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European population changes during Marine Isotope Stages 2 and 3

Pierre M. Vermeersch

Katholieke Universiteit Leuven, Laboratory for Prehistory, Instituut voor Aardwetenschappen, Redingenstraat 16, Leuven 3000, Belgium

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Abstract

The combination of an extensive database, a GIS environment and a ^{14}C calibration tool provides the possibilities for extensive searches within the geography and chronology of the European Palaeolithic populations. Combining all these data provides us with possibilities of automatically constructing different kinds of maps that, eventually, will bring some understanding of population migrations in the Last Glacial.

1. Discussion

We all know that the Neandertals went extinct in Europe and we hope to learn something more about the way this may have happened. Unfortunately, the Neandertals left behind very little skeletal material which can be used for understanding the reason of their extinction. For that reason, most approaches are based on technologically and culturally defined data that were presumably associated with the Neandertals. In doing so, we face more problems, since it is difficult to attribute specific technical and cultural elements only to Neandertals, as different from those of anatomically modern *Homo sapiens*. Several hypotheses have been put forward suggesting that the Aurignacian was the result of the activities of the first anatomical modern *H. sapiens* in Europe, whereas the Mousterian and the Châtelperronian were the products of activities of the Neandertals. However, it remains very difficult to prove this assumption. Indeed very few typical assemblages are associated with human remains, who were the presumed makers of the assemblages. Without more skeletal material in a cultural environment, it will remain very hazardous to build up a precise chronology for the arrival of anatomically modern humans and the disappearance of the Neandertals.

E-mail address: pierre.vermeersch@geo.kuleuven.ac.be (P.M. Vermeersch).

An approach that has not often been implemented is to look for diachronic movements of human population across Europe during the time period of the arrival of anatomically modern *H. sapiens*. It is our conviction that, for improving our comprehension of what happened during the crucial transition from the Middle to the Upper Palaeolithic in Europe, the disappearance of the Neandertals, and the arrival of *H. sapiens*, we may arrive at a better understanding if we rely more than we do at present on the evidence of diachronic geographical human distributions in Europe during MIS 2 and 3.

We are faced with increasing numbers of conventional ^{14}C and AMS dates (as indicated by several papers presented in the Reno Symposium), which are used in the literature for proving or disproving different hypotheses. Few authors have access to all the European dates, as they are distributed widely in the literature. Even if some useful lists have been published, none of them can pretend to present all the available dates. Moreover, we face the problem of the interpreting of the available dates. There is no doubt that most of the samples that have been submitted for dating were considered by the excavators as being samples that had good potential for dating a Palaeolithic event. However, when a determination does not fill the excavator's expectation, the date is usually considered as being "incorrect." Several reasons can be invoked for this problem. Sometimes the excavator did a poor job, but, most often, postdepositional effects can be

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considered as responsible for the 'bad' datings. Some are evidently wrong because an ill-defined relationship existed between the sample and the Palaeolithic event they were considered to date. For the user of the datings, it remains a difficult task to separate the 'good' dates from the 'bad' ones. Too often, the literature presents only the raw results of the dating procedure, giving very few elements of the sample environment and characteristics. Under such circumstances, it remains a difficult task to evaluate and use the dates. For that reason, we consider that we need a database, which includes an evaluation of each dated sample and a clear statement about the relationship between the sample and the Palaeolithic event. Such a database should be a forum wherein each sample provider can describe and evaluate sample characteristics. An attempt to construct such a database has been started by the project "European Late Pleistocene Isotopic Stages 2 & 3: Humans, Their Ecology & Cultural Adaptation", a working group of the previous INQUA-Commission on Human Evolution & Palaeoecology (chaired by Vermeersch and Renault-Miskovsky, 1999). Many colleagues graciously have submitted their data, whereas other data have been collected from the literature and from the Internet. We have used the database made available by the Cambridge Stage 3 project (http://www.esc.cam.ac.uk/oi-stage3/Secure/OIS-3i.html), which collected nearly 1900 dates. There is no doubt that the present database still needs much improvement, especially with regard to evaluation of sample quality. We hope that because of the availability of the database on the Internet (http://www.kuleuven.ac.be/geography/frg/projects/14c-palaeolithic/), many other colleagues will be willing to improve data quality. At present, our database contains more than 4880 items comprising conventional ^{14}C, AMS, TL, OSL, ESR and Th/U dates from Europe. The present database adheres to the methods and restrictions put forward by the Cambridge Stage 3 Project (http://www.esc.cam.ac.uk/oistage3/Details/Homepage.html). The collected sample data include categories on the information provider, the geographical, stratigraphical and cultural context of each site, the available dates, information on postdepositional activities, local glaciology, environmental condition and bibliographic references. Fig. 1 is a specimen of the data form, which was constructed with Microsoft Access©.

