Europe during the early Upper Paleolithic (40 000-30 000 BP): a synthesis

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ABSTRACT An attempt at a European synthesis concerning the emergence of Upper Paleolithic industries is proposed, based only on the stratigraphic sequences with reliable series of AMS ^{14}C dates and reliable information on the characteristics of the industries and the paleoenvironments. The available data, site by site, are summed up, and their reliability is discussed. The synthesis is based on a geographical division of Europe into thirteen areas. A complex pattern of cohabitation, with or without acculturation, is shown to exist between 40 000 BP and 30 000 BP: between 40 000 and 35 000 BP, a contemporaneous peopling of "transitional" industries, Aurignacian "0" and final Mousterian; between 35 000 and 32 000 BP, a geographical expansion of the early Aurignacian (I), with acculturation, a process from which result the Castelperronian, the Uluzzian and the Szeletian; between 32 000 and 30 000 BP, an overall expansion of the late Aurignacian (II) across all Europe, but with a persistence of the Streletian in the northeast, the Gorotsovian in the east, and the Mousterian in several peninsulas of the south (Crimea, meridional Iberia).

Introduction

How to understand the transition from the Middle to the Upper Paleolithic in Europe, with both missing data in many European areas and contradictory data in other areas (see, for example, the syntheses published in 1999 by Djindjian et al. and Zilhão and d'Errico), as a result of the history of research and the evolution of methods in Prehistory over more than a century? The only solution is to use a methodology which makes explicit the different steps of the reasoning involved, from the data (levels, artifacts, ^{14}C dates, paleoenvironmental data), at one end, to the data structures (types, facies, oscillations, chronology) and then at the other end, the reconstruction of human settlement. Due to the limitations of available space, it has not been possible to be totally explicit here. So, the option was chosen to list only, for each area, the diagnostic elements concerning both the stratigraphies and their reliability, the identification of facies, the paleoenvironments and the ^{14}C chronology.

Methodology

Our general methodological approach is based on the selection of sites having delivered enough information from different sources, so that cross-validation through the confrontation of the different disciplines can be used to validate results. Therefore, the sites in question must have a detailed multi-level stratigraphy of rich archeological layers, a reconstruction of paleoenvironments, and a series of numerous recent ^{14}C AMS dates.

Based on this information, our approach consists of the following steps: correlation of stratigraphic sequences in their paleoenvironmental context; individual validation of available ^{14}C dates, in relation with the relative reliability of the ^{14}C method beyond 30 000 BP; identification and characterization of artifact assemblages, involving space and time structuration using techniques of data analysis; determination of the anthropological characteristics of the inferred populations.

Paleoenvironments

The paleoclimatological reconstruction of the period between 40 000 and 20 000 BP in Europe is based on several paleoclimatic curves, including Summit ice cores (Greenland), the KET 8004 Tyrrhenian sea core, and pollen cores basically from the peat bogs of La Grande Pile (Vosges, France), Tennaghi-Philippon (Macedonia, Greece), and Banyoles (Catalonia, Spain) (Dansgaard et al., 1993; Paterne, 1986; Weissmuller, 1997; Wijmstra, 1969; Woillard, 1978). The period is characterized by a transition from a temperate and humid phase, the Würmian interpleniglacial, to the ice age maximum of the late Würm, through a certain number of oscillations, which, by tradition, are named Hengelo (39 000 BP?), Les Cottès (36 000 BP?) Arcy (31 000 BP), Maisières (29 000 BP), Tursac (25 000 BP). Their amplitude and climatic features, depending on altitude and latitude, are discussed by Bosselin et Djindjian (2002).

The long loess sequences including fossil soils also provide an excellent record of paleoclimatic events, although rich archeological layers are not necessarily associated with each fossil soil in the same sequence, which limits their usefulness. The sedimentation in rockshelters and karstic caves must be used more carefully, because it frequently reveals patterns of erosion, truncation and weathering during temperate/humid oscillations, and gelifluxion mechanisms during cold periods. The implications of such problems are more far-reaching during the Würmian interpleniglacial, at the time of the transition from Middle to Upper Paleolithic. Those limitations explain the current difficulties in the correlation of artifact assemblages with paleoclimatic events.

