the statistical results are very clear, other empirical information is also evident – the general technological and typological morphology as well as the raw material choice also points to identical assemblages. Just look at the blades in Figure 4 – they are from Vascas, Vale de Porcos I and Quinta do Sanguinhal – as one can notice, they are very similar in their general attributes.

A different line of evidence was also found during the reanalysis of the Vale de Porcos assemblage: a fragment of a backed bladelet was found mixed in a bag of burin spalls. Thus, just as in Quinta do Sanguinhal, backed bladelets are present in very low numbers.

In conclusion, it seems very clear that Vale de Porcos, and consequently Vascas and Chainça, are identical to Quinta do Sanguinhal. Since this site is Gravettian, then and necessarily, the so-called Aurignacian open air sites are, in fact, Gravettian. The question is why are they so different from the other Gravettian assemblages that are known for the same area, that is the Rio Maior region. It is likely that the differences reside on the location and function of these sites. Presently, they are the only studied sites located on top of the raw material where there are nodules of good quality and of large dimensions – and, just as Zilhão (1995: 5.4 – vol. 1) suggested in his dissertation, the nodules were used for producing large blades. Thus, the two elements (location and function) seem to explain the technological and typological differences between these assemblages and the other Gravettian sites.

One of the fundamental points of the existence of the Aurignacian, that is the presence of open air sites that produced the blanks for the microlithic weaponry found in the caves, is now dismissed. Let's now review the data of the site formation processes of Pego do Diabo cave and evaluate the integrity of the deposits and the validity of the interpretation of the 28,000 year old date.

Pego do Diabo was excavated twice, first in 1976 and then again in 1988-89 (Zilhão, 1995: cap. 7 – vol. 2). The site is located near Lisbon, some 250 meters of altitude, overlooking the southern side of the Loures River valley. It is opened in a high point of the limestone bedrock. It is a narrow chamber, about 13 meters long. The stratigraphy of Pego do Diabo is fairly simple, with 6 geological layers (Figure 5). The top layer, A, is of recent Holocene age. Layer 1 is present only in certain areas of the cave, and is, according to Zilhão, the redeposition of the lower layer. Layer 2 corresponds to the Aurignacian occupation, documented by the presence of fauna and lithic artifacts. Layer 3 and 4 present a few artifacts and some fauna that were not considered to be culturally or chronologically diagnostic. The lowest layer, 5, is sterile.

There are four sets of data available to review the site formation processes of Pego do Diabo Cave: lithic and ceramic artifacts, radiocarbon dates and fauna. I will not deal with the faunal data, since it is not my expertise. It is interesting, however, to note two aspects. First, that the bone preservation is very diverse within the same level, type of bones and species. This is the case of the example shown in Figure 6, coming from below the so-called Aurignacian level, where the difference between the caprid tooth and the rest of the fauna is evident. Second, that the zooarchaeological study carried out by Valente (2000) in her masters thesis showed that although there are signs of anthropic induced fauna, a large fraction of the fauna present at the cave is the result of carnivore activity at the site.

In what concerns the lithic and ceramic artifacts, the first aspect that needs to be reviewed is their distribution. The excavation was carried out on a total of 19 square meters. Lithic artifacts were present in only 13 squares, and in the case of layer 2, the so called Aurignacian level, lithic artifacts were in only 12. Ceramics, on the other hand, were present in 10 of those squares, with a very similar spatial distribution to the lithics in layer 2 (Figure 7).

The vertical distribution also seems to present a very distinct pattern (Table 3). There are a total of 2 lithic artifacts and 43 ceramic fragments in the top layer. Layer 2 has produced 30 lithic pieces and more than 160 sherds. Layers 3 and 4 combined have 11 lithic artifacts and 5 sherds, apparently with a slight different spatial pattern. From this very easy horizontal and vertical spatial empirical analysis it is clear that layer two is the result of a severe taphonomic action, where mixing of Paleolithic, possibly of different ages, and recent Historical materials took place. It should be noted that from those 200 ceramic fragments of different sizes, only 3 from layer 1 were 3D plotted, while all the other were collected in the screens.

TABLE 3. Artifact distribution by geologic layers, Gruta do Pego do Diabo

	Lithic artifacts	Ceramic fragments
Layer 1	2	43
Layer 2	30	161
Layer 3 and 4	11	5

The ceramic fragments show a very diverse chronology. There are some prehistoric materials, but also roman and even modern porcelain. This variability in ceramic materials and chronology, mixed with Paleolithic artifacts, again, indicates that the site is severely disturbed.

In what concerns the lithic artifacts, and from a typological point of view, it is interesting to note that there are various components that Zilhão (1995) did not notice (or at least, did not present in his dissertation). During the excavation, there were sections of the stratigraphy that were apparently disturbed. Artifacts from these areas were collected without provenience. From this collection, there is a small microgravette point (Figure 8) made of red flint. Its typology is similar to those found in both Gravettian and Magdalenian contexts of Estremadura. One should, however, refer its physical aspect, that is the weathering and patina of the artifact, since it is very different from the other microlithic pieces found in layer 2. On the other hand, from the typological point of view it is similar to a straight backed point said to belong to the Aurignacian level.

The other key element is the presence of a small assemblage of lithic materials that by its technological and raw material characteristics appear to be very different from the rest of the collection (Figure 9). They are only 11 artifacts, ranging from chips to discoidal flakes and one notch. They are made on a white chert with very fine and homogenous grain and that is very distinctive from the rest of the lithic artifacts from Pego do Diabo. These artifacts are coming mostly from layer 3, but there are a few pieces from layer 4, one piece from layer 2 and a couple from the mixed zone. In any case, it seems to suggest the presence of a Mousterian occupation, probably of very short duration at the site.

Lets now focus on the dating results from Pego do Diabo (Table 4). There are 4 dates, 3 from layer 2 and one from layer 3. There is a result of 2,400 BP, obtained from disperse charcoal fragments from layer 2 in square M13. The date is clearly the result of mixing and a good evidence of disturbance of the site sequence. The other 3 dates are on bone. All samples were composed of various fragments of long bones of large mammals and, in one case, some rabbit bones were also added to the sample. The first two samples came from squares M11 and L11, while the third sample came from M13 and M14. This sample yielded a result of 18,600 BP, while the results of the others where, from bottom to top, respectively about 28 and 23,000. Although these two dates are in good stratigraphical accordance, the group of 4 dates shows a clear mixed stratigraphical context, which is obviously confirmed by the other archaeological evidence. In the case of the dates from Layer 2, it seems probable that some of the bones that compose the samples have different proveniences within the two squares and the thickness of each stratigraphical subdivision. The older date is probably a mix of younger and older carbon coming from vertically disturbed bones, as happened with both ceramics and lithic artifacts. The older bones are likely coming from the Mousterian occupation.

TABLE 4. Radiocabon dates from Gruta do Pego do Diabo

Unit	Layer	Date BP	Lab #	Material
L/M11	Layer 2a	23,080±490	ICEN-490	macrofauna
L/M11	Layer 2b	28,120 -780 +860	ICEN-732	macrofauna
M13	Layer 2	2,410±80	ICEN-306	Charcoal
M13/14	Layer 3	18,630±640	ICEN-491	Rabbit and macrofauna

In summary, it is clear that Pego do Diabo suffered severe stratigraphical disturbance, as shown by the vertical and horizontal spread of prehistoric, roman and modern ceramics through out the site. The lithic artifacts, as well as the dating results, also show some mixing of the deposits.

The attribution of the Dufour bladelets present at Pego do Diabo to either the Gravettian or Magdalenian, most likely the former, might be a more parsimonious way to explain their presence at the site. Note that there are other microlithic weaponry, that is the microgravette and straight backed bladelet that are typical of those periods. Finally, the clear evidence of the presence of Mousterian, immediately under laying the sampled area can help to explain the very old date found at the base of Layer 2.

So, from my point of view, it seems clear that there is no clear evidence for Aurignacian in Portugal. Thus, it seems that the first Upper Paleolithic people in the Portuguese territory carried a Gravettian tool kit and the respective cultural characteristics of that period. With this model, a few of questions come to mind:

- When did the Neanderthal extinction in Iberia and in Portugal take place?
- When was the first modern human occupation of Iberia and of Portugal?
- When and where could there have been contact between the two populations?
- What are the dates for the last Aurignacian and the first Gravettian in Iberia and was there a regional difference?
- How many routes did the modern humans take to penetrate in the Iberian space, and what routes did they take?

There are different ways to answer this set of questions. I would like to use two: dates from Iberia during the transitional period and Gravettian stylistic elements found In Portugal.

5. The Neanderthal extinction and the emergence of the Upper Paleolithic

Just I mentioned earlier, there are some 260 dates ranging between 45 and 24,000 BP from close to 70 sites. These sites can be organized in roughly 6 main regions (Figure 10): North, Center-North, Northeast, East, South and West. The Northern region corresponds to the sites in the area along the Bay of Biscay. The Northeast are the sites found in Catalunya, while the Center-North ranges from the Douro basin and the Madrid region up to the Burgos area. The Eastern region is the Valencia area, while the Southern is Andalucia and Algarve. Portuguese Estremadura, Northern Alentejo and the Tagus basin compose the Western region.

Based on the earlier discussion on the radiocarbon calibration and the relation to different methods, there should be no integration of the results. Thus, there are two sets of dating results: radiocarbon on one side; and ESR, TL, OSL and Uranium series on the other. The analysis of each of those two sets of results and its subsequent contrast is very interesting.

Unfortunately, the data set resulting from ESR, Luminescence and U series, formed by close to 60 dates, is not large enough to show any clear patterns across time or space. Radiocarbon dates are in a total of close to 200 dates (Appendix 1). As one would expect, they do not spread uniformly over time but they still form apparent patterns (Figure 11). These, in my opinion, may point to increase in population at certain times, which, in turn, reflect the entrance or the dispersal of a group in the Peninsula. The frequency peak around 41 K corresponds to the appearance of the very early Aurignacian in the North and Northeast of Iberia at sites such as El Castillo, L'Arbreda, Reclau Viver and Abri Romani.

