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THE CHRONOLOGY OF HUMAN CULTURES IN EUROPE AND THE MEDITERRANEAN BASIN ACCORDING TO ¹⁴C DATING

ABSTRACT: GARZELLI M.R. & BONADONNA F.P., *The chronology of human cultures in Europe and the Mediterranean Basin according to ¹⁴C dating*. (IT ISSN 0391-9838, 1996).

¹⁴C ages, from 20 ka to 2 ka BP inclusive, related to human cultures, cultivated plants and native flora in Europe and in the Mediterranean area allowed us to build a time succession for the evolution of the human cultures compared with cultivations and the diffusion of native flora in post-glacial times. The results show the invalidity of transition cultures, such as the Mesolithic and Chalcolithic, as chronological indicators even in the same area and they strengthen the diachrony of the same events at different latitudes.

KEY WORDS: Post-glacial time, Human cultures, Cultivation, Radiocarbon chronology.

RIASSUNTO: GARZELLI M.R. & BONADONNA F.P., *La successione delle culture umane in Europa e nel Bacino del Mediterraneo in base a misure di età ottenute con il metodo del radiocarbonio*. (IT ISSN 0391-9838, 1996).

Oltre 3800 età ¹⁴C, comprese tra 20 e 2 ka BP, raccolte, per i paesi europei e per il bacino del Mediterraneo, sulla letteratura geocronologica specializzata e su altre riviste (vedi BONADONNA, 1993a e 1993b) hanno permesso la ricostruzione, nell'area studiata, della successione temporale per le culture umane.

Queste date sono state comparate, ove possibile, con la diffusione, dopo l'ultimo glaciale, della flora spontanea e dell'instaurazione e dello sviluppo della flora coltivata. I dati, a volte per alcuni paesi piuttosto scarsi, hanno mostrato, però, la non validità cronologica delle cosiddette «culture di transizione», come il Mesolitico o l'Eneolitico, non soltanto nel confronto di aree a diversa latitudine ma anche per una stessa area. Tali dati hanno mostrato, inoltre, la scarsità di interessi, in alcune zone, per i periodi culturali più antichi: ad esempio in l'Egitto mancano misure di età per culture cronologicamente anteriori al Neolitico, anche se esistono ritrovamenti riferibili a tali culture. La mancanza, invece, di misure di età per l'Eneolitico nelle aree più settentrionali potrebbe essere legata a migrazioni, in quelle aree, di popolazioni culturalmente più avanzate, già in possesso della tecnica di lavorazione del bronzo, rispetto a quelle autoctone, ancora ferme alla cultura neolitica.

La diffusione della flora spontanea indica ancora una volta la diacronia degli eventi legati alla deglaciazione a seconda delle differenti latitudini. Anche la comparsa, contemporanea con le culture del Tardo Paleolitico, e la diffusione delle piante coltivate sono fortemente influenzate dalla latitudine. L'analisi dei dati conferma inoltre che tale fenomeno ha determinato anche lo sviluppo delle culture umane e la loro diffusione. Ad esempio nel Regno Unito, tra 30 e 14 ka BP, si nota la totale scomparsa di misure di età legate alla cultura paleolitica; nel Bacino Mediterraneo, invece, quelle relative a siti riferibili a tale cultura mostrano una continuità temporale per tutto il periodo coperto dalle misure ¹⁴C.

TERMINI CHIAVE: Periodo post-glaciale, Culture umane, Piante coltivate, Cronologia ¹⁴C.

INTRODUCTION

The source of ¹⁴C dates herein considered is the database «A detailed list of ¹⁴C significative ages» (BONADONNA, 1993a, 1993b). This is a detailed list of more than 3800 ¹⁴C significative ages of cultural and climatic events. The considered area embraces the countries of the Mediterranean Basin and of Northern-Central Europe. The time period is between 20 and 2 ka BP that covers the time between the last glacial climax and the historical times. The ages considered cannot be all the ages published throughout the literature, but are, principally, those published in geochronological journals such as *Radiocarbon* (1959-1995) and *Archaeometry* (1984-1996) and in journals devoted to Quaternary geology and palaeontology, on which the database was built. The listed ages are been chosen on the reliability drawn by the geological or archaeological description that accompanies them. Each age is arranged in the following way: 1) the location name; 2) the co-ordinates of the site, generally expressed as latitude and longitude, degrees and minutes only: for the United Kingdom, sometimes the co-ordinates are expressed in NCR notation; 3) the ¹⁴C measure, expressed in years BP, and its experimental error; 4) if present, the quote above or below sea-level; 5) the material on which the measure was performed, as wood, shell, collagen, etc.;

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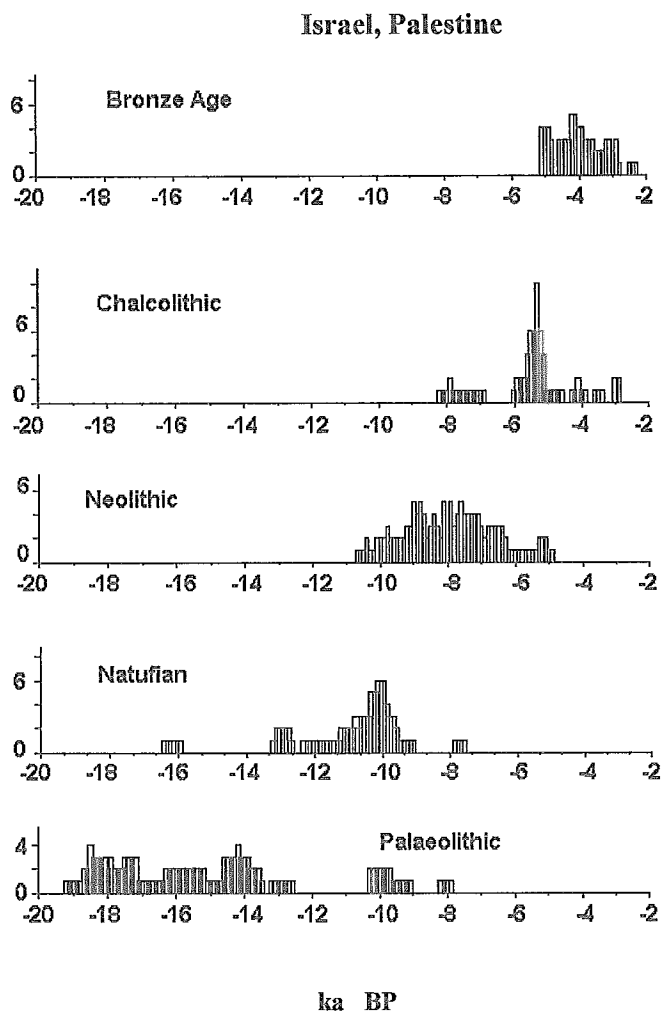


Fig. 1 - Israel-Palestine: histograms showing the chronological cultures sequence.