Once we have an extended database of chronological and other information of the European sites during MIS 3 and 2, we will be able to use a GIS environment for understanding geographical site distributions by period. A GIS environment is available in the Cambridge Stage 3 project and in the PanMap (http://www.pangaea.de/Software/) software (Fig. 2), but we prefer to have more extensive possibilities for map information. We therefore, use MapInfo Professional 6©. A DTM for the maps is available through ESRI's Digital Chart of the

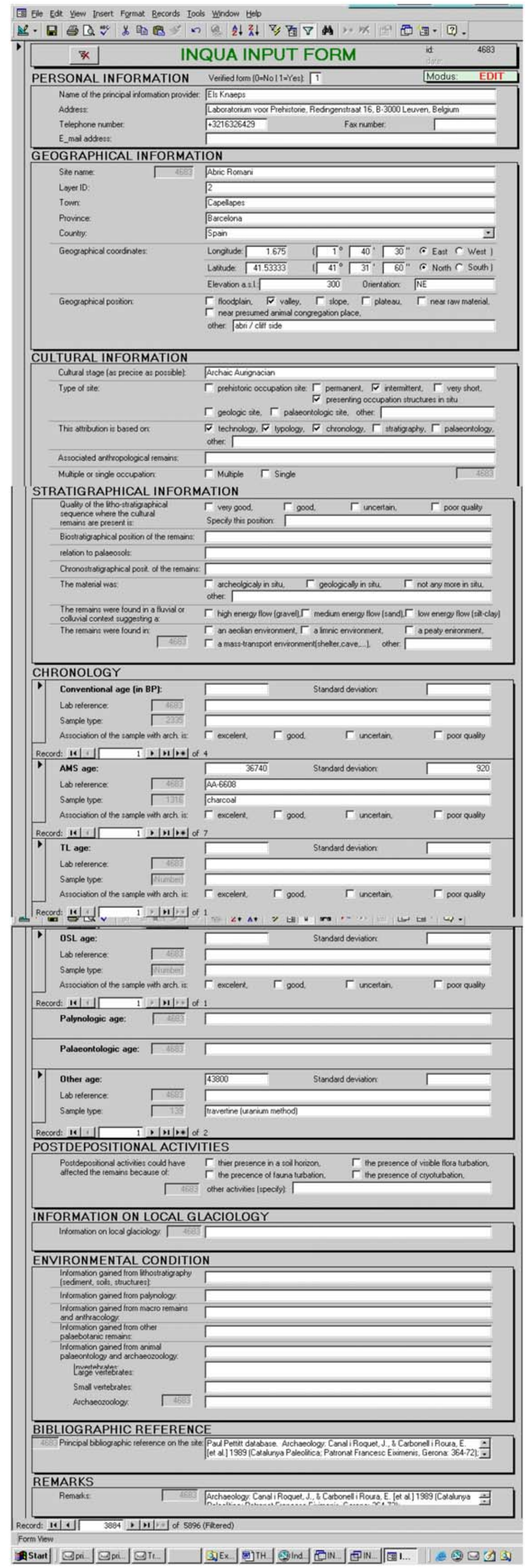

Fig. 1. Database form.

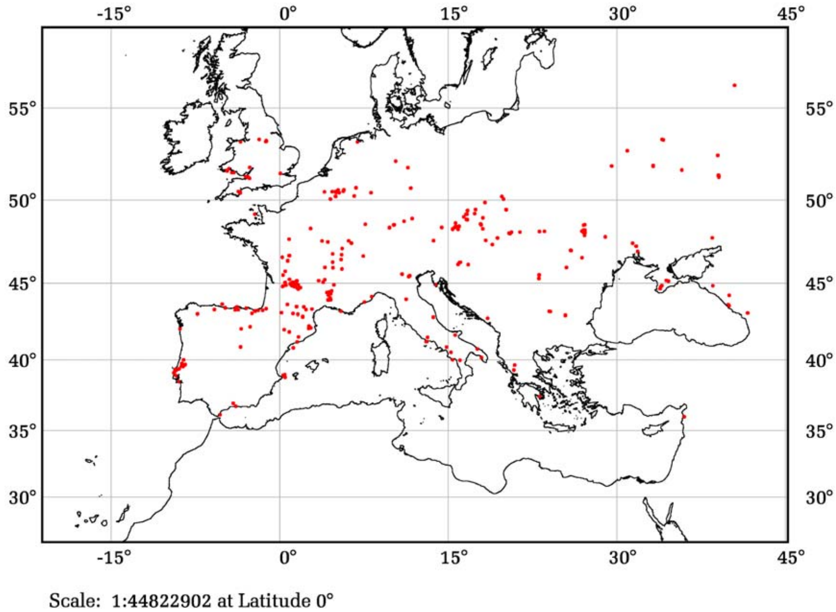

Fig. 2. Map produced by PanMap with all the sites from the Cambridge Stage 3 Project.