Though not widely accepted, it is important to refer here to Zilhão's and D'Errico's (2003: 317; 1999: 25-30) argument that those dates are not of Aurignacian, but of Mousterian levels that suffered processes of mixing with later (and higher) Aurignacian industries. They also have offered (Zilhão and d'Errico, 2003: 325-326), though not so explicitly as the mixing argument, a different possibility for El Castillo: that those industries might correspond to transitional moments between the Mousterian and the Upper Paleolithic. In either case, it is very hard to explain the presence of such a peak of dates if there is no change in population. It is also difficult to explain how the Aurignacian appeared before in Northern Spain than in the rest of Western Europe if it was made by *Homo sapiens sapiens* as it is believed for so long. Maybe, in fact, the earliest Aurignacian of Northern Spain is not the result of modern humans but of Neanderthals, just like the Chatelperronian. And those very early industries found at those sites might, in fact, be transitional to the Aurignacian and even to the Chatelperronian.

The fact is that there is no biological evidence for this period for the region and thus, it should be considered as a valid possibility. Either way, the problem is certainly based on the poor definition of what Aurignacian is and how it is defined across Europe and the Near East – clearly, the definition masks the reality and unites a wide diversity of things (see also the work of Straus, 2003; and Bon, 2002).

The second peak in the frequency of dates is between 31 and 29 K. This peak clearly corresponds to the dispersal over to the East, Central-North and to the South of the Aurignacian. At the same time there is still a very strong presence of Mousterian sites, mostly in the South and West, but also in the other areas. The Chatelperronian was still present in its little niche in the Northern region. The decrease in the number of dates after 29 K is the result of the disappearance of the Chatelperronian and the rapid diminution of the Aurignacian and the Mousterian until 27,000 BP, when both lithic industries were replaced by a new one – the Gravettian.

This general pattern can be recognized for each region, reflecting the advance waves of the different hominids and cultures. In the Northern region (Figure 12), the Mousterian seems to have lasted all the way to 30 K, while the Chatelperronian started around 37,000 and disappeared 10,000 years later. It should be noted that the Chatelperronian in Iberia is restricted to this area and it seems to have, at least partially, replaced the Mousterian. In fact, with the exception of three dates from La Flecha and El Ruso, all the other dates are prior to the appearance of the Chatelperronian. This fact, suggests that, in general, the Chatelperronian replaced the Mousterian in this area, but sometime around 31 k there seems to have been a new Mousterian advance from the South. The Aurignacian (or the transitional industries plus the Aurignacian) started around 42 K and existed up to 27,000 years ago, followed immediately by the Gravettian.

In the Northern-Center area (Figure 13), the Mousterian lasted up to 29 K. Although there are no dates, there seems to be some evidence for the presence of Aurignacian and Chatelperronian in the area, apparently followed by the Gravettian. Unfortunately, the only dates we have for this lithic industry are on TL, from the Côa Valley, sometime around 28,000 calendric years.

In the Northeastern region there are only dates for the Mousterian and Aurignacian (Figure 14). The former lasted up to 33,000 BP, while the latter, that is the Aurignacian, seems to have started after 40,000 and ended, like the Mousterian around 33 K. This period, however, is likely to be the result of the lack of dates, as it is indicated by the fact that there are no dates for the Gravettian.

The Eastern region (Figure 15) is again marked by the lack of Gravettian dates. The Mousterian seems to have lasted up to 28 K while the Aurignacian started sometime around 34 K and ended around 26,000 years ago.

The Southern region (Figure 16) is also characterized by a very late Mousterian, that lasted up to after 29 K. The Aurignacian probably started slightly prior to 30 K and ended sometime after 28,000 years ago. The Gravettian seems to have arrived in the area around 26,000 years ago, maybe slightly before.

The Western region (Figure 17) is marked by a very late Mousterian that lasted to close to between 27 and 26,000 years ago, and it was replaced by the Gravettian about that time.

In conclusion (Figure 18), the Middle Paleolithic in Iberia was marked by a differential rate of disappearance. While in Northern Iberia the Mousterian was totally replaced by Upper Paleolithic industries, that is the Aurignacian and the Chatelperronian, between 41 and 35,000 years ago, in the Northeastern region that replacement took place only a couple of thousand years later.

In the Eastern, Southern and Central Iberia, Middle Paleolithic technology survived to slightly later than 29 K. The Mousterian apparently had its last breath in Portuguese Estremadura and in the Tagus valley around 27,000 years ago. The scenario for the Neanderthals is almost identical to that of the Middle Paleolithic, except for the presence of the Chatelperronian in the Cantabrian world between 36 and 29 K.

Although many believe that there was no contact between Neanderthals and modern humans, data seem to suggest otherwise (Figure 19). In fact, with the Aurignacian in all regions, except for Portugal and central Spain, there is a clear chronological overlap in each region of the two biological entities, as it can be seen in this slide. Note the area of interface, corresponding to a time and space where Neanderthals and modern humans used the same regions. This interface seems to be mostly in the Northern and Northeastern areas, but also during 2,000 years in Eastern and Southern Iberia.

It is also interesting to see the gradual loss of importance of the Aurignacian advance through Iberia (Figure 20) and the importance of its presence in the Northern region. It seems very clear, that as one approaches the Levantine coast and the Pillars of Hercules, the beginning of the Aurignacian is later and its importance diminishes greatly, ending more or less simultaneously around 27,000 years ago. It is just before this moment that Gravettian technology flourishes and spreads from north to south and to west, starting sometime around 28,000 BP. This new Upper Paleolithic technology reached the western Iberia around 27,000 BP, while apparently replaces the Aurignacian in southern Iberia only 1,000 years later, reaching the Algarve about that time.

Stylistic aspects, based on personal ornaments as well as on art, suggest that the first Upper Paleolithic, that is the Gravettian, arrived in Portugal through two different routes (Figure 21). The first, and apparently more important, comes form the North and enters the Portuguese territory through Central Iberia, via the Douro Basin. Site evidence is seen in the Côa valley with very early TL dates for the Gravettian sites of Cardina and Olga Grande (Aubry et al., 2002; Mercier et al., 2001), as well as by the splendid rock art locations found in the valley. From here, the Early Upper Paleolithic probably found its way to Estremadura, as it is suggested by the cherts found at the Côa sites originating from the Coimbra and Rio Maior areas (Aubry et al., 2002: 73-74; Aubry, 2001: 269) as well as by the Gravettian pendants found in Estremadura (Vanhaeren and d'Errico, 2002).

The second route is that of the Spanish Levantine coast, crossing Gibraltar and occupying Vale Boi, in Western Algarve (Bicho, in print). This is indicated not only by the presence of a diverse and very common bone technology, but also by the choice of shell pendants used in body decoration (Bicho et al., 2003, in print). In addition, this close stylistic similarity is also found in the variety of techniques to produce teeth pendants. This close stylistic proximity seems to last to the end of the Solutrean, when certain weaponry uses the same formal concepts found in the Valencian country, as seen here with these Solutrean points.

Finally, to conclude, I would like to make the following points:

- Neanderthals lasted to as late as 27 to 26,000 years ago in Portugal, just slightly later than in the rest of Iberia;
- They were replaced in Portugal by Modern Humans with a Gravettian technology that arrived via the Douro basin and the Southeastern Spanish coast, apparently earlier in the former – this group might have had two genetic signatures, resulting from possible contacts, both cultural and genetic, in Northern Iberia.
- There was no Aurignacian in Portugal and very little or no contact between the Neanderthals and modern humans in Portugal;
- Finally, that most of the work presented here today was based on the analysis of data that used a series of methods that are found in the field of archaeological methodology. And this, of course, is the subject of the course Prehistoric Archaeology.

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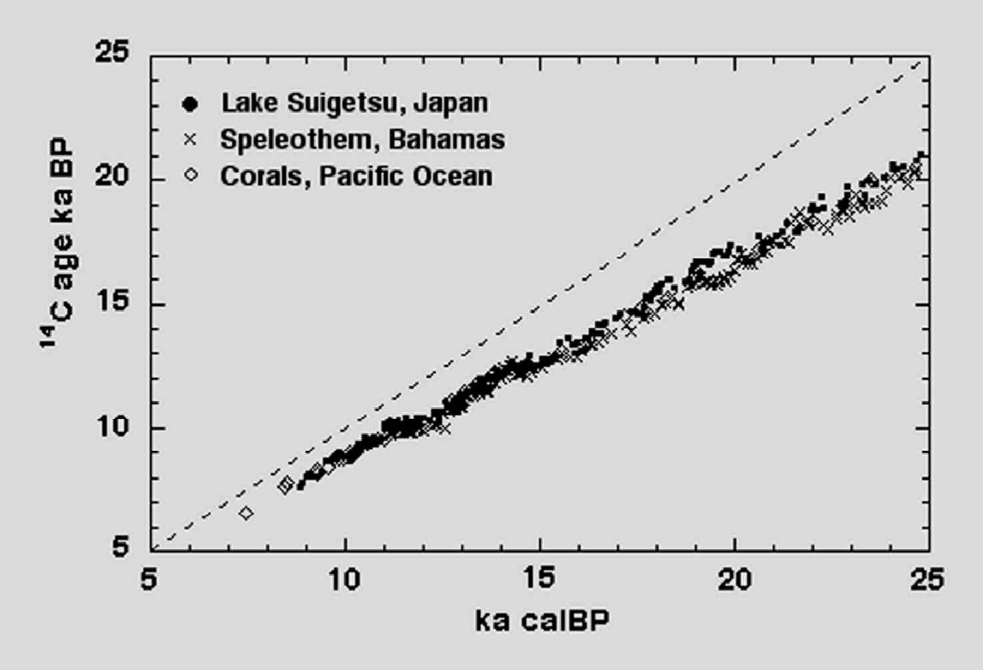

FIGURE 1. Calibration (or comparison) curves for the laminated sediment from Lake Suigetsu, Japan (fig. 2a, ●) and for a Speleothem from the Bahamas (Fig. 2b, ×). Only the deglaciation part is shown here in more detail. Coral datapoints are plotted for comparison (◇). For clarity reasons, the error bars are not plotted here (after Van der Plicht, in press: fig. 3).