6) if present, some botanical information; 7) the climatic marking expressed according the Blitt and Sernander peat stratigraphy (GARZELLI & BONADONNA, 1992, figs. 6 and 7) and/or the cultural marking; 8) the bibliographic reference, as «Alessio *et al.*, 1969». It is possible to find the complete bibliographical references for each age, more than 390 items, in the references list annexed to the database (BONADONNA, 1993b).

The cultures taken into consideration, according to the individual authors' definitions, range from the Late Upper Palaeolithic up to including the Bronze Age. The Upper Palaeolithic includes terms such as «Solutrean», «Magdalenian», «Gravettian», «Epigravettian», «Romanellian», «Epipalaeolithic», «Perigordian», «Oranian» and «Ibero-Marusian». The Mesolithic comprises «Azilian», «Sauveterrian», «Tardenoisian», «Natufian» for the Near East and «Capsian» for Northwest Africa. The Neolithic includes «Chassean» and «Capsian tradition Neolithic». For the transition from Neolithic culture to the Metal Age we use the term «Chalcolithic» as a general term, but, for

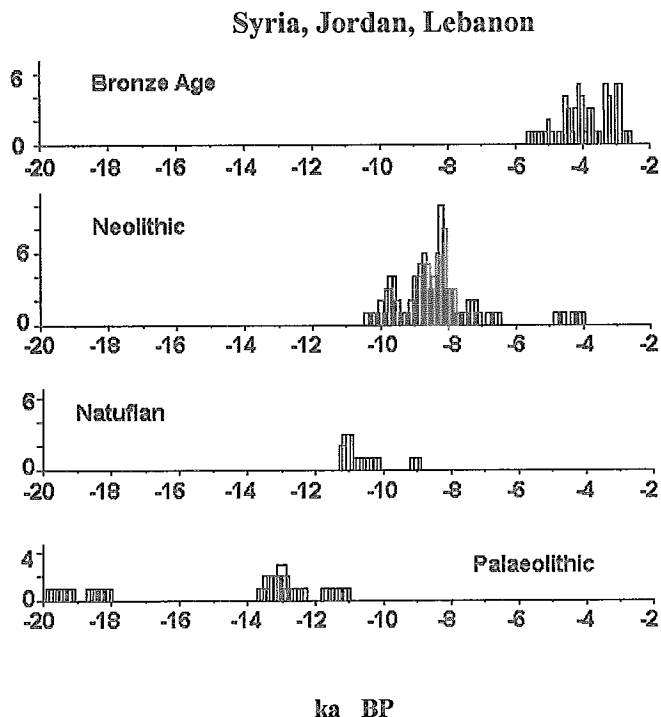


Fig. 2 - Syria-Lebanon-Jordan: histograms showing the chronological cultures sequence.

Italian and French areas, also the term «Eneolithic» is used. The expression «Bronze Age» was taken as an inclusive term for this culture. For the Metal Ages in the Greek area we chose the archaeological classifications universally known as referable to the above mentioned Metal cultures. The «Polada» culture was also taken into consideration for the Italian Bronze Age.

The beginning of diffusion and the distribution through the time of cultivated plants apply to the Mediterranean Basin and to Northern-Central Europe. Measurements regarding Northwest Africa were not found. We also considered the ^{14}C datings regarding native flora in order to compare the human cultures with the flora and, consequently, with climatic evolution.

All the ages are fitted on the graphs with their quoted uncertainty of $\pm 1\sigma$.

CULTURES

The data analysis begins in the Palestine-Israel area, moves north-northwest as far as the Scandinavian peninsula and then returns to the southern areas, Spain, Northwest Africa and Egypt.

Israel and Palestine (fig. 1) - The histograms for the cultures show a lack of measurements for the Late Upper Palaeolithic in the interval between 12 and 10 ka BP. This interval is, however, covered by Natufian (Mesolithic)

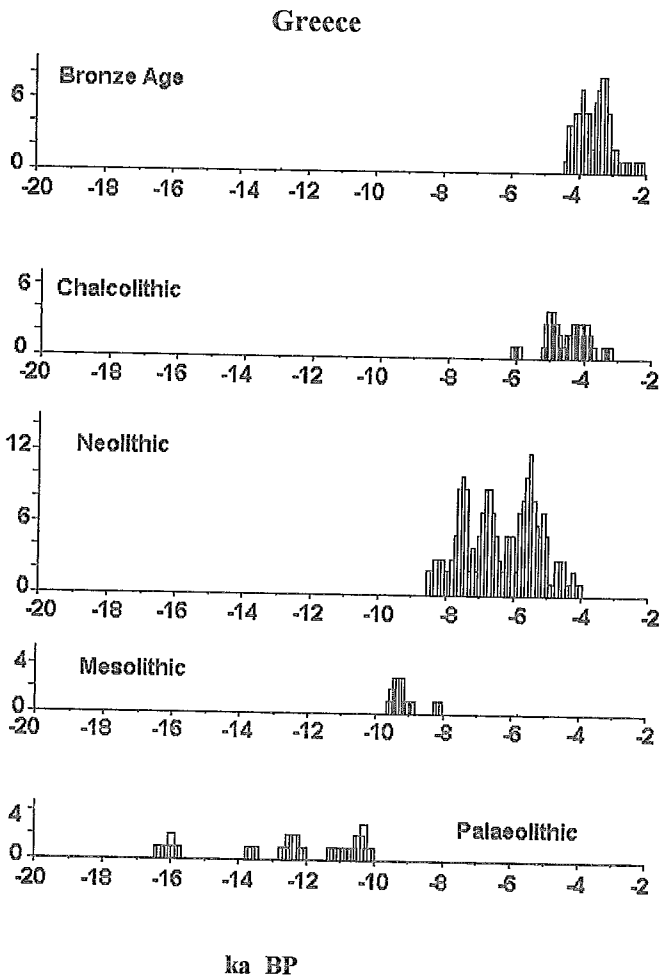


FIG. 3 - Greece: histograms showing the chronological cultures sequence. In this area the age measurements include the Cyprus ages for the Neolithic and the Chalcolithic cultures.