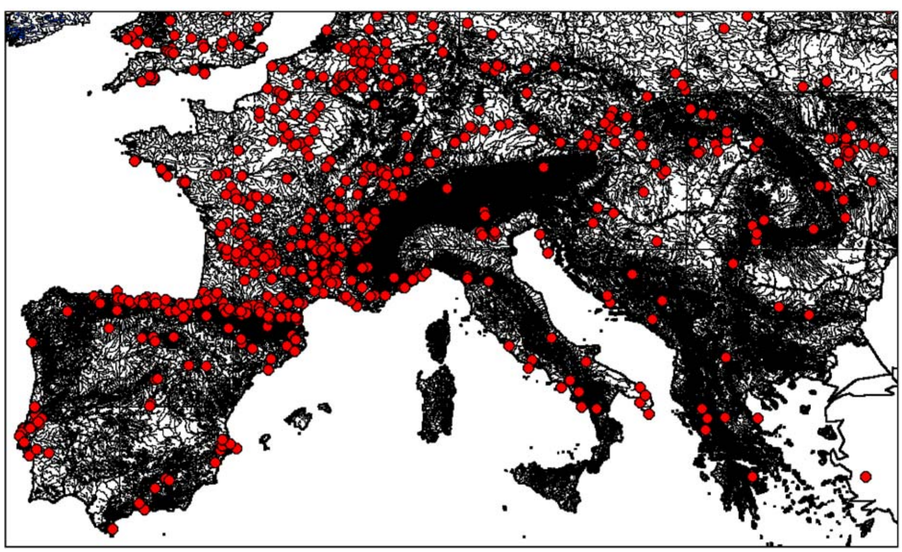

Fig. 3. All sites from the INQUA-database on a map by Mapinfo.

World made available through the Digital Chart of the World Server at the Pennsylvania State University Libraries (http://www.maproom.psu.edu/dcw/). This database is especially useful for a detailed representation of the hydrography (see Fig. 3, for a general map and Fig. 4 for detail), the physiography and the topography of the area. The Alexandria Digital Library Gazetteer Server Client (http://testbed.alexandria.ucsb.edu/gazclient/index.jsp) associates geographic names (place names and feature names) with geographic locations and other descriptive information. We used it to find the geographic location of a named place (site or town) within the geographic area. However, some information of the database is probably missing or erroneous, but this can be improved with time. It is easy to convert the data of the INQUA-database into a format that can be imported in MapInfo©. Starting from that database of Palaeolithic sites with their characteristics and the available dating, the GIS-based mapping is used to investigate the spatial distribution of the sites over Europe. Queries are used to select specific characteristics to be mapped (e.g., for the Aurignacian, all the sites with dates between 35 and 30 ka).

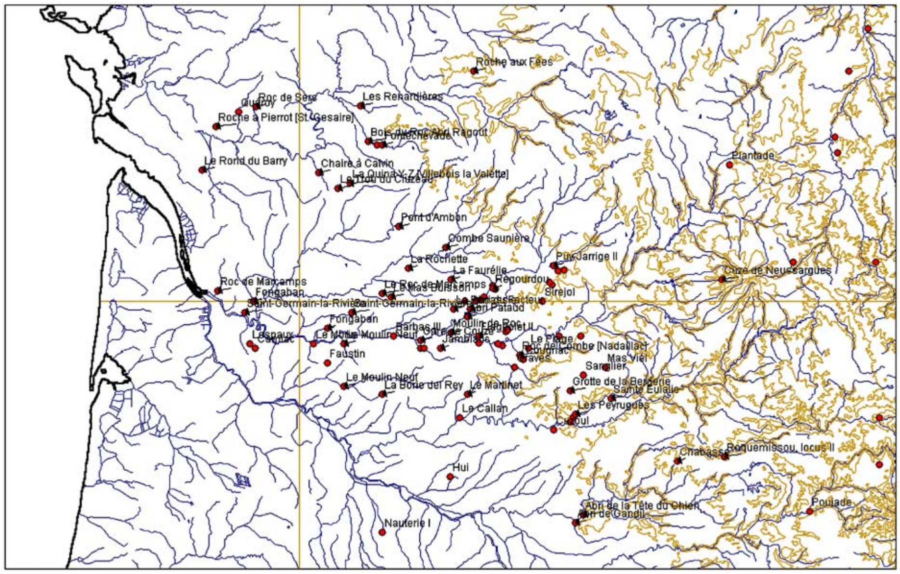

Fig. 4. Details of the map from Fig. 3.

The Last Glacial climatic changes did certainly affect the geographical distribution of the Palaeolithic population across Europe. Marine Isotope Stages 3 and 2 are characterised by rapid and important climatic changes. Large parts of northern Europe became devoid of any human occupation during Marine Isotope Stage 2. When considering the important climatic changes during MIS 3, we might expect that during this stage important migratory movements also occurred in Europe, in which Neandertals as well as *H. sapiens* were involved. It is, therefore, important to map those movements and to relate them eventually to climatic changes. Moreover, it is possible to correlate the site datings with the available climatic proxies, as a result of the $^{18}O/^{16}O$ sequences.