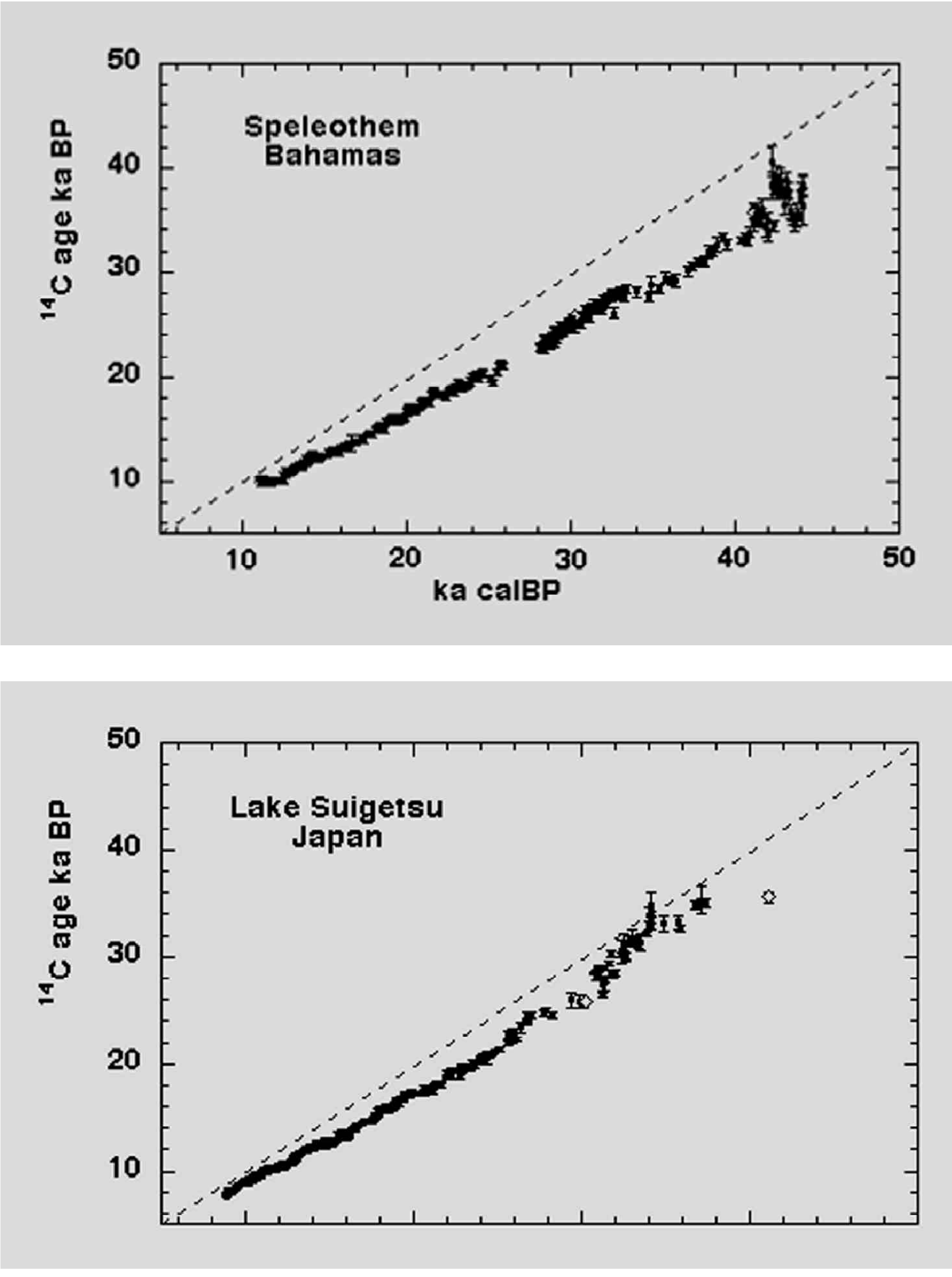

FIGURE 2a and 2b. Calibration (or comparison) curves for the laminated sediment from Lake Suigetsu, Japan (top) and for a Speleothem from the Bahamas (bottom). Note that the curves diverge severly after 25,000 BP (after Van der Plicht, in press: fig. 2a e 2b).

FIGURE 3. Crested blades from Vascas (1) and from Quinta do Sanguinhal (2 and 3).

FIGURE 4. Blades from Vascas (1), Quinta do Sanguinhal (2, 3, 5, 6, 10 and 11) and Vale de Porcos (4, 7, 8 e 9).

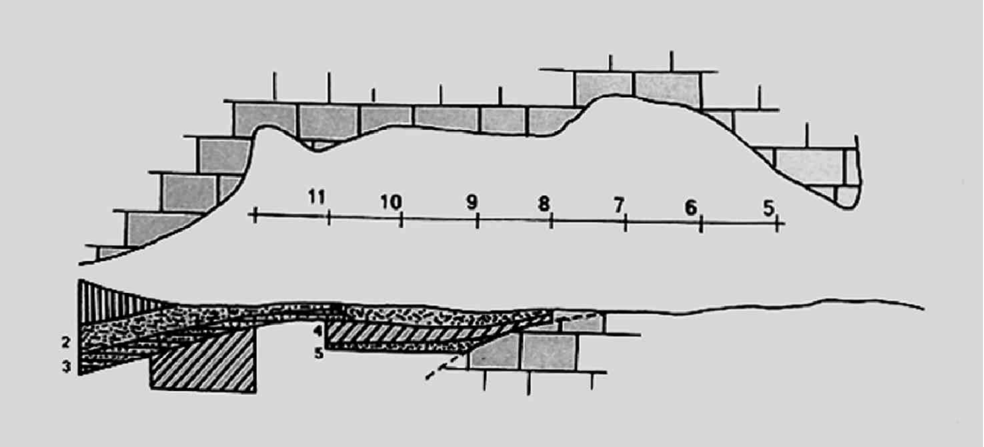

FIGURE 5. Section from Gruta do Pego do Diabo (after Zilhão, 1995: 7-4, fig. 7.2).

FIGURE 6. Fauna from Layer 3, Gruta do Pego do Diabo. Note the difference in color and outside aspect between the caprid tooth and the rest of the material.

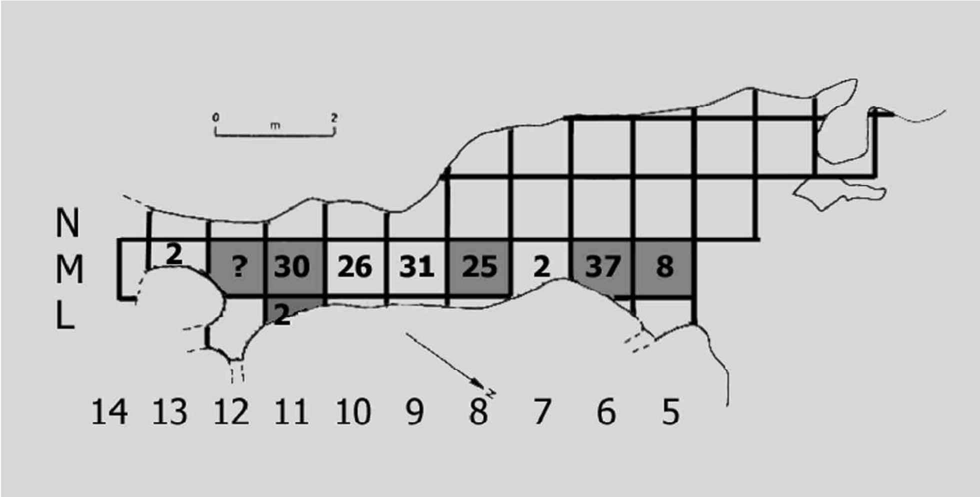

FIGURE 7. Plan view from Gruta do Pego do Diabo. Numbers indicate the frequency of ceramic fragments while the shaded squares show where Dufour bladelets were found (modified after Zilhão, 1995: fig. 7.2).

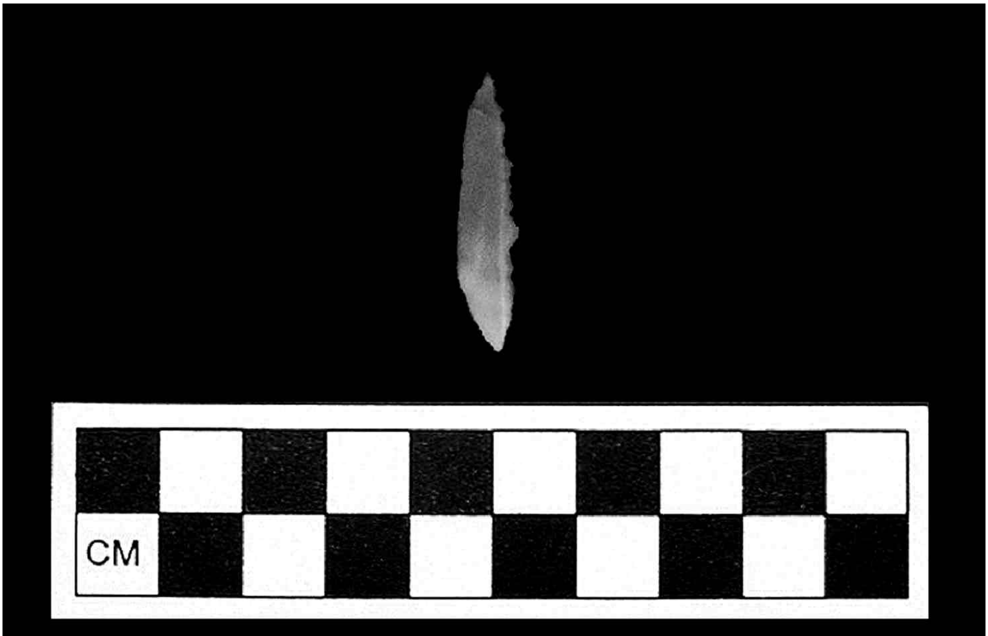

FIGURE 8. Microgravette point from Gruta do Pego do Diabo (from mixed area).