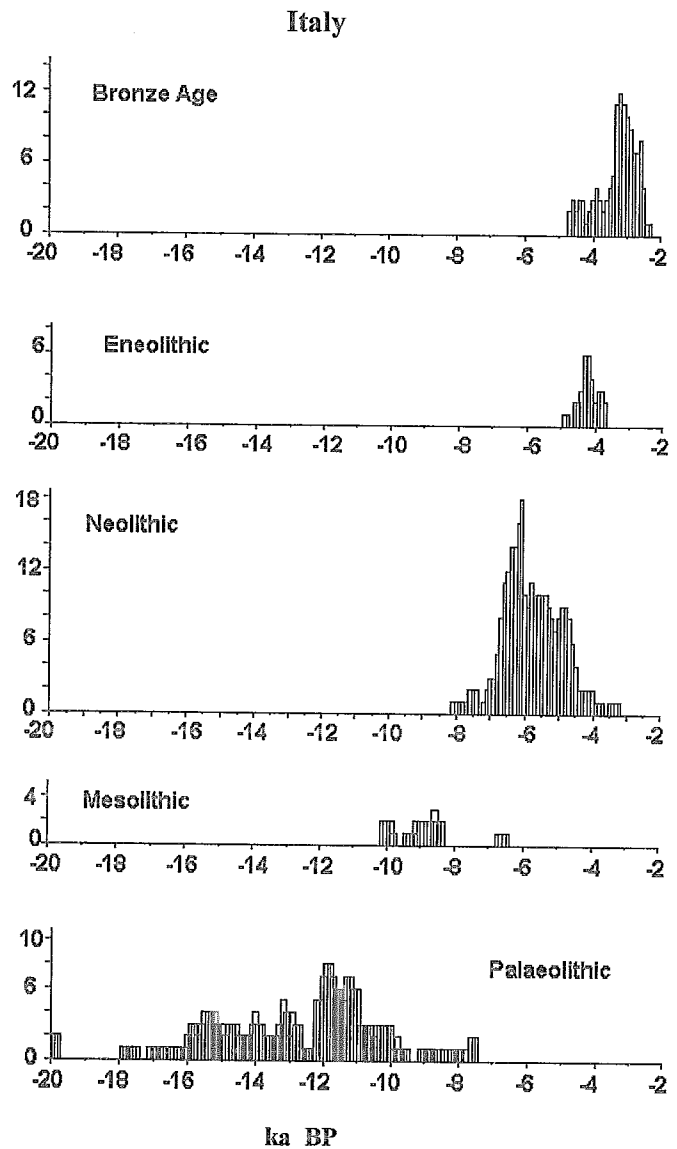


FIG. 4 - Italy: histograms showing the chronological cultures sequence.

ages. Furthermore, the Natufian ages are never younger than those of the Late Upper Palaeolithic. The Natufian peak is at about 10.5 ka BP, that is when we find many Neolithic ages. The later part of the Neolithic corresponds to the peak of the Chalcolithic; its beginning is contemporaneous with the peak of Neolithic ages with a lack of measurements of about one thousand years around 7 ka BP. The peak of Chalcolithic ages also corresponds to the beginning of the Bronze Age.

Syria, Lebanon, Jordan (fig. 2) - For this area we can note very few measurements relative to the Late Upper Palaeolithic and Natufian. This may be due to a lack of interest of the students in these cultures in this region. Furthermore, we have no ages for the Chalcolithic culture, but we found an early beginning of the Bronze Age which coincides with the end of Neolithic culture.

Turkey (figs. 11, 12) - As in the previous area the oldest cultures are lacking. The beginning of our rather limited data goes back to the Neolithic. Only for the Bronze Age do we have a sufficient number of datings.

Greece (fig. 3) - We have a very limited number of ages for the Late Upper Palaeolithic and Mesolithic cultures; therefore, we are not able to discuss their chronology. The Neolithic and the Chalcolithic cultures also include the ages relative to Cyprus. The whole of the last Neolithic peak corresponds to the beginning and to one of the peaks of the Chalcolithic culture; the end of Neolithic culture, about at 4 ka BP, coincides with the beginning of the Bronze Age. Therefore, there seems to be a time continuity between these last two cultures.

Italy (fig. 4) - Considering the time interval relative to the Late Upper Palaeolithic and Mesolithic cultures, we note that the limited number of Mesolithic ages, though of poor statistical significance, coincide with the youngest peak of the Palaeolithic datings. The largest number of ages relative to the Eneolithic, that is Chalcolithic, culture corresponds to a time during which there is an

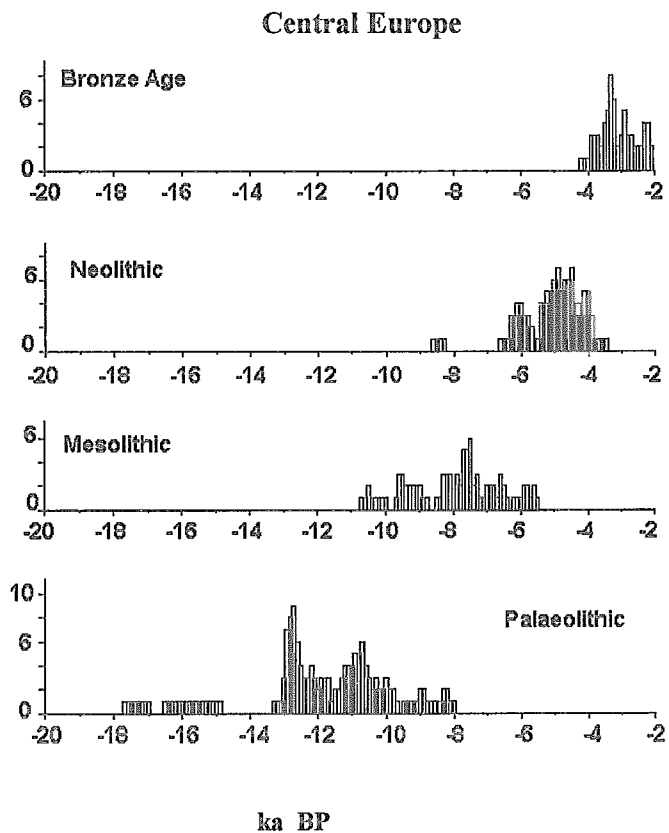


FIG. 5 - «Central Europe»: histograms showing the chronological cultures sequence. We include in this area The Netherlands, Germany, Belgium and Poland.

abundant number of Neolithic ages. The end of the Neolithic, at more than 4 ka BP, occurs when the Bronze Age is well developed.

«Central Europe» (fig. 5) - This term covers an area including The Netherlands, Germany, Belgium and Poland. Also in this region the ages for Late Upper Palaeolithic and Mesolithic overlap over ca. 3000 years, from 11 to 8 ka BP. On the other hand, the Mesolithic culture persists during the greatest extent of the Neolithic culture, between 6 and 4 ka BP. In this area we have no ages for the beginning of the Metal Age. The Bronze Age begins about one thousand five hundred years before the end of the Neolithic culture.

Scandinavian Area (figs. 11, 12) - This includes Sweden, Norway and Denmark. There are no data for the Late Upper Palaeolithic and for the beginning of the Metal Age, and those for Mesolithic culture are very scarce. Despite that, the time contiguity and the overlapping between the Neolithic and Bronze ages seem evident.