Radiocarbon dates

After a long period of absolute confidence in ^{14}C dates, archeologists understand now that they need to be concerned with the validation of the results supplied by radiocarbon laboratories. For the period between 40 000 and 30 000 BP, the reliability of ^{14}C dates is critical, due to the low percentage of ^{14}C in the sample. As a result, the impact of sample pollution or measuring error is fatal: at 30 000 BP, 1% of pollution gives a date younger by 2800 years, and at 40 000 BP by >6000 years. The superiority of the AMS method over the conventional method is also related to the ability to process very small amounts of material, allowing dating on bone, antler or ivory artifacts (essential for the dating of the Aurignacian when the integrity of the archeological layer in questionable) and human bones (Cro-Magnon, Vindija, Mladeč, Vogelherd, etc.).

The selection of the raw material is also of critical importance, the worst being a collection of many small bone fragments of uncertain stratigraphical origin for the conventional method. The question is not one of bone versus charcoal, as pointed out recently by several archeologists, but one of porous material being polluted by various means. The more frequent source of pollution is water carrying younger and, rarely, older carbon, with H_2CO_3 and $CaCO_3$. The best procedure is to choose only one raw material in a sequence of

dates, bone (not porous burnt bones but diaphyseal fragments, far better than the porous epiphysis) or charcoal (which may also be very porous and, therefore, polluted).

Nowadays, the chemical treatment in a ^{14}C date is as important as the physical treatment, and it will be perhaps essential in the near future to deal with two different laboratories, a chemical one for the preparation of the gas tube and a physical one for the AMS measure. As a conclusion, we can say, first, that the accuracy of 80% of published ^{14}C dates is lower than the given standard deviation, due to various uncontrolled errors and pollutions (Djindjian, 1999b), and, second, that, after 35 000 BP, dates have an accuracy not better than about 5000 years! So, many recent disagreements between archeologists concerning the comparison of very old ^{14}C dates are vacuous.

Artifact assemblages and their spatio-temporal distribution

When reading recent papers concerning the Aurignacian, it is striking to note that authors tend to refer to the Aurignacian as a general and sketchy concept of assemblages with carinated artifacts and/or retouched bladelets, no other structuration being expected through the ten thousand years of its duration across all of Europe. Such a methodological weakness is at the origin of the revival of numerous pseudo-Aurignacian facies during the Upper Paleolithic, with names like Aurignacian V, late Aurignacian, or Epi-Aurignacian. Sophisticated methods, using powerful data analysis, have showed the structured variability of the Aurignacian and its correlation with climatic variability (Djindjian, 1993a). Such results have never been refuted, and, in fact, have been strengthened by data from new field research. They are only limited by the need to have representative assemblages from several stratigraphical sequences in the same area, explaining the limited number of published studies: for the Périgord/Quercy (Djindjian, 1986, 1993b), the Upper Danube (Hahn, 1977), the Languedoc (Bazile and Sicard, 1999), Europe (Dolukhanov et al., 1980).

European geographical areas

According to its physical geography during the late Würm (Djindjian, 1995), Europe can be divided into the following thirteen areas, corresponding globally to the areas separated by the intersection of four latitudinal (northern, middle, Mediterranean, peninsular) and three longitudinal (western, central, eastern) divides:

1. northwestern Europe (United Kingdom, Belgium, Rhineland, and northern, central and eastern France);
2. central-western Europe (Charentes, Aquitaine, Cantabrian coast);
3. west Mediterranean coast (Liguria, Provence, Languedoc, Catalonia, Levant, Murcia);
4. central-northern Europe (Netherlands, Denmark, northern Germany, northern Poland);
5. central Europe (upper Danube, lower Austria, Slovakia, Hungary, Czech Republic, western Romania, Serbia, Croatia, Slovenia);
6. Adriatic area (Puglia, Venetia, Istria, Dalmatia, Montenegro, Albania, western Greece);
7. northeastern Europe (Belarus, Baltic countries, Scandinavian peninsula, northern Russia);
8. central-eastern Europe (Moldova, Romanian Moldova, Ukraine, Crimea, southern Russia);

9. southeastern Europe (southeastern Romania, Bulgaria, eastern Greece);
10. Iberian Peninsula (Portugal, Andalucia, Meseta);
11. Italian Peninsula;
12. Peloponnese;
13. Crimea.