The CalPal (Cologne Radiocarbon Calibration & Palaeoclimate Research Package) software (http://www.calpal.de/) is used to correlate the sites with the rapidly changing climatic conditions during MIS 2 and 3. According to the arguments put forward by CalPal, we have chosen to calibrate glacial ^{14}C-Ages using the GISP2 Age-Model. It is not easy to evaluate the climatic conditions that had an important impact on population movements. Based on the graph of the GISP2 Age-Model among the CalPal graphs, we suggest categorising some periods of MIS 2 and 3 as rather "warm" or rather "cold". We consider the periods with a delta $^{18}O > 39‰$ as "warm" and those with delta $^{18}O < 39‰$ as "cold". Based on the GISP2 Age-Model, the "cold" periods correspond with the time periods 10.2–11.0 ka BP, 13.0–24.5 ka BP and 26.0–27.5 ka BP, whereas the "warmer" periods are 11.0–13.0 ka BP (11.0–13.5 cal BC, period 1, on Fig. 5), 24.5–26.0 ka BP (25.0–27.0 cal BD, period 2, on Fig 5) and 27.5–34 ka BP (29.5–37.0 cal BC, period 3, on Fig. 5).

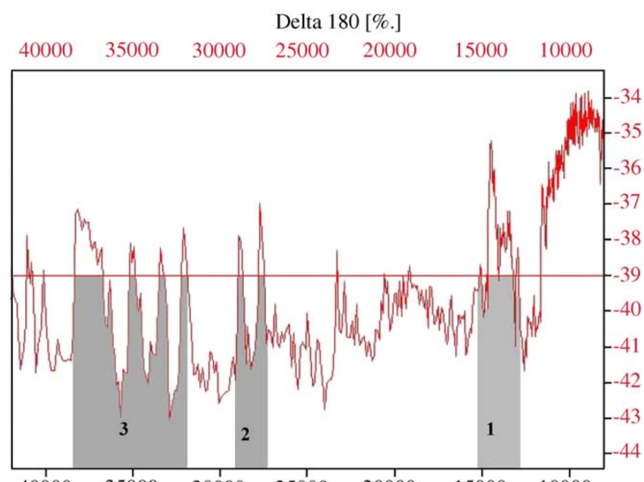

Fig. 5. GIS2 graph, in which three "warmer" periods in Cal BC have been selected. They correspond respectively to 11.5–13 ka BP, 24–26.5 BP and 28–34 BP (adapted from CalPal, GISP2).

When we are looking for changes in the occupation of Europe, we need to define different climatic regions between which eventual population movements could have taken place. Various palaeoclimatic maps have already been designed (Fig. 6, http://www.esd.ornl.gov/projects/qen/nerc.html and links), but they lack sufficient resolution for the purpose for which we would like to use them. In order to arrive at such a degree of resolution, we used a present-day vegetation map (Council of Europe, 1987), which allowed us to define several botanical regions in Europe (Fig. 7). We are well aware that these regions correspond to the modern climate, but we assume (a fact of course not entirely justified) that those regions could be useful for understanding the palaeo-regions, their climate and their