United Kingdom (fig. 6) - In this region the Late Upper Palaeolithic age measurements are very limited and those pertaining to the beginning of the Metal Age are totally lacking. We have two different peaks, during the Mesolithic culture, one at about 9 ka BP and the other at about 6 ka BP. The latter coincides with a time of the Neo-

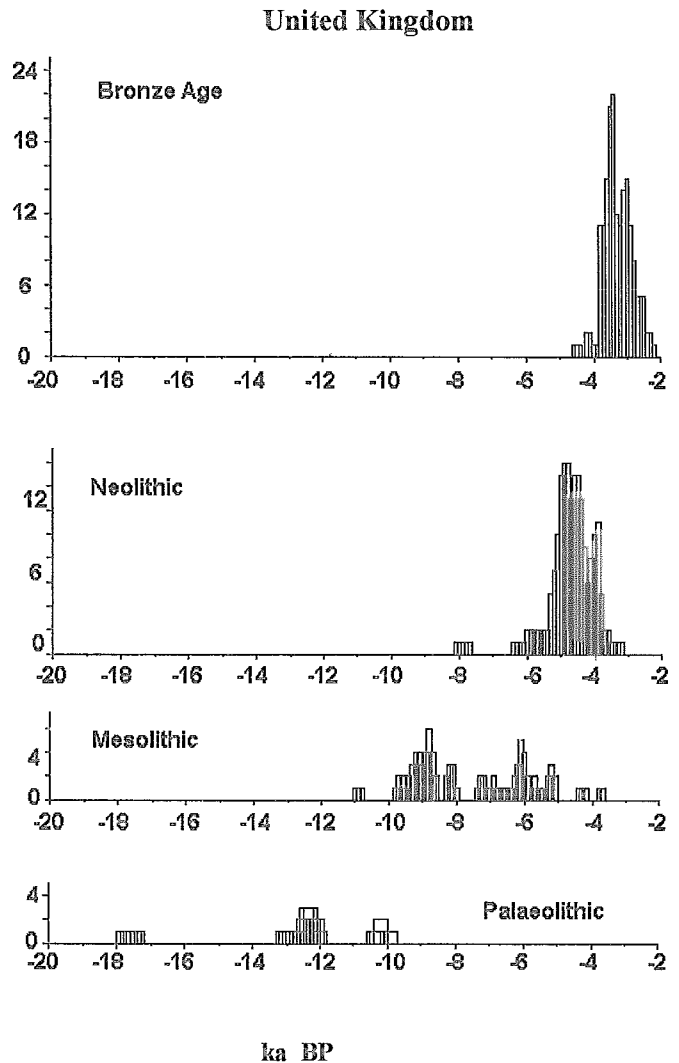


FIG. 6 - United Kingdom: histograms showing the chronological cultures sequence.

lithic culture during which this culture is considerably widespread, while the youngest Neolithic peak, about 4 ka BP, corresponds to a well developed Bronze Age.

France (fig. 7) - In this area it is possible to observe, for all the cultures, a very large number of age measurements, compared with those of the other regions. Also in this case the overlapping of the different cultures is evident.

Spain (fig. 8) - Here it is impossible to distinguish, from a chronological point of view, the Mesolithic culture and the Late Upper Palaeolithic. The same holds true for the beginning of the Metal Age, as it is fully overshadowed by the Neolithic and Bronze Age cultures. Furthermore, there is no time gap between these two cultures.

North-western Africa (fig. 9) - In this area we found only the age measurements relative to the oldest cultures; there is no data for the Metal Age. For the Late Upper Palaeolithic we consider also the terms «Ibero-Marusian», «Oranian» and «Epipalaeolithic». This choice is determined by the fact that authors' views regarding the chronological

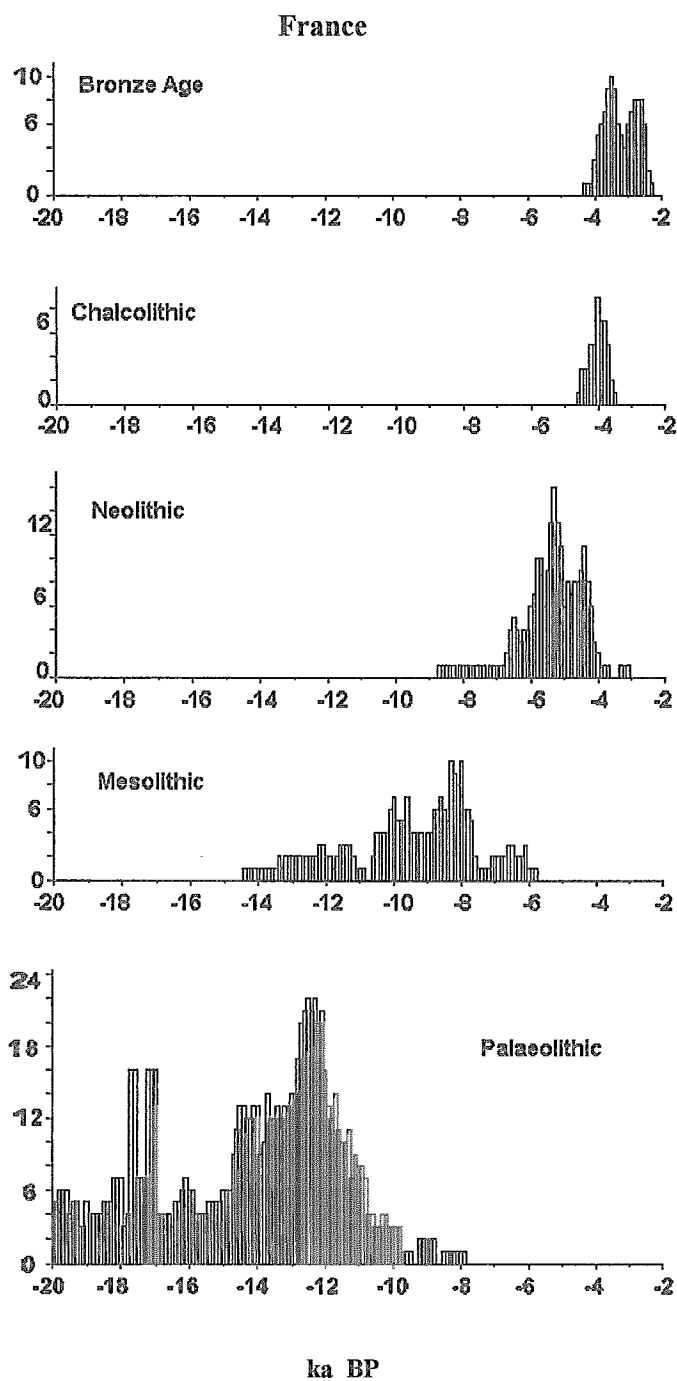


FIG. 7 - France: histograms showing the chronological cultures sequence.

cultural sequence of this area diverge. The Capsian culture has been considered as corresponding to that of the Mesolithic, but in the Neolithic culture we have associated, according to the literature, also the ages of the «Capsian tradition Neolithic». However, the histograms show no chronological differences between the Capsian and the Neolithic, and the Palaeolithic culture ends in correspondence with the maximum frequency peak of the Capsian.