FIGURE 9. Sidescraper from layer 3, Gruta do Pego do Diabo (probably of Mousterian age).

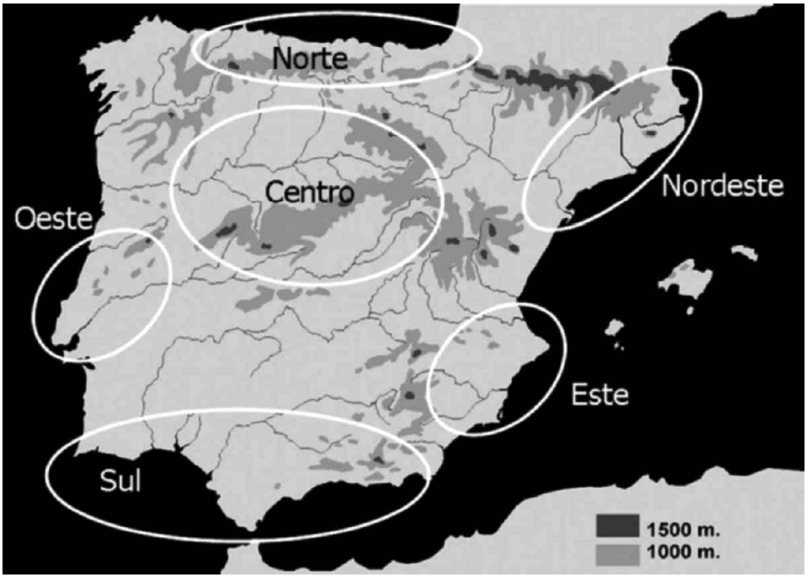

FIGURE 10. Location of archaeological sites dated between 45 and 24,000 BP.

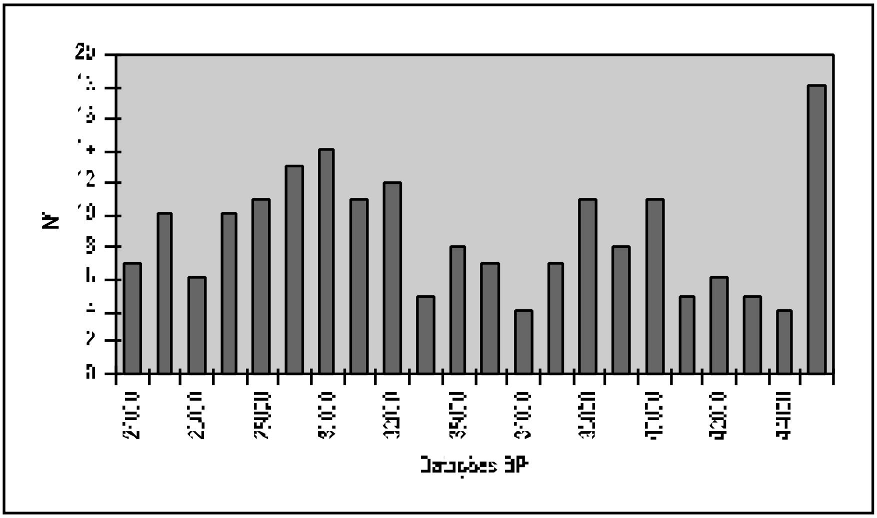

FIGURE 11. Bar graph with all the dates from Iberia between 45 and 24,000 BP (appendix 1).

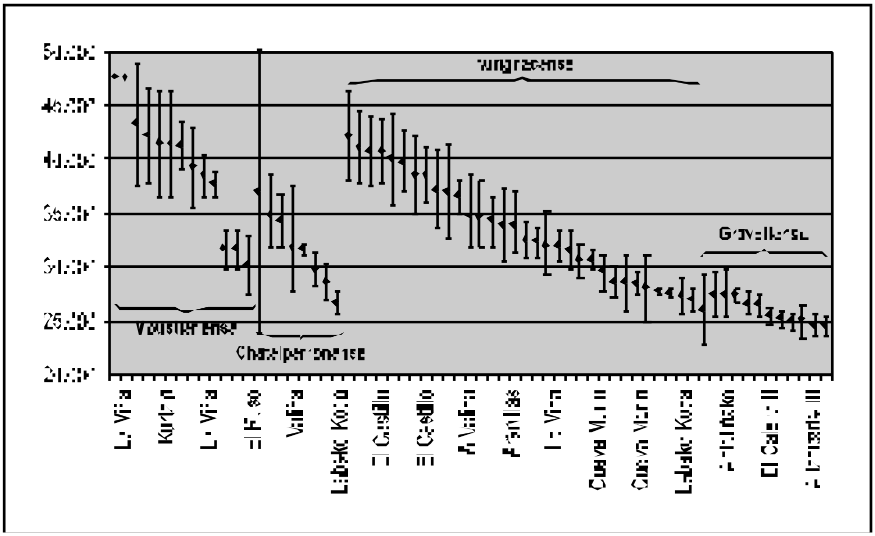

FIGURE 12. Radiocarbon dates from the Northern area.

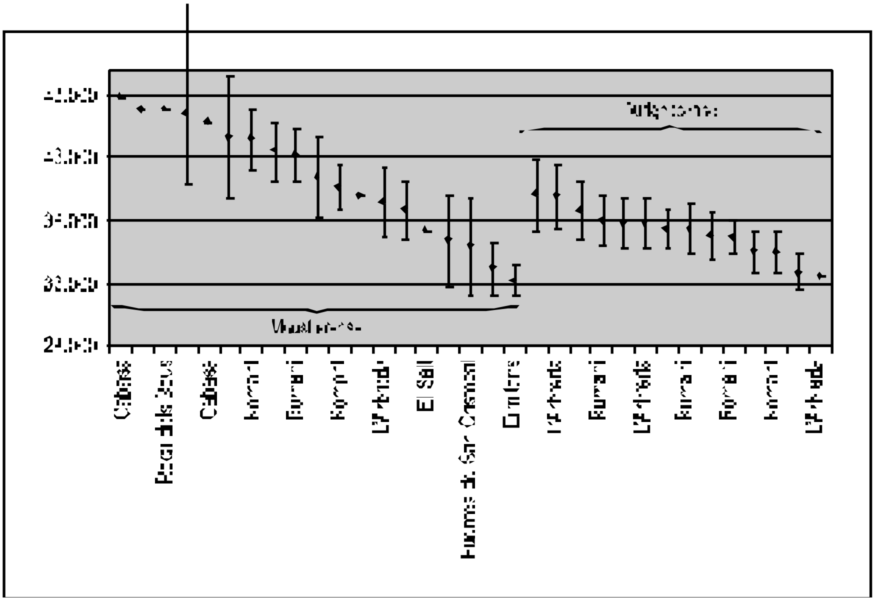

FIGURE 13. Radiocarbon dates from central Iberia.

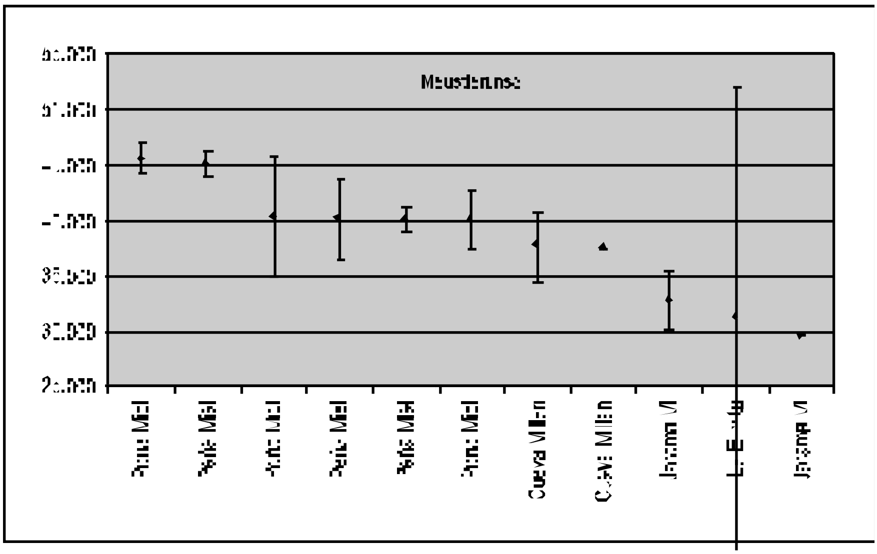

FIGURE 14. Radiocarbon dates from Northeastern Iberia.

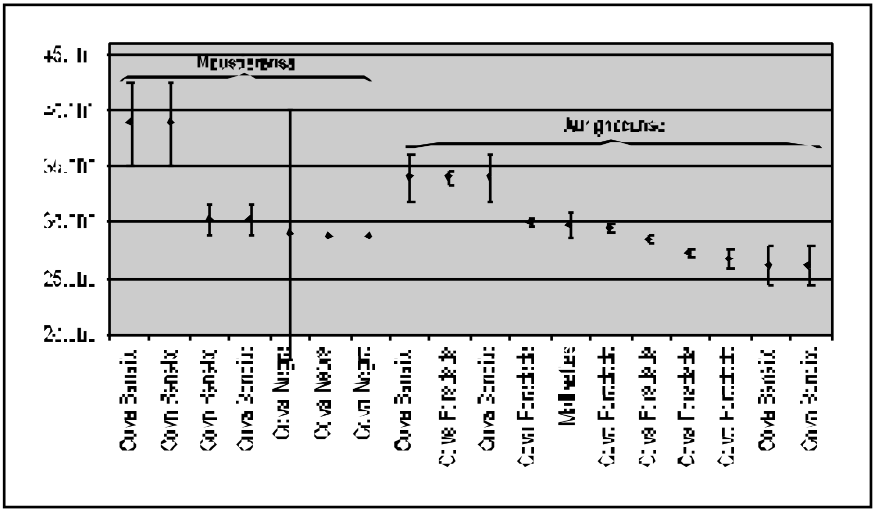

FIGURE 15. Radiocarbon dates from Eastern Iberia.