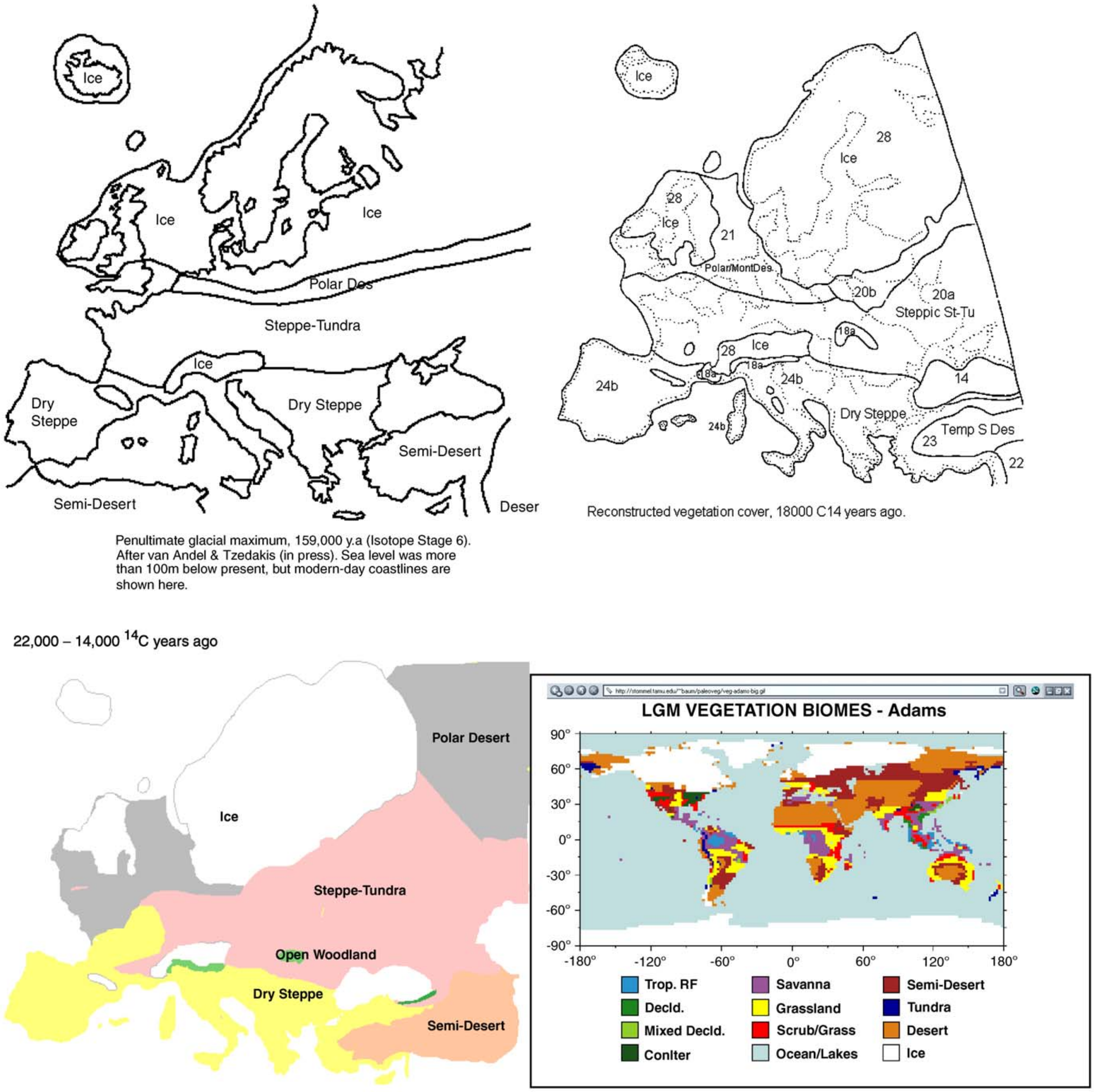

Fig. 6. Several climatic Palaeomaps.

carrying capacity. Mapinfo permits us to plot present-day vegetation maps, like that furnished with the Mapinfo-data files (Fig. 8), together with the sites of particular regions, such as the Balkan and Crimea. In the future, when Palaeomaps will be available that will give better possibilities for evaluating the climate and the carrying capacity of the different regions in Europe, we may hope to arrive at a better understanding of human migrations.

The calibration feature of CalPal provides composed graphs in which the different regions with their sites and their chronology can be plotted. Fig. 9 is a plot of all ^{14}C dates for site layers attributed to the Aurignacian (505 items) from the database. There is no doubt that an evaluation (as to quality, reliability, etc…) of the dates is a necessity, but already without such a full-fledged interpretation, the different regions can clearly be distinguished in relation to their occupation history, if we accept that the ^{14}C-database is more or less representative of the human occupations of a given region. The Magdalenian plot (Fig. 10) also suggests some interpretation.

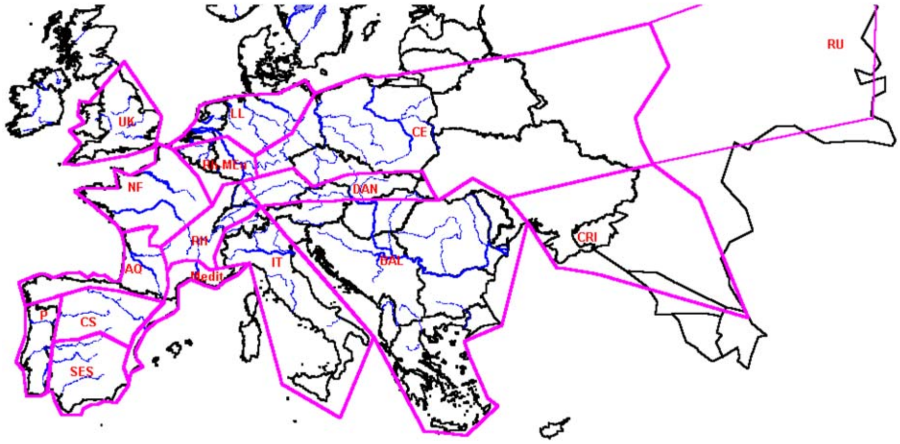

Fig. 7. European regions used in mapping of the Palaeolithic sites—SES: Southeast Spain; P: Portugal; CS: Central Spain; Medit: West Mediterranean Europe; Aq: Aquitaine and Cantabria; Rh: Rhone area; It: Italy; Bal: Balkans; DAN: Danube area; NF: Northern France; RhMeu: Rhine-Maas area; UK: United Kingdom; LL: Lowland; CE: Central Europe; CRI: Crimean area; RU: Russia.