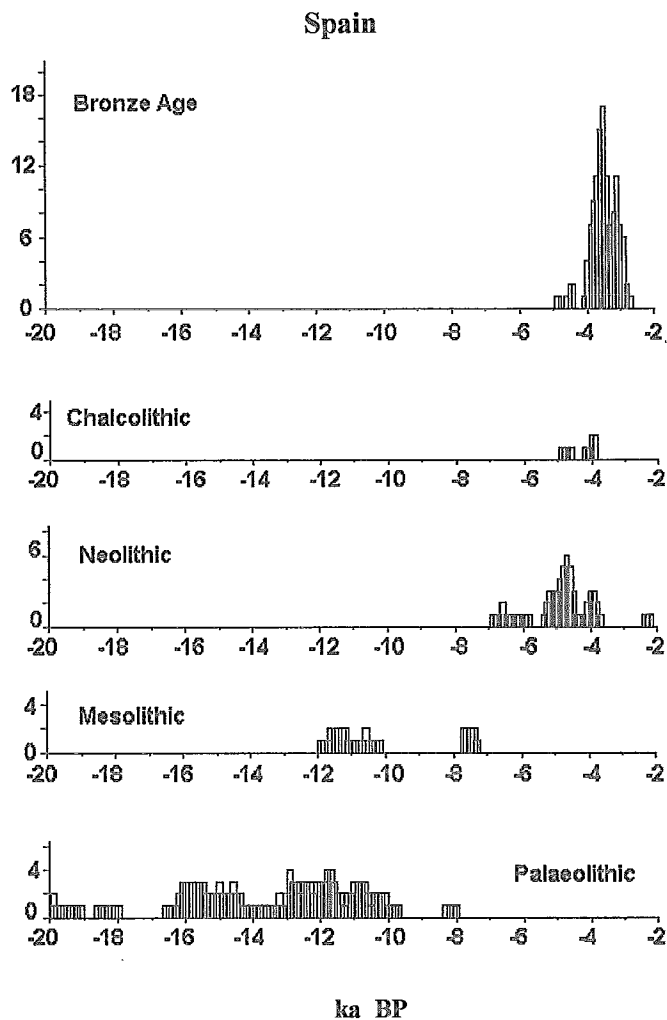


FIG. 8 - Spain: histograms showing the chronological cultures sequence.

Egypt (fig. 11) - In the literature quoted (BONADONNA, 1993b) we found no age measurements older than those of the Neolithic culture. The lack of Late Upper Palaeolithic and Mesolithic ages may be due to a lack of interest of the students in the oldest cultures of this area. According to the data we have, the Neolithic culture, in Egypt, begins around 10 ka BP and ends about 5 ka BP.

The comparison of the cultures from the studied areas shows the following:

a) the Late Upper Palaeolithic (fig. 10) ends, in the Near East area, such as Lebanon, Syria, Israel and Palestine, earlier, compared with the Late Upper Palaeolithic of the Mediterranean area of Greece, Italy, Spain and North-western Africa. Particularly in Palestine and Israel, the previous assertion does not take into account the time gap, around 13 ka BP, which precedes by about two thousand years a small number of datings, still referred to the Late Upper Palaeolithic. For the northern latitudes the scarcity or complete lack of age measurements between 20 and 16 ka BP may be due, in our opinion, to climatic influence.

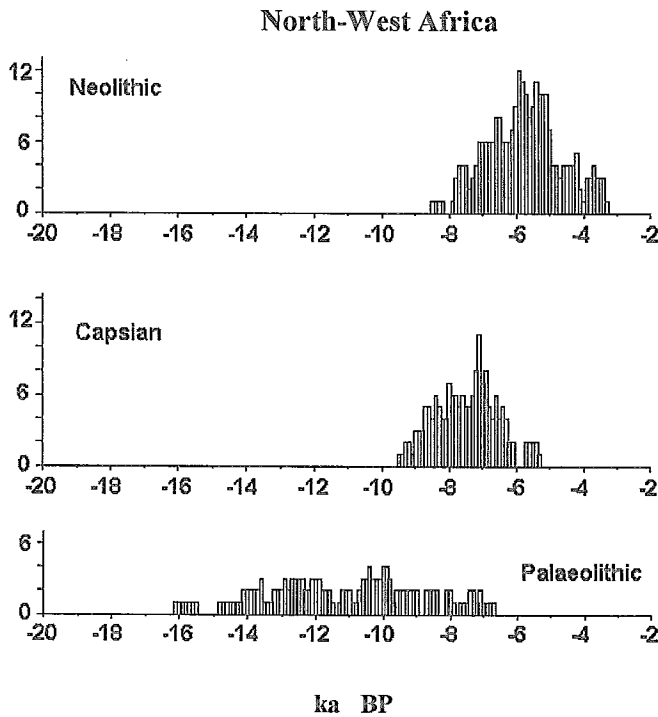


Fig. 9 - North-western Africa: histograms showing the chronological cultures sequence.

In fact, at these latitudes deglaciation occurs when, in the temperate areas, the Upper Palaeolithic culture comes to an end.

b) Significant data of Mesolithic cultures are only available for France (fig. 7), for the Francophone area of North-western Africa (fig. 9) and for the Palestine-Israel area (fig. 1). In the Mediterranean Basin the scarce data found show that the beginning and the end in the Near East also of this culture precede the beginning and the end of the same culture in western areas. The Mesolithic culture overlaps the Late Upper Palaeolithic everywhere, this being particularly striking in the French area (fig. 7) because of the numerous ^{14}C ages both for the older and younger culture.

c) In the Near East and the area of Egypt the radiocarbon data set the beginning of the Neolithic culture (fig. 11) at more than 10 ka BP, whereas in the other areas of the Mediterranean Basin this culture appears about two thousand years later; soon after 10 ka in Turkey, between 9 and 8 ka in Greece and in North-western Africa, around 8 ka in Italy and 7 ka in Spain. This trend leads to the hypothesis of a spreading of the culture from the Lebanon-Israel-Palestine-Egypt area westwards, that is towards North-western Africa and Spain. However, at the same time, there is diffusion towards North-Northwest, still from the same area, and reaches Italy through Turkey and Greece. In France we have low frequency, 1, ages, spanning from 9 and 7 ka BP and corresponding to the Mesolithic peak. A frequency higher than 1 begins around