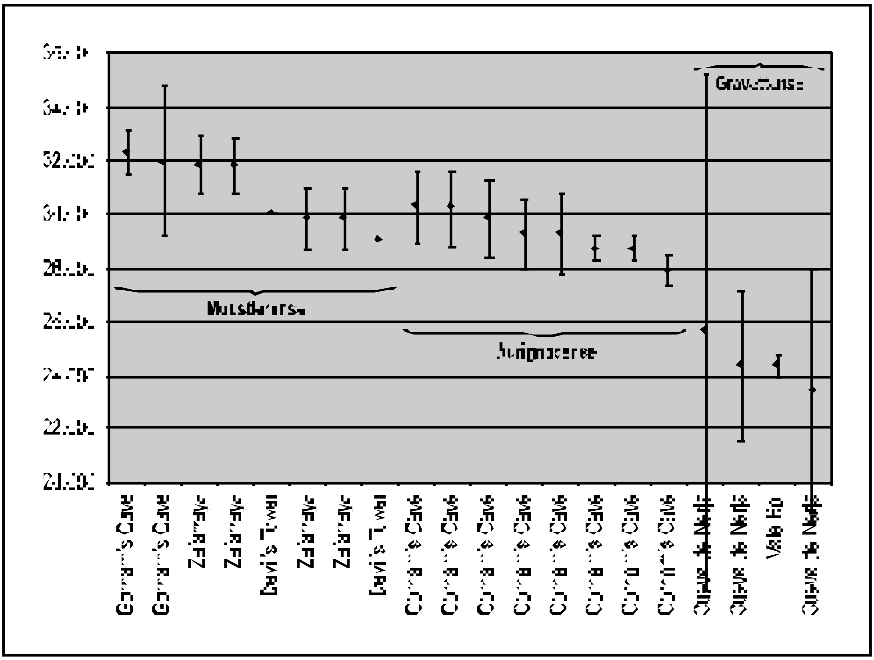

FIGURE 16. Radiocarbon dates from Southern Iberia.

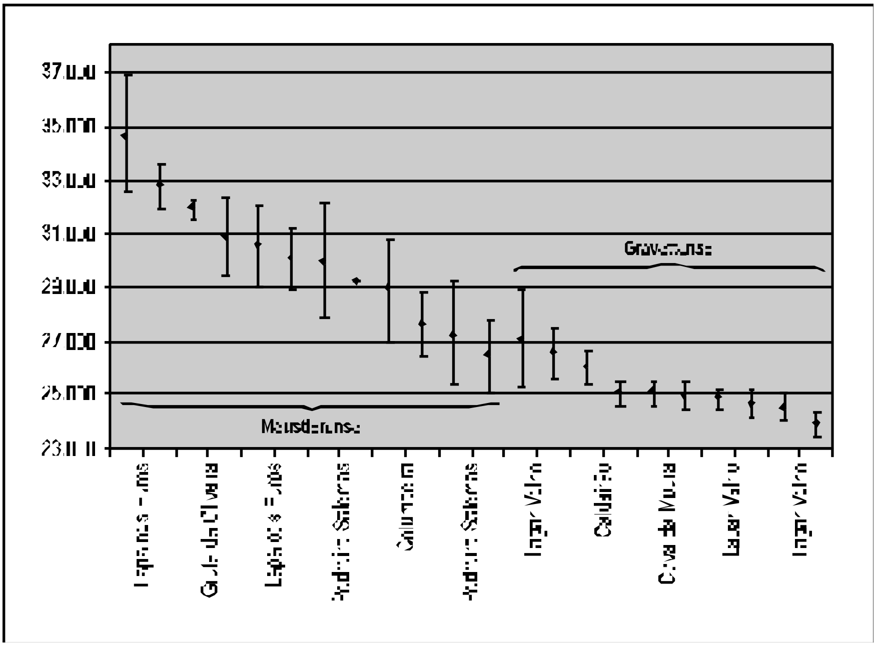

FIGURE 17. Radiocarbon dates from Western Iberia.

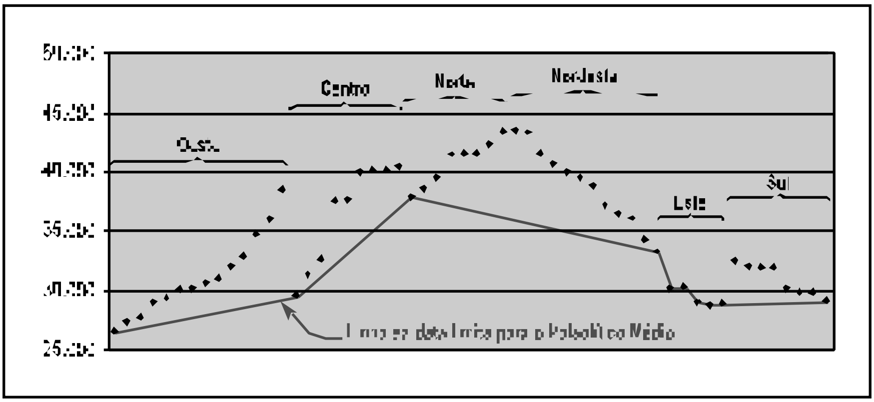

FIGURE 18. Radiocarbon dates showing the end of the Neanderthal occupation in Iberia.

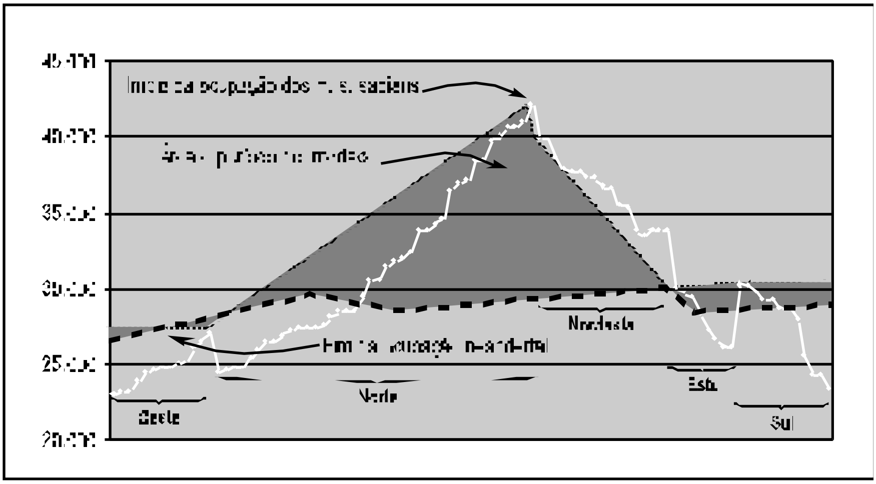

FIGURE 19. Radiocarbon dates showing the end of the Neanderthal occupation and the appearance of modern humans in Iberia. Note that the shaded areas represent the time and space where contact between the two groups might have occurred.

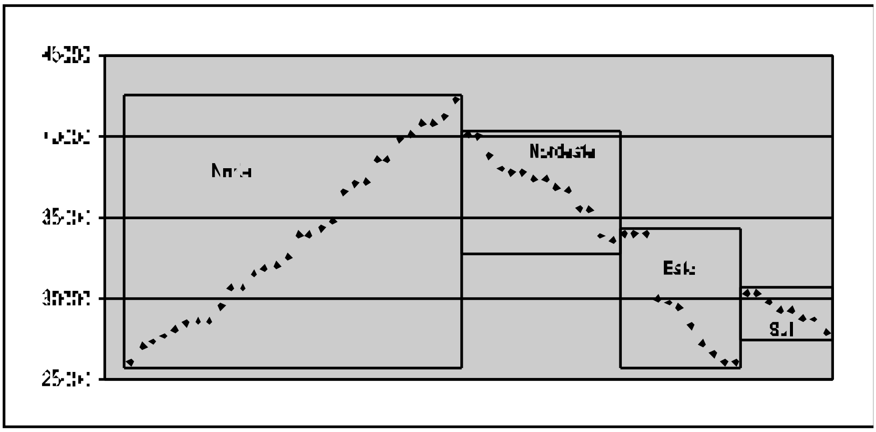

FIGURE 20. Radiocarbon dates showing the Aurignacian occupation in Iberia. Note the gradual diminution of importance as it goes South and West.

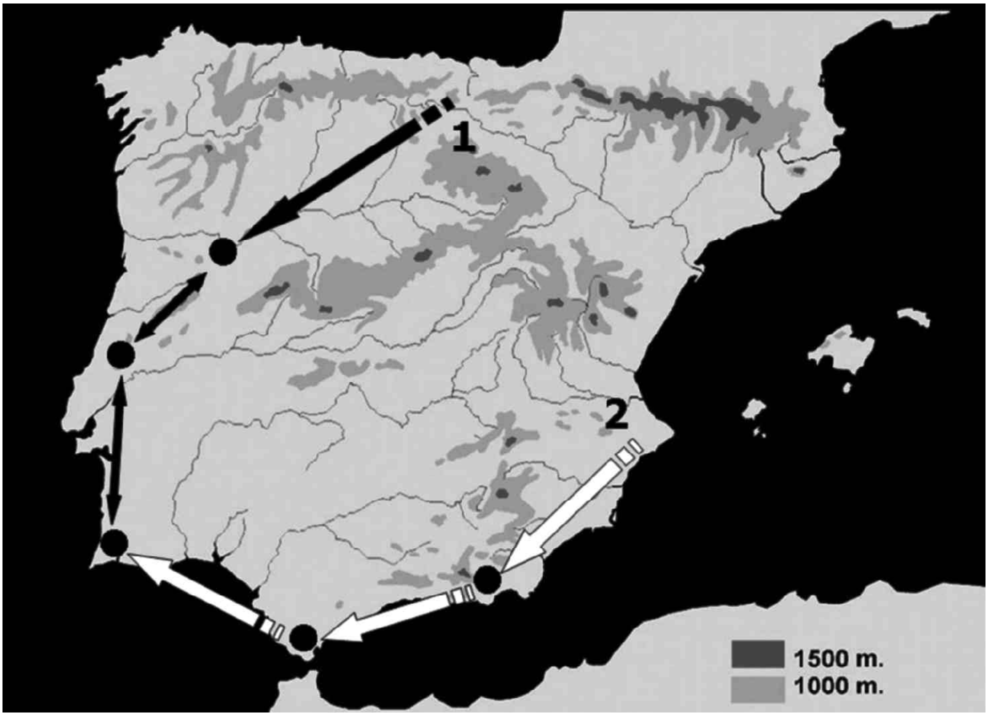

FIGURE 21. Possible routes of penetration of modern humans in Iberia.