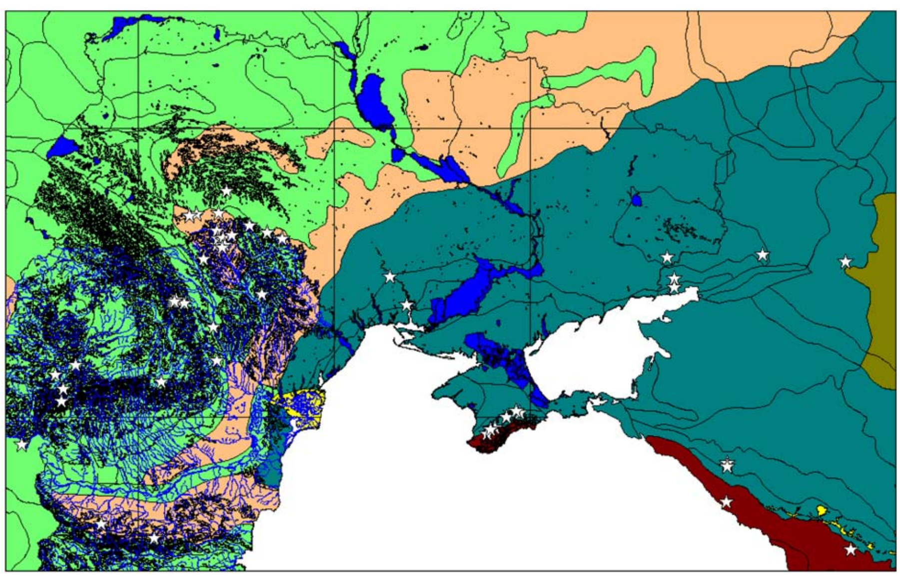

Fig. 8. Black Sea area with sites, vegetation, hydrography and hypsometry.

As another example of the potential of the database, it is also of interest to map the sites of a cold period 20.5–23.0 ka BP (22.2–24.2 ka calBC) and to compare this distribution to that of sites from the warmer periods. In creating the map of the cold period (Fig. 11), for several reasons, we did not take in account several highly problematic dates.[1] There is no doubt that queries should be corrected by evaluating the included data. Criteria used for doing this will depend on the purpose of the queries made. Once this has been done, maps are easily created and geographical differentiation in site density, which can eventually be interpreted as an indication of the existence of refuge areas, is popping up from the maps.

We do not pretend here that the database is already in a position of being a reliable tool. But it certainly can

[1]Dates not used for the LGM map: Miesenheim 2, LY 3484, Federmesser; Meiendorf, W-172, (humus), Hamburgian; Poggenwisch, W-93, (humus), Hamburgian; Poggenwisch, H-32/60, (chalk-gyttja); Poggenwisch, H31/67, (organic fraction in bone), Hamburgian ; Poggenwisch, H32/116A, (chalk-gyttja), Hamburgian; Pin Hole Cave, OxA-1936, Creswellian, (reindeer shed antler); Pin Hole Cave, OxA-1468, Creswellian, (humerus); Little Hoyle, OxA-1026, Final Palaeolithic, (bone); Robin Hood's Cave, OxA-4116, Gravettian, (tooth);

(*footnote continued*)
Robin Hood's Cave, OxA-6115, Gravettian, (tooth); Terrasse de l'Aa, Gif-1712, Magdalenian, (bone). Vermeersch, P., Renault-Miskovsky, J. (Eds.), 1999. European Late Pleistocene, Isotope Stages 2 and 3: Humans, their Ecology and Cultural Adaptations. ERAUL 90, Liège.