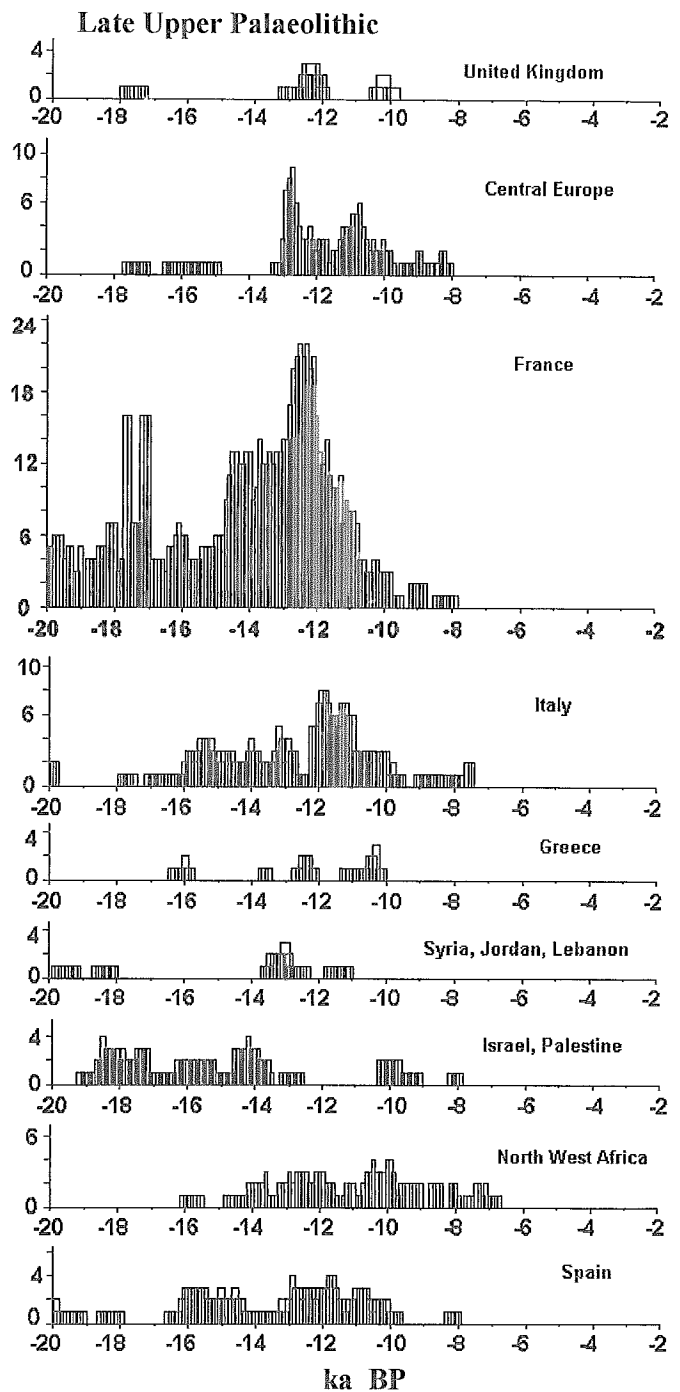


Fig. 10 - Chronology of the Late Upper Palaeolithic culture in the different regions.

7 ka BP, an age similar to those available for the Iberian area and just a little older than the Neolithic ages of North Central Europe. Furthermore, for France, Italy and Northwest Africa, where ^{14}C ages are abundant, the end of Palaeolithic culture matches with the beginning of the Neolithic. Such evidence points out the Mesolithic culture is indistinguishable, as chronology, from the preceding and following cultures.

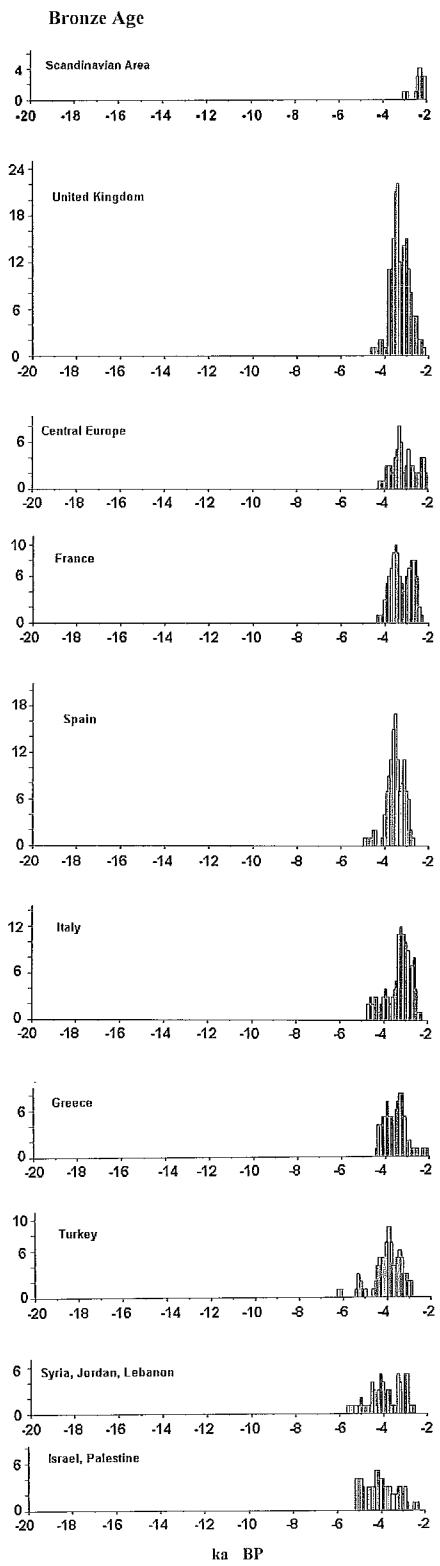
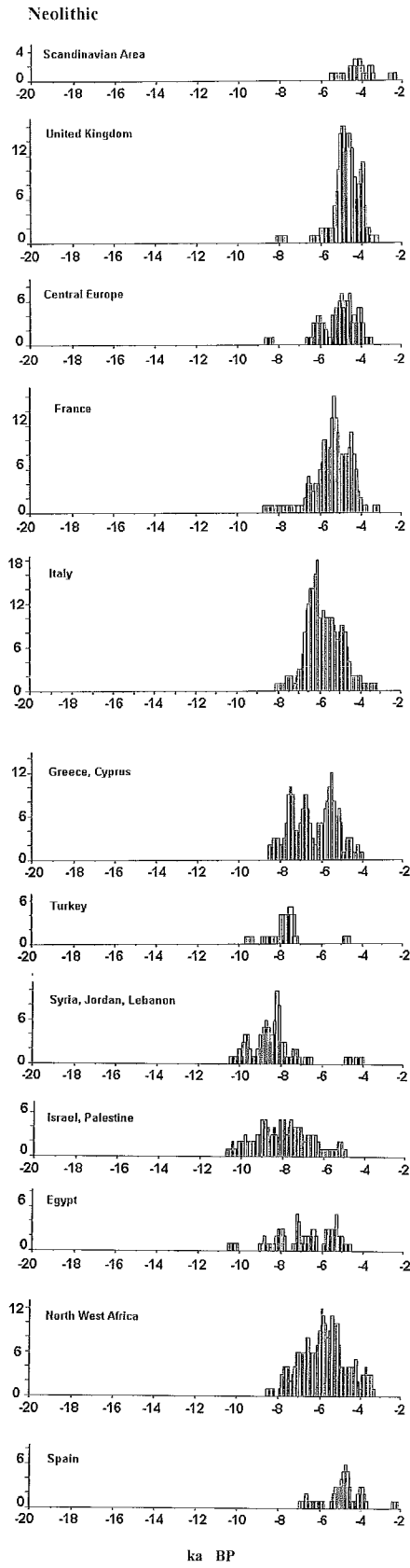


FIG. 11 - Chronology of the Neolithic culture in the different regions.