APPENDIX 1
List of radiometric dates for Iberia between 45 and 24,000 BP

Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Central Iberia								
Cardina I	C4 base	G	TL	27.800	1.500	1.500		Sd
Cardina I	C4 base	G	TL	28.000	2.100	2.100		Sd
Cardina I	C4 base	G	TL	30.100	1.500	1.500		Sd
Cardina I	C4 base	G	TL	27.000	1.800	1.800		Sd
Cardina I	C4 base	G	TL	26.500	1.800	1.800		Sd
Cardina I	C4 base	G	TL	20.700	1.300	1.300		Sd
Cardina I	C4 base	G	TL	23.400	1.500	1.500		Sd
Olga Grande 4	C3 base	G	TL	27.200	2.300	2.300		Sd
Olga Grande 4	C3 base	G	TL	30.000	2.400	2.400		Sd
Olga Grande 4	C3 base	G	TL	28.500	2.300	2.300		Sd
Olga Grande 4	C3 base	G	TL	31.000	2.500	2.500		Sd
Olga Grande 4	C3 base	G	TL	26.800	2.300	2.300		Sd
Peña Miel	C	M/A	AMS	37.700	1.300	1.300	OxA-5518	B
Peña Miel	C	M/A	AMS	39.900	10.500	10.500	UGRA-128	
Cueva Millan	1a	M	C14	37.600	700	700	GrN-11021	
Cueva Millan	1b	M	C14	37.450	600	600	GrN-1161	
Jarama VI	2 top	M	C14	29.500	2.700	2.700	Beta-56638	C
Jarama VI	2	M	C14	32.600	1.860	1.860	Beta-56639	C
Jarama VI	2	M	C14	23.380	500	500	Beta-56639	C
La Ermita	Va	M	C14	31.100	550	550	OxA-4603	C

(a) A – Aurignacian; C – Castelperronean; EUP – Early Upper Paleolithic; G – Gravettian; LG – Late Gravettian; M – Mousterian; MP – Middle Paleolithic; PA – Proto-Aurignacian; PSL – Proto-Solutrean; UP – Upper Paleolithic.

(b) B – bone; BB – burnt bone; C – charcoal; Cl – *Canis lupus*; Cp – *Capra*; Cv – *Cervus*; Eq – *Equus*; F – flint; H – humus; Hn – *Helix nemoralis*; Hs – *Homo sapiens*; Oc – *Oryctolagus cuniculus*; OM – organic matter; P – *Pinus*; Pt – *Patella*; Sd – sediment; T – tooth; Tv – travertine.

Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Central Iberia (continued)								
Peña Miel	E	M	C14	45.500	1.400	1.200	GrN-12123	
Peña Miel	E	M	AMS	40.300	1.600	1.600	OxA-5519	
Peña Miel	g	M	C14	>40000			CSIC-546	
Peña Miel	e	M	C14	4.500	1.400	1.200	GrN-12123	
Peña Miel	e	M	C14	39.900	10.500	10.500	UGRA-128	
Peña Miel	g	M	C14	>40000			CSIC-546	
Eastern Iberia								
Cova Beneito	VIII	A	C14	26.040	890	890	Gif-7650	
Cova Beneito	VIII	A	C14	33.900	1.100	1.100	AA-1388	
Cova Foradada	VII sector I	A	C14	33.900	310	310		
Cova Foradada	VI sector I	A	C14	29.910	150	150		
Cova Foradada	II sector II	A	C14	28.310	170	170		
Cova Foradada	II sector II	A	C14	26.610	460	460		
Mallaettes	2/XII	A	C14	29.690	560	560	KN-I/960	C
Cova Beneito	C4	A?	C14	26.040	890	890	Gif-7650	
Cova Beneito	C4	A?	AMS	33.900	1.100	1.100	AA-1388	
Cova Foradada	V sector I	A?	C14	27.170	150	150		
Cova Foradada	V sector I	A?	C14	29.420	190	190		
Cova Beneito	D1	M	14C	30.160	680	680	GifTan-89283	
Cova Beneito	D1	M	AMS	38.800	1.900	1.900	AA-1387	C
Cova Beneito	XI-XII	M	C14	30.160	680	680	Tan-89283	
Cova Beneito	XI-XII	M	C14	38.800	1.900	1.900	AA-1387	C
Cova Negra	V	M	C14	28.900	5.600	5.600	C-847	

(a) A – Aurignacian; C – Castelperronean; EUP – Early Upper Paleolithic; G – Gravettian; LG – Late Gravettian; M – Mousterian; MP – Middle Paleolithic; PA – Proto-Aurignacian; PSL – Proto-Solutrean; UP – Upper Paleolithic.

(b) B – bone; BB – burnt bone; C – charcoal; Cl – *Canis lupus*; Cp – *Capra*; Cv – *Cervus*; Eq – *Equus*; F – flint; H – humus; Hn – *Helix nemoralis*; Hs – *Homo sapiens*; Oc – *Oryctolagus cuniculus*; OM – organic matter; P – *Pinus*; Pt – *Patella*; Sd – sediment; T – tooth; Tv – travertine.

Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Eastern Iberia (continued)								
Cova Negra	V	M	C14	>28700			C-848	
Cova Negra	V	M	C14	>28700			C849	
Northeastern Iberia								
Romaní	below level 2	?	C14	35.000	500	500	USGS-2840	C
L'Arbreda	H base	A	AMS	37.700	1.000	1.000	AA-3780	C
L'Arbreda	H base	A	AMS	35.480	820	820	OxA-3730	B
L'Arbreda	H top	A	AMS	37.340	820	820	OxA-3729	B
L'Arbreda	H base	A	AMS	37.700	1.000	1.000	AA-3779	C
L'Arbreda	H base	A	AMS	39.900	1.300	1.300	AA-3781	C
L'Arbreda	H	A	AMS	38.700	1.200	1.200	AA-3782	C
L'Arbreda	H	A	C14	>33500			Beta-46690	
Mollet	0.60-0.80	A	AMS	33.780	730	730	OxA3728	B
Reclau Viver	A, 5.2-5.4	A	AMS	40.000	1.400	1.400	OxA-3727	B
Romaní	A, 2,Ar-2	A	C14	37.900	1.000	1.000	AA-8037B	C
Romaní	A, 2, Ar-2	A	C14	35.400	810	810	AA-8037A	C
Romaní	A, 2, Ar-2	A	C14	37.290	990	990	AA-7395	C
Romaní	A, 2, Ar-2	A	AMS	36.590	640	640	NZA-2311	C
Romaní	A, 2, cvn-2	A	C14	36.740	920	920	AA-6608	C
Romaní	A	A	U-Th	42.600	1.100	1.100		
Banyoles		M	U-Th	45.000	4.000	4.000		
El Salt	XI-IX	M	TL	43.200	3.300	3.300		
El Salt	V base	M	AMS	37.100				
Ermitons	IV	M	C14	36.430	1.800	1.800	CSIC-197	C

(a) A – Aurignacian; C – Castelperronean; EUP – Early Upper Paleolithic; G – Gravettian; LG – Late Gravettian; M – Mousterian; MP – Middle Paleolithic; PA – Proto-Aurignacian; PSL – Proto-Solutrean; UP – Upper Paleolithic.

(b) B – bone; BB – burnt bone; C – charcoal; Cl – *Canis lupus*; Cp – *Capra*; Cv – *Cervus*; Eq – *Equus*; F – flint; H – humus; Hn – *Helix nemoralis*; Hs – *Homo sapiens*; Oc – *Oryctolagus cuniculus*; OM – organic matter; P – *Pinus*; Pt – *Patella*; Sd – sediment; T – tooth; Tv – travertine.

Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Northeastern Iberia (continued)								
Ermitons	IV	M	AMS	33.190	600	600	OxA-3725	B
Ftes. S. Cristobal	P	M	AMS	36.000	1.900	1.900	OxA-8590	C
Gabasa	e	M	C14	46.500	4.400	2.800	GrN-12809	
Gabasa	E	M	AMS	>51900			OxA-5674	
Gabasa	c	M	AMS	>47800			OxA-5673	
Gabasa	c	M	AMS	>46900			Beta-68931	
Gabasa	a-c	M	AMS	>45900			OxA-5672	
Gabasa	a	M	AMS	>39900			OxA-5671	
L'Arbreda	I	M	AMS	39.400	1.400	1.400	AA-3776	C
L'Arbreda	I	M	AMS	34.100	1.000	1.000	AA-3777	C
L'Arbreda	I	M	AMS	41.400	1.600	1.600	AA-3778	C
L'Arbreda	I	M	AMS	44.560	2.400	2.400	OxA-3731	C
Roca dels Bous	R3	M	AMS	38.800	1.200	1.200	AA-6481	
Roca dels Bous	S1	M	AMS	>46900			AA-6480	
Romaní	travertine	M	U-Th	43.800	1.500	1.500		
Romaní	travertine	M	U-Th	46.300	1.500	1.500		
Romaní	travertine	M	U-Th	42.700	1.300	1.300		
Romaní	B	M	AMS	43.500	1.200	1.200	NZA-2312	
Romaní	travertine	M	U-Th	43.400	1.500	1.500		
Romaní	travertine	M	U-Th	45.600	3.500	3.500		
Romaní	travertine	M	U-Th	43.200	1.100	1.100		
Romaní	travertine	M	U-Th	44.400	200	200		
Romaní	D	M	AMS	40.600	900	900	NZA-2313	
Romaní	E	M	AMS	43.200	1.100	1.100	NZA-2314	

(a) A – Aurignacian; C – Castelperronean; EUP – Early Upper Paleolithic; G – Gravettian; LG – Late Gravettian; M – Mousterian; MP – Middle Paleolithic; PA – Proto-Aurignacian; PSL – Proto-Solutrean; UP – Upper Paleolithic.