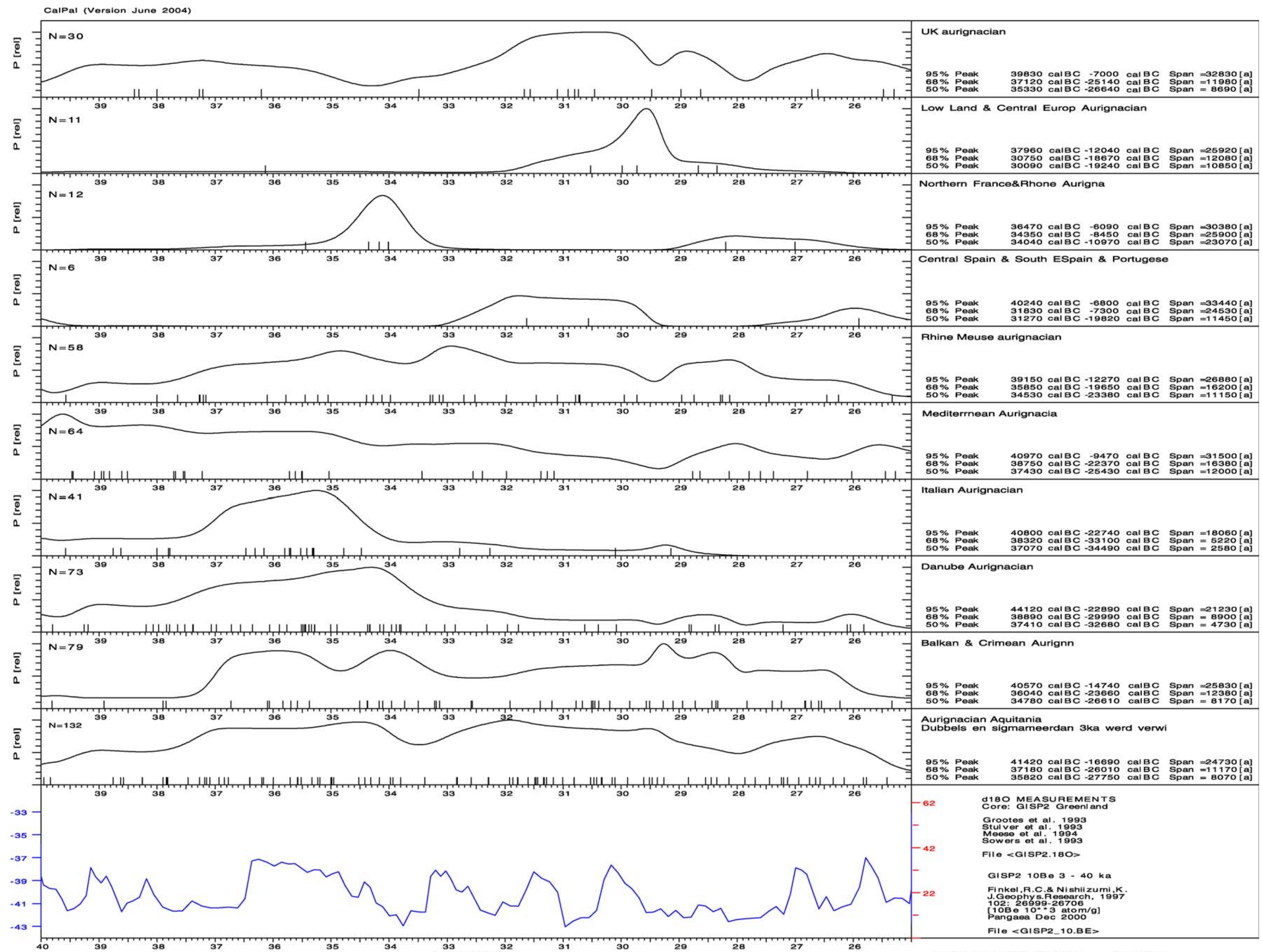

Fig. 9. Chronological distribution of dates, typologically or technologically attributed to the Aurignacian from different regions, from bottom to top: Cantabria and Aquitaine; Balkans and Crimea; Danube; Italy; Mediterranean region; Rhine, Meuse; Spain and Portugal; Northern France and Rhone; Lowland and Central Europe; Great Britain.