FIG. 12 - Chronology of the Bronze Age culture in the different regions.

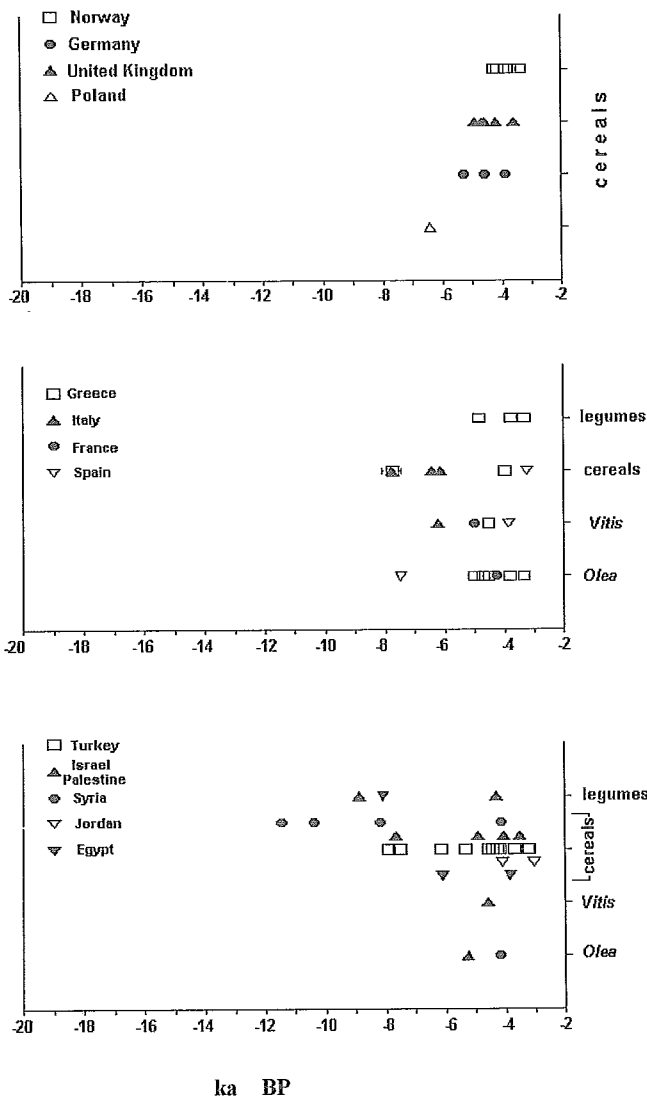


FIG. 13 - Diagrams showing the cultivated plants distribution in a) Northern Central Europe area, b) Northern Mediterranean area, c) South-Eastern Mediterranean area.

d) The beginning of the metal ages, Chalcolithic or Eneolithic culture, is found only in the Mediterranean area, whereas ages of this culture were not found for Northern Central Europe (figs. 5, 6). Also for this culture the oldest ages, around 8 ka BP, are in the Near East area, particularly in the Israel-Palestine region (fig. 1). They become younger the further they are from this point of spreading (figs. 3, 4). Everywhere the Chalcolithic overlaps the Neolithic culture, both also with high peaks of frequency. This overlapping is less evident in Turkey.

e) The oldest ^{14}C ages measurements for the Bronze Age (fig. 12), between 6 and 5 ka BP, are also found in the Near East and in Turkey. In the rest of the Mediterranean area and Central Europe they are about one thou-

sand years younger. Only in the Scandinavian Area does the Bronze Age begin around 3 ka BP. In all the areas in which we have numerous age measurements, beginning of the Bronze Age overlaps the measurements of the Neolithic culture. In some areas, such as Italy, Spain, France, Central Europe and the United Kingdom, it overlaps the high frequency peaks, in others, like Israel and Greece, it only extends over the end of the Neolithic. This kind of overlapping eliminates any kind of chronological relevance for the Chalcolithic culture it also does for the Mesolithic culture (GARZELLI & BONADONNA, 1992, fig. 7).

CULTIVATED PLANTS

The three plots of figure 13 refer to the three areas which, in our opinion, seem to be the most homogeneous: the «Northern Mediterranean» area, the Spain, France, Italy and Greek region, the «south-eastern Mediterranean» area, Turkey, Israel and Palestine, Syria, Jordan and Egypt, the «Northern Central Europe» area, Germany, Poland, Norway and United Kingdom. We made this choice as we have no data for the other regions. The most evident datum, on measurements that we have, is cereal cultivation in Syria before 11 ka BP, during the Natufian (Mesolithic) culture, about one thousand years before the beginning of the Neolithic. Further, according to what was said before, the first cereal cultivation begins during the final phases of the Late Upper Palaeolithic.

This hypothesis is in good agreement with HEDGES & alii, 1996. They affirm (page 198), in fact, «It remains to be demonstrated that the Epipalaeolithic proper of the area also contained sedentary groups (like the Natufian community at Eynan in northern Israel), but we now know that pre-agricultural, sedentary harvester-hunters were much more widespread in the Near East in the latter half of the 10th millennium cal BC than has been commonly supposed».

The oldest ages for cereal cultivation, in the Mediterranean area, are a little after 7 ka BP. Particularly, in Italy these dates are in the later period of the Late Upper Palaeolithic, corresponding to the beginning of Neolithic culture. In Greece, owing to the lack of measurements related to the oldest cultures, we are able only to state that cereal cultivation seems to have begun during the Neolithic, while in Spain, at this time, there is the appearance of *Olea*.

In «Northern Central Europe» there are measurements exclusively referable to cereal cultivation; they are younger than those of the other areas. The oldest appearance, about 6.5 ka BP, is in Poland during the Mesolithic culture; the youngest in Norway after 5 ka BP; both appearances are contemporaneous with the beginning of Neolithic culture. In the United Kingdom the beginning of cereal cultivation occurs about 5 ka BP, a little before that in Norway. As in the previous events it is during the Mesolithic culture and then, at the same time as the beginning of the Neolithic.