Area 1 (northwestern Europe)

1. Kent's Cavern (Devon, England, U.K.) (Jacobi, 1980)
Sequence: Mousterian/Lincombian/late Aurignacian (31 000 BP)

2. Paviland Cave (Wales, U.K.) (Jacobi, 1980)
Sequence: Mousterian/Lincombian (38 000 BP)/late Aurignacian (29 600 BP)

3. Trou Walou (Belgium) (Dewez, 1993)
Level 6 = Late Aurignacian (30 000 BP)

4. Trou Magritte (Belgium) (Otte and Straus, 1995)
Level 3 = Ranisian (not Aurignacian 0)

5. Grotte du Renne (Arcy-sur-Cure, Yonne, France) (David et al., 2001)
Sequence: Xc = Les Cottès oscillation = Mousterian
X, IX, VIII = Cold = Castelperronian (38 000-33 500 BP)
VII = Arcy = late Aurignacian (31 800-30 800 BP)

6. Les Cottès (Vienne, France) (Lévêque, 1993)
Sequence: Level 6 = Mousterian
Sterile = Les Cottès oscillation (?)
Level 5 = Castelperronian = Cold = 33 300 BP (?)
Level 4 = late Aurignacian (31 000 BP)
Level 3 = Aurignacian
Level 2 = Gravettian

7. Quinçay (Vienne, France) (Lévêque, 1987, 1993)
Sequence: Level EG, ER = Les Cottès oscillation = Castelperronian
Level EM, EJ = Cold = Late Castelperronian
Arcy interstadial

Synthesis
38 000-33 000 BP = Les Cottès oscillation + cold period = Lincombian (U.K.), Ranisian (Belgium), Castelperronian (France)
31 000 BP = Arcy oscillation = late Aurignacian (II)
[N.B. In the Saône basin and in the Rhineland, the chronology has to be clarified. The Castelperronian is present in the Saône basin (Germolles, Trou de la Mère Clochette), but not in the Rhineland (Wildsheuer, Lommersum). The beginning of the Aurignacian is still imprecise, but recent results suggest an age of up to 34 000 BP (Solutré).]

Area 2 (western Europe, from Asturias to the Charentes)

Charentes

1. Saint-Césaire (Charente-maritime, France) (Lévêque, 1987, 1993; Leroyer, 1987)

Sequence: Levels 17-10 = Mousterian
Levels 8-9/EJOP = Würmian interstadial = Castelperronian
Level 7/EJO- = instability = sterile
Level 6/EJO+ = Cold = early Aurignacian (not Aurignacian 0)
Level 5/EJF = Cold = early Aurignacian
Level 4-3/EJM, EJJ = Arcy oscillation = late Aurignacian

2. La Quina (Charentes, France) (Dujardin, colloquia 6.7 UISPP Liège)

Sequence: Castelperronian
early Aurignacian (32 650 BP)

Périgord-Quercy

1. La Ferrassie (Dordogne, France) (Delporte, 1984)

Sequence: Level L = Les Cottès oscillation = Castelperronian
Levels K7, K6, K5 = Cold = early Aurignacian (I)
Levels K4, K3, K2 = Arcy oscillation = late Aurignacian (IIa)
Levels J, I2 = Arcy oscillation = late Aurignacian (IIb)
Levels I1, H = Cold = final Aurignacian (III)
Levels F, G = Maisières oscillation = final Aurignacian (IV)
Levels E1, D2 = Cold = early Gravettian
Levels B, C = Tursac oscillation = middle Gravettian

2. Pataud (Dordogne, France) (Bricker, 1995)

Sequence: Levels 14-9 = Cold = early Aurignacian (I)
Level 8 = Arcy oscillation = late Aurignacian (IIa)
Level 7 = Arcy oscillation = late Aurignacian (IIb)
Level 6 = Cold = final Aurignacian (III)
hiatus = Maisières oscillation
Level 5 = Cold = early Gravettian