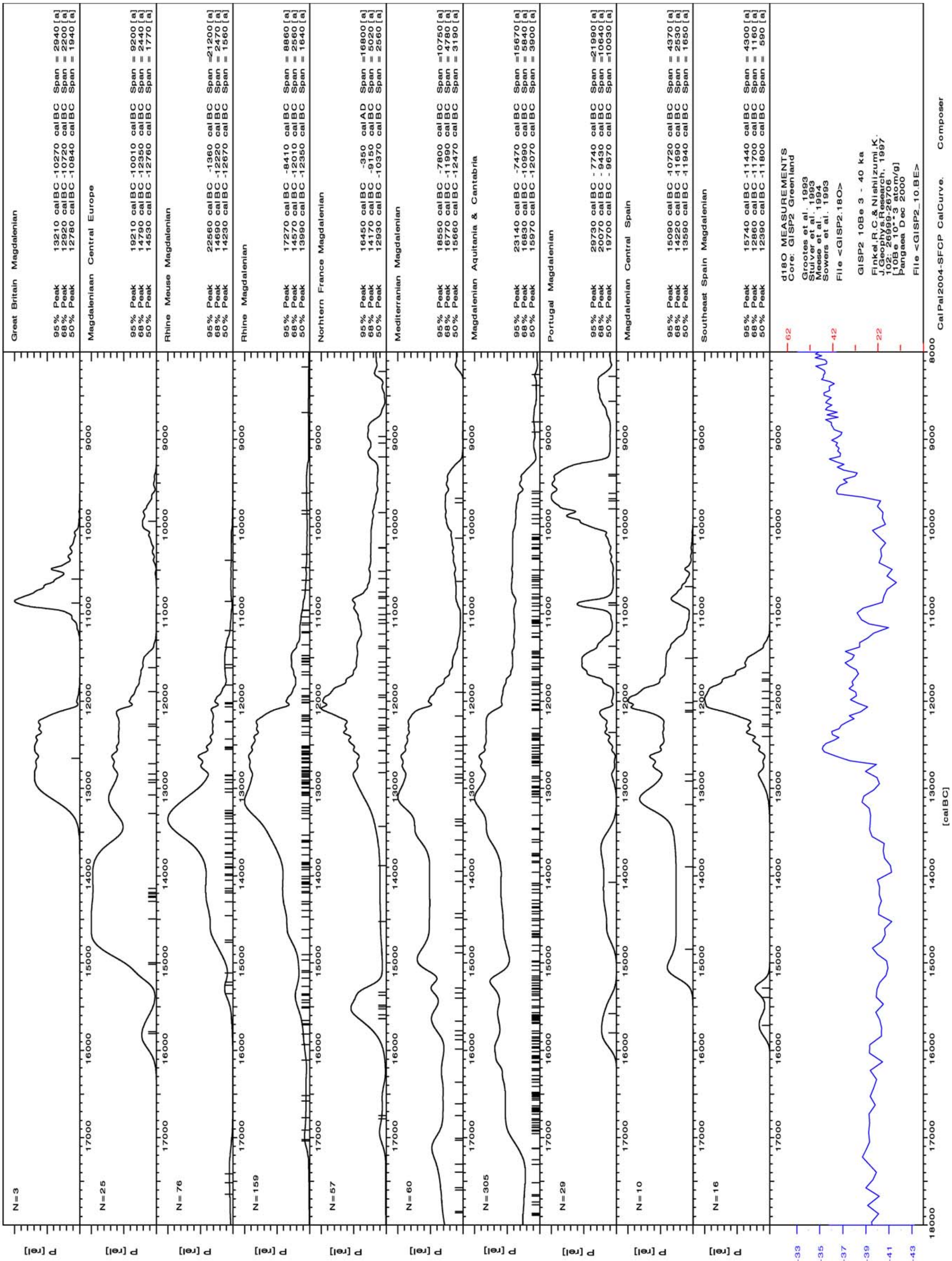

Fig. 10. European Magdalenian dates by region.

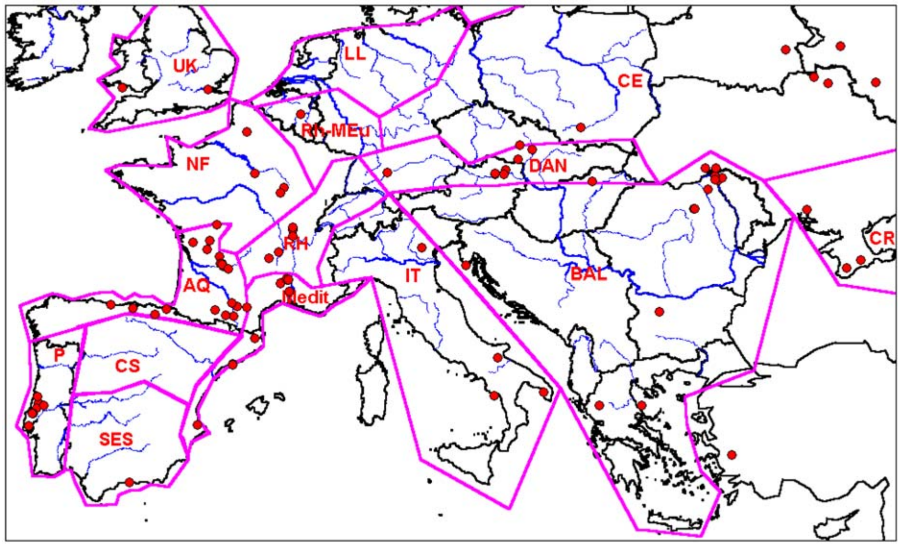

Fig. 11. Sites in the cold period, 20.5–23.0 ka BP (22.2–24.2 ka calBC).

become just that. Our only purpose was to suggest that the combination of an extensive database, a GIS environment and a ^{14}C calibration tool provides the ability for extensive searches within the geography and chronology of European Palaeolithic populations. By combining all the data, we can automatically construct different kind of maps that, eventually, will bring some understanding of the phenomenon of population migrations in the late Upper Pleistocene.

We hope that our colleagues will be interested in improving the quality of the database. For that reason it is available on the Internet (http://www.kuleuven.ac.be/geography/frg/projects/14c-palaeolithic/). A blank datasheet is also available which will enable researchers to incorporate new data. The dataset can immediately be transmitted to maps, so that they are continuously updated. The dataset can also immediately be correlated and contrasted with new climate proxies, when available. This procedure will help us in rapidly mapping the European population and its changes over time and with climate phases.

Reference

Council of Europe, 1987. Map of the natural vegetation, scale 1:3000000, Second edition. Commission of the European Community, Brussels.