(b) B – bone; BB – burnt bone; C – charcoal; Cl – *Canis lupus*; Cp – *Capra*; Cv – *Cervus*; Eq – *Equus*; F – flint; H – humus; Hn – *Helix nemoralis*; Hs – *Homo sapiens*; Oc – *Oryctolagus cuniculus*; OM – organic matter; P – *Pinus*; Pt – *Patella*; Sd – sediment; T – tooth; Tv – travertine.

Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Northeastern Iberia (continued)								
Romaní	H	M	AMS	44.500	1.200	1.200	NZA-2315	
Reclau Viver	B	UP	AMS	30.190	500	500	OxA-3726	
Romaní	travertine	UP	U-Th	40.800	1.500	1.500		
Romaní	travertine	UP	U-Th	39.400	1.500	1.500		
Romaní	travertine	UP	U-Th	42.900	1.600	1.600		
Romaní	travertine	UP	U-Th	39.100	1.500	1.500		
Romaní	travertine	UP	U-Th	44.400	1.600	1.600		
Romaní	travertine	UP	U-Th	41.800	800	800		
Romaní	travertine	UP	U-Th	36.300	1.300	1.300		
Romaní	above level 2	UP	C14	36.600	1.300	1.300	USGS-2839	C
Northern Iberia								
El Castillo	18b1	A	AMS	38.500	1.800	1.800	AA-2406	C
Cueva Morín	6	A	C14	25.950	1.600	1.600	WSU-501	OM
Arenillas	II	A	C14	33.870	1.700	1.700	GrN-?	
Arenillas	II	A	C14	34.660	1.700	1.400	Beta?	B
Arenillas	II	A	C14	33.870	1.600	1.300	Beta?	B
Arenillas	II	A	C14	34.290	1.165	1.165	GrN-?	
Cueva Morín	8A	A	C14	28.435	540	540	Si-952	C
Cueva Morín	8A	A	C14	28.515	735	735	Si-952a	C
Cueva Morín	8A	A	C14	28.515	1.280	1.280	Si-956	C
Cueva Morín	7	A	C14	29.515	840	840	Si-955	
Cueva Morín	7	A	C14	28.055	1.490	1.490	Si-955a	
Cueva Morín	.7	A	C14	32.415	865	865	Si-954	C

(a) A – Aurignacian; C – Castelperronean; EUP – Early Upper Paleolithic; G – Gravettian; LG – Late Gravettian; M – Mousterian; MP – Middle Paleolithic; PA – Proto-Aurignacian; PSL – Proto-Solutrean; UP – Upper Paleolithic.

(b) B – bone; BB – burnt bone; C – charcoal; Cl – *Canis lupus*; Cp – *Capra*; Cv – *Cervus*; Eq – *Equus*; F – flint; H – humus; Hn – *Helix nemoralis*; Hs – *Homo sapiens*; Oc – *Oryctolagus cuniculus*; OM – organic matter; P – *Pinus*; Pt – *Patella*; Sd – sediment; T – tooth; Tv – travertine.

Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Northern Iberia (continued)								
Ekain cave	9b	A	C14	>30600	450	450	I-11056	B
El Castillo	18	A	ESR	36.200	4.100	4.100		T
El Castillo	18b2	A	AMS	37.000	2.200	2.200	OxA-2473	C
El Castillo	18b2	A	AMS	37.100	1.800	1.800	AA-2407	C
El Castillo	18b2	A	AMS	38.500	1.300	1.300	OxA-2474	C
El Castillo	18b2	A	AMS	40.700	1.600	1.600	OxA-2475	C
El Castillo	18c	A	AMS	39.800	1.400	1.400	OxA-2478	C
El Castillo	18c	A	AMS	40.000	2.100	2.100	AA-2405	C
El Castillo	18c	A	AMS	40.700	1.500	1.500	OxA-2476	C
El Castillo	18c	A	AMS	42.200	2.100	2.100	GifA-89147	C
El Castillo	18c	A	AMS	41.100	1.700	1.700	OxA-2477	C
El Castillo	18c	A	ESR	40.000	5.000	5.000		B
El Castillo	18c	A	ESR	36.200	4.100	4.100		B
El Castillo	18c	A	ESR	39.900	4.600	4.600		B
La Viña	XIII inf.	A	C14	36.500	750	750	Ly-6390	C
La Viña	XIII	A	AMS	31.860	680	680	GifA-95463	C
La Viña	XIII inf.	A	AMS	19.930	220	220	OxA4092	C
Labeko Koba	V	A	AMS	30.615	820	820	Ua-3322	B
Labeko Koba	V	A	AMS	23.360	300	300	Ua-3035	B
Labeko Koba	IV	A	AMS	21.660	300	300	Ua-3323	B
Rascaño	n9	A	AMS	>27000			BM-1457	B
La Güelga	alfa	A	C14	32.000	1.600	1.350	GrN-18256	
Horños de la Peña	D	A	AMS	20.930	370	370	BM-1883-R	
El Ruso	4b	A	C14	27.620	180	180	Beta-70812	B

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Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Northern Iberia (continued)								
Rascaño	n7	A?	AMS	27.240	950	810	BM-1456	B
Cueva Morín	10	C	C14	36.960	6.580	6.580	Si-951A	C
Cueva Morín	10	C	C14	28.515	840	840	Si-951	C
Labeko Koba	IX base	C	AMS	26.570	500	500	Ua-3034	B
Labeko Koba	IX	C	AMS	29.750	740	740	Ua-3325	B
Labeko Koba	IX base	C	AMS	34.215	1.265	1.265	Ua-3324	B
Valiña	IV	C	C14	34.800	1.900	1.500	GrN-17729	B
Valiña	IV	C	C14	31.780	2.880	2.110	GrN-20833	B
Valiña	IV	C	AMS	31.600	250	250	GrA-3014	B
Aitzbitarte III	VI (15)	G	AMS	24.635	475	475	Ua-2627	B
Aitzbitarte III	VI (14)	G	AMS	24.545	415	415	Ua-2626	B
Aitzbitarte III	VI (11)	G	AMS	24.920	410	410	Ua-2245	B
Aitzbitarte III	VI (9)	G	AMS	25.380	430	430	Ua-2244	B
Aitzbitarte III	V (7)	G	AMS	24.910	770	770	I-15208	B
Alkerdi	2	G	C14	26.470	530	490	GrN-20322	
Amalda	VI	G	C14	27.400	1.000	1.000	I-11665	
Amalda	VI	G	C14	27.400	1.100	1.100	I-11664	
Cueto de la Mina	VII=H	G	C14	26.470	520	520	Ua-3587	B
Antoliñako	LMBK	G	C14	27.390	320	320	GrN-23785	
El Castillo	20	M	AMS	39.300	1.900	1.900	GifA-89144	C
El Castillo	20	M	AMS	43.300	2.900	2.900	GifA-92506	C
El Pendo	26	M	ESR	33.700	1.300	1.300		
El Pendo	32	M	ESR	30.500	300	300		
El Pendo	B	M	ESR	<40000				

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Northern Iberia (continued)								
El Pendo	F	M	TL	39.626	3.864	3.864	MaD-555	
Kurtzia		M	C14	41.400	2.500	2.500	UGRA-293	
Kurtzia		M	C14	41.400	2.500	2.500	UGRA-293	
La Flecha		M	C14	31.600	900	900	SI-4460	
La Flecha		M	C14	31.600	900	900	SI-4460	
La Viña	XIII inf.	M	AMS	>47600			GifA-95537	C
La Viña	XIII inf.	M	AMS	42.200	2.200	2.200	GifA-95546	H
La Viña	XIV	M	AMS	>47700			GifA-95521	C
La Viña	XIII bottom	M	AMS	38.500	1.000	1.000	GifA-95550	
La Viña	XIII bottom	M	AMS	37.700	590	590	GifA-99231	
Horños de la Peña	F	M	AMS	24.340	470	470	BM-1884-R	
El Ruso	5a	M	C14	30.200	1.360	1.360	Beta-70813	B
El Mirón	128	EUP	AMS	27.580	210	210	GX-27113	C
El Mirón	128	MP	AMS	41.280	1.120	1.120	GX-27112	C
Labeko Koba	VII base	PA	AMS	26.910	530	530	Ua-3320	B
Labeko Koba	VII top	PA	AMS	31.455	915	915	Ua-3321	B
A Valiña	I	UP	C14	34.800	1.900	1.500	GrN-17729	
El Calero II	painting	UP	AMS	25.128	450	450	AA-20046	C
Peña Cadamo	painting	UP	AMS	32.310	690	690		C
Western Iberia								
Pego do Diabo	3	A	14C	18.630	640	640	ICEN-491	B
Pego do Diabo	2b	A	14C	28.120	860	780	ICEN-732	B
Pego do Diabo		A	14C	2.400	80	80	ICEN-306	C