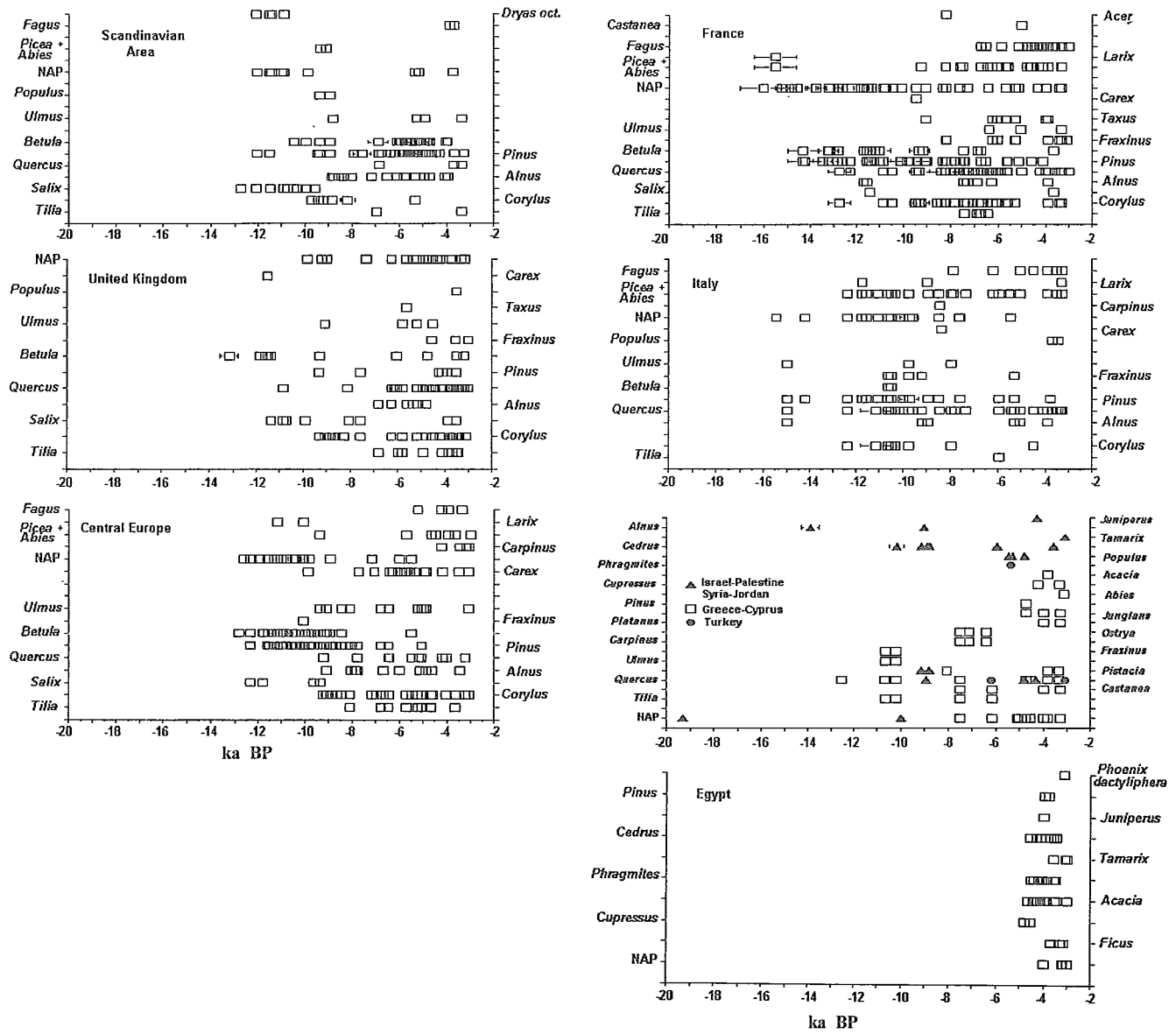


FIG. 14 - Diagrams showing the native flora in the different regions.

NATIVE FLORA

Native flora age measurements are, unfortunately badly correlated among themselves, discontinuous and with few topographical references. Therefore they are of little use to discuss the climatic events of the past in the various regions considered.

The diagrams drawn for the studied areas (fig. 14) show, according to Zagwijn's results (1994), that the appearance of *Corylus* in continental Europe, in the Scandinavian area and in the United Kingdom occurs between 10 and 9 ka BP.

These are also the conclusions of Day (DAY, 1996, page 21): «The first arrival of *Corylus avellana* in the area has been dated to around 9400 yr BP in the late-edge deposit (DAY & MELLARS, 1994) with a major population expansion at ca 9000 yr BP».

This event reveals the marked continental nature of the climate soon after the beginning of the deglaciation (ZAGWIJN, 1994). In the Mediterranean Basin *Corylus* appears earlier than in the previous areas, a little before 13 ka BP in Italy and France. This further supports the diachrony of the effects of the deglaciation at different latitudes, before in temperate areas and after in more northern regions.

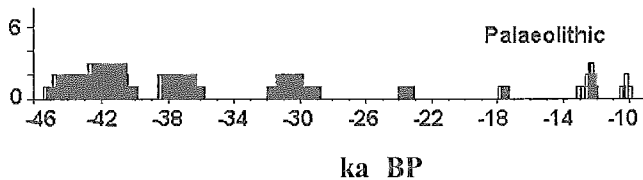


FIG. 15 - Histogram of the ^{14}C ages of the whole Upper Palaeolithic in the United Kingdom.

In the northern Mediterranean region, France and Italy, some deciduous forest elements, enduring high seasonal thermic variations such as *Ulmus*, *Betula* and *Alnus*, appear but still together with a marked presence of herbaceous elements (COMBOURIEU NEBOUT, 1993; COMBOURIEU NEBOUT & VERGNAUD GRAZZINI, 1991). This event, around 16-15 ka BP, shows that the beginning of forestation matches that of the deglaciation, but it happens in former times as regards northern central Europe. The transition from a continental climate to a more Mediterranean one, that is towards a more limited seasonal thermic variation, is shown by the appearance of Mediterranean elements such as *Fraxinus*. This latter appears about 11 ka BP in Italy and in Greece and around 8.5 BP in France. In our opinion this event could be compared with Zagwijn's hypothesis on climate succession, during the deglaciation, in the northern regions. In these places, however, the transition from a high seasonal thermic difference climate to a more oceanic conditions occurred later, between 5 and 4 ka BP (ZAGWIJN, 1994, figs. 21, 22, 23).

The comparison between human cultures, cultivated plants and native flora bring about various considerations.

The diffusion of native flora indicates once more the diachrony, during post-glacial times, of the advance of the deglaciation at different latitudes, a process that influenced both development and spreading of the human cultures. For instance, in Northern Europe and in the United Kingdom, there is an almost total disappearance of age measurements related to human cultures between 30 and 14 ka BP (fig. 15). On the other hand, in southernmost regions, such as France or the Mediterranean area, the age measurements related to Palaeolithic cultures are

distributed continuously over the whole time span covered by the ^{14}C dating (figs. 4, 7, 8).

The appearance and the diffusion of cultivated plants is contemporaneous with Late Upper Palaeolithic culture. These events are strongly influenced by latitude. The oldest ages, between 11 and 10 ka BP, are in the Near East, while the more recent ones, younger than 5 ka BP, are in Norway. The history of cultivated plants in Europe develops between these time boundaries, about 8 ka BP in Italy and in Greece and about 5 ka BP in the United Kingdom.

Unfortunately the scarcity of measurements in some regions qualify our view as a working hypothesis. However, the most striking evidence is the lack of chronological significance of the transition cultures, that is the Mesolithic and Chalcolithic cultures and the identification of the diffusion point of all the cultures born after the Last Glaciation and of the cultivated plants in the Near East area.

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