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Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Western Iberia (continued)								
Pego do Diabo	2a	A	14C	23.080	490	490	ICEN-490	B
Buraca Escura	2f	G	AMS	26.560	450	450	GifA-97258	Cp
Caldeirão	Jb	G	14C	26.020	320	320	OxA-5542	B
Lagar Velho	ms	G	AMS	22.493	107	107	OxA-9256	P
Lagar Velho	ms	G	AMS	23.130	130	130	OxA-9571	BB
Lagar Velho	ls	G	AMS	23.042	142	142	Wk-9571	B
Lagar Velho	ls	G	AMS	22.720	90	90	Beta-139361	BB
Lagar Velho	ls	G	AMS	23.170	140	140	OxA-9572	BB
Lagar Velho	gs, grave	G	AMS	23.920	220	220	OxA-8422	Oc
Lagar Velho	gs, grave	G	AMS	24.520	240	240	OxA-8423	Cv
Lagar Velho	gs, grave	G	AMS	24.660	260	260	OxA-8421	Cv
Lagar Velho	gs, grave	G	AMS	24.860	200	200	GrA-13310	P
Lagar Velho	gs, grave	G	AMS	17.380	160	160	GrA-10972	Hs
Lagar Velho	gs, grave	G	AMS	17.660	160	160	GrA-12194	Hs
Lagar Velho	gs, grave	G	AMS	21.980	100	100	GrA-13360	Hs
Lagar Velho	gs, grave	G	AMS	21.420	220	220	OxA-8417	Hs
Lagar Velho	tc	G	AMS	24.950	240	240	OxA-8423	Eq
Lagar Velho	bs	G	AMS	27.100	900	900	OxA-10849	B
Casa da Moura	1b	G	14C	25.090	220	220	TO-1102	Cl
Cova da Moura	1b	G	14C	25.090	220	220	TO-1102	Cl
V. Comprido cruz.	north profile	G	TL	30.300	3.900	3.900		F
V. Comprido cruz.	L. -40cm	G	TL	26.700	2.700	2.700		F
V. Comprido cruz.	L. -35 cm	G	TL	12.400	2.100	2.100		F
Fonte Santa		LG	TL	38.330	4.300	4.300		F

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Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Western Iberia (continued)								
Almonda EVS	cone	M	U-Th	35.000	2.000	2.000	SMU-231E1	T
Caldeirão	K base	M	AMS	23.040	340	340	OxA-5521	Cp
Caldeirão	K top	M	AMS	27.600	600	600	OxA-1941	Cv
Caldeirão	K top	M	AMS	18.060	140	140	OxA-5541	Cv
Columbeira	8 (20)	M	C14	28.900	950	950	Gif-2704	Sd
Columbeira	8 (20)	M	U-Th	60.927			SMU-236E1	T
Columbeira	8 (20)	M	U-Th	101.487	35.522	27.405	SMU-236E1	T
Columbeira	7 (16)	M	C14	26.400	700	700	Gif-2703	Sd
Columbeira	7 (16)	M	C14	54.365	27.525	22.240	SMU-238E1	T
Columbeira	7 (16)	M	C14	35.876	35.583	27.299	SMU-235E1	T
Conceição	C	M	OSL	27.200	2.500	2.500	QLTS-CNC 11	Sd
Conceição	E	M	OSL	74.500	11.600	10.400	QLTS-CNC 12	Sd
Figueira Brava	2	M	C14	30.930	700	700	ICEN-387	Pt
Figueira Brava	2	M	C14	30.050	550	550	ICEN-386	Pt
Figueira Brava	2	M	U-Th	30.561	11759	10.725	SMU-232	T
Figueira Brava	2	M	U-Th	44.806	15.889	13.958	SMU-233	T
Foz do Enxarrique	C	M	U-Th	34.093	920	920	SMU-224	T
Foz do Enxarrique	C	M	U-Th	34.088	800	800	SMU-226	T
Foz do Enxarrique	C	M	U-Th	32.938	1.055	1.055	SMU-225	T
Gr. da Oliveira	8	M	AMS	31.900	200	200	GrA-10200	BB
Gr. da Oliveira	8	M	AMS	32.740	420	420	OxA-8671	BB
Gr. da Oliveira	9	M	AMS	40.420	1.220	1.220	Beta-111967	BB
Gr. da Oliveira	9	M	AMS	38.390	480	480	GrA-9760	BB
Gr. da Oliveira	11	M	AMS	42.900	1.200	1.200	OxA-8672	BB

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Sites	Level	Culture (b)	Method	Date	StD +	StV -	Lab.	Sample
Western Iberia (continued)								
Gr. das Salemas	T.V.b	M	C14	24.820	550	550	ICEN-379	B
Gr. das Salemas		M	C14	23.830	580	580	ICEN-383	B
Gr. das Salemas		M	C14	20.740	470	470	ICEN-384	B
Gr. do Escoural	3a, 80-90cm	M	U-Th	39.800	10.000	9.000	SMU-249	T
Gr. do Escoural	3a, 90-100cm	M	U-Th	26.400	11.000	10.000	SMU-248	T
Gr. do Escoural	3a, 60-70cm	M	U-Th	48.900	5.800	5.500	SMU-250	T
Lapa dos Furos	4	M	C14	34.580	1.160	1.010	ICEN-473	Hn
Lapa dos Furos	4	M	C14	30.570	760	760	ICEN-472	Hn
Pedreira Salemas	lower	M	C14	29.890	1130	980	ICEN-366	B
Pedreira Salemas		M	C14	>29200			ICEN-371	B
Pedreira Salemas		M	C14	27.170	1.000	900	ICEN-361	B
Gato Preto		PSL	TL	38.100	3.900	3.900		F
Lagar Velho	al	?	AMS	29.800	2.500		OxA-11318	Eq
Southern Iberia								
Gorham's Cave	D, context 9	UP	C14	27.860	300	300	GrN-1363	
Gorham's Cave	D, context 9	UP	C14	28.700	200	200	GrN-1455	C
Gorham's Cave	context 9	UP	AMS	30.200	700	700	OxA-7074	C
Gorham's Cave	context 9	UP	AMS	29.800	700	700	OxA-7075	C
Gorham's Cave	context 9	UP	AMS	30.250	700	700	OxA-7076	C
Gorham's Cave	context 9	UP	AMS	29.250	650	650	OxA-7077	C
Gorham's Cave	context 13a	UP	AMS	29.250	750	750	OxA-7110	C
Gorham's Cave	context 15	UP	AMS	28.680	240	240	OxA-7792	C
Cueva de Nerja	12a	G	C14	25.600	4.800	4.800	UBAR-343	

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Southern Iberia (continued)								
Cueva de Nerja	12b	G	C14	23.400	2.300	2.300	UBAR-342	
Cueva de Nerja	13a+b	G	C14	21.760	970	970	UBAR-341	
Cueva de Nerja	13c	G	C14	24.300	1.400	1.400	UBAR-340	
Vale Boi	18	G	AMS	24.300	205	205	Wk-12132	C
Bajondillo	base	M	U-Th	27.300	1.700	1.700		Tv
Bajondillo	base	M	ESR	25.300	2.530	2.530		Tv
Bajondillo	base	M	ESR	26.500	3.975	3.975		Tv
Carihuela	VI.9	M	AMS	45.200	1.200	1.200	Beta-74381	
Carihuela		M	TL	38.600			BT	F
Devil's Tower	3	M	14C	>30000			GrN-2488	C
Devil's Tower	4	M	14C	c. 29000				
Gorham's Cave	context 24	M	AMS	32.280	420	420	OxA-7857	C
Gorham's Cave	context 18	M	AMS	42.200	1.100	1.100	OxA-7791	C
Gorham's Cave	context 18	M	AMS	23.800	600	600	OxA-7979	
Gorham's Cave	contact 18/19	M	AMS	42.800	2.100	2.100	OxA-8542	C
Gorham's Cave	context 19	M	AMS	31.900	1.400	1.400	OxA-8541	C
Gorham's Cave	context 19	M	AMS	43.800	1.300	1.300	OxA-8525	C
Gorham's Cave	context 19	M	AMS	47.900	2.100	2.100	OxA-205	C
Gorham's Cave	context 19	M	AMS	46.700	1.900	1.900	OxA-8526	C
Gorham's Cave	context 22	M	AMS	45.300	1.700	1.700	OxA-6075	C
Gorham's Cave	context 22	M	OSL	35.000	7.000	7.000	MacGor-3	Sd
Gorham's Cave	G-P, 18-24?	M	ESR	35.000	5.000	5.000		T
Vanguard Cave	top section	M	AMS	45.200	2.400	2.400	OxA-7389	C
Vanguard Cave	Unit 55	M	AMS	41.800	2.400	2.400	OxA-6998	C

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Southern Iberia (continued)								
Vanguard Cave	Unit 55	M	AMS	10.170	120	120	OxA7191	B
Vanguard Cave	side chamber	M	AMS	>44100			OxA-7078	C
Vanguard Cave	Unit 53	M	AMS	46.900	1.500	1.500	OxA-6892	C
Vanguard Cave		M	OSL	46.320	3.300	3.300	OxL-1029	Sd
Zafarraya	I(3-7)	M	C14	29.800	600	600	Gif-9140-II	T
Zafarraya	I (8)	M	U-Th	31.700	3.600	3.600	Gif/LSM-9140-I	T
Zafarraya	I (8)	M	C14	31.800	550	550	Gif/LSM-9140-I	T
Zafarraya	D	M	U-Th	33.400	2.000	2.000		T
Zafarraya	I (3-7)	M	U-Th	26.970	2.700	2.700	Gif-9140-II	T
Zafarraya	I-3/7	M	U-Th	25.100	1.300	1.300		
Zafarraya	I-3/7	M	U-Th	26.900	2.700	2.700		
Zafarraya	I-3/7	M	U-Th	28.900	4.200	4.200		
Zafarraya	I-3/7	M	C14	29.800	600	600	Gif-9140-II	
Zafarraya	I-8	M	U-Th	31.700	3.600	3.600		
Zafarraya	I-8	M	C14	31.800	500	500	Gif/LSM-9140-I	
Zafarraya	D	M	U-Th	33.400	200	200		
Lagoa do Bordoal		MP?	OSL	26.700	4.300	4.300		Sd
Lagoa do Bordoal		MP?	OSL	14.800	2.900	2.900		Sd
Gorham's Cave	context	?	AMS	25.680	280	280	OxA-6997	B

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