3. Le Facteur (Dordogne, France) (Delporte, 1968)

Sequence: Level 21 = Cold = early Aurignacian (I)
Level 19 = Arcy oscillation = late Aurignacian (IIa)
hiatus
Level 17 = Cold = final Aurignacian (III)
Levels 16-15 = Maisières oscillation = final Aurignacian (IV)
Level 15 = Cold = early Gravettian
hiatus
Levels 11-10 = middle Gravettian

4. Roc de Combe (Lot, France) (Bordes and Labrot, 1967)

Sequence: Levels 10-8 = Les Cottès oscillation = Castelperronian
Level 7 = Cold = early Aurignacian (I)
Level 6 = Arcy oscillation = late Aurignacian (IIa)
hiatus
Level 5 = Cold = final Aurignacian (III)
Hiatus = Maisières oscillation
Level 4 = Cold = Early Gravettian

5. Caminade (Périgord, France) (Sonneville-Bordes and Mortureux, 1955; Sonneville-Bordes, 1970)

East sequence: Level G = Cold = Mousterian, Castelperronian, early Aurignacian
Levels F, E = Cold = early Aurignacian (I)
Level D2 = Arcy oscillation = late Aurignacian (IIb)
Level D1 = Cold = final Aurignacian (III)

West sequence: Level 1 = Cold = early Aurignacian
Level 2 = Arcy oscillation = Late Aurignacian (IIa)

6. Trou de la Chèvre (Dordogne, France) (Arambourou and Jude, 1964)

Sequence: Level 18-15 = Les Cottès oscillation = Castelperronian
Level 14-11 (3, 4A) = Cold = early Aurignacian (I)
Level 10 (4B) = Arcy oscillation = late Aurignacian (IIa)
Level 9 (4C) = Cold = final Aurignacian (III)
Level 8 = sterile = Maisières oscillation
Level 7 = Cold = early Gravettian

7. Le Flageolet (Rigaud, 1982)

Sequence: Level 11 = Cold = early Aurignacian (I)
hiatus
Levels 9-8 = Cold = final Aurignacian (III)

8. Le Piage (Lot, France) (Champagne and Espitalié, 1981)

Sequence: Level GI = Castelperronian
Level F, F1 = early Aurignacian (I)
Level J, K = late Aurignacian (IIa) inversed stratigraphy (?) or mixed levels

9. La Rochette (Dordogne, France) (Delporte, 1962)

Sequence: Level 5D = mixed Mousterian, Castelperronian, and early Aurignacian
Level 5C = early Aurignacian
Level 4 = late Aurignacian

10. Grotte XVI (Dordogne, France) (Lucas et al., this volume)

Sequence: Level C = Mousterian
Level B = Castelperronian (38 100-35 000 BP)
Level A = early Aurignacian

11. Combe-Saunière (Dordogne, France)
Sequence: Level XI = Mousterian = (39 000 BP, 38 200 BP?)
Level X = Castelperronian = (38 100-33 000 BP?)
Level IX = early Aurignacian = (33 700-32 000 BP)

12. Castanet (Dordogne, France) (Pelegrin et al., colloquia 6.7 UISPP Liège)
Level lower = early Aurignacian = 35 200 BP (date corrected by a younger date by the Gif laboratory)

Synthesis
No interstratification Castelperronian-Aurignacian o
No Aurignacian o
Aurignacian: five chronological and paleoenvironmental facies
Sequence
Early Würm = Mousterian
Les Cottès oscillation = Castelperronian = 38 000-35 000 BP
Cold = Aurignacian I = 35 000-31 000 BP
Arcy oscillation = Aurignacian IIa/IIb = 31 000-30 000 BP
Cold = Aurignacian III = 30 000-29 000 BP
Maisières oscillation = Aurignacian IV = 29 000-28 000 BP
Cold = early Gravettian = 28 000-26 000 BP
Tursac oscillation = middle Gravettian = 26 000-24 000 BP
Cold = late Gravettian = 24 000-22 000 BP

Corrèze

Synthesis
No Protoaurignacian (Laplace, 1966a) but late Aurignacian

Pyrenees

1. Tuto de Camalhot (Ariège, France) (Vezian and Vezian, 1970)
Mix of early and late Aurignacian in a 70 cm level

2. Brassempouy (Landes, France) (Bon, 2000)
early Aurignacian levels filling a karstic network (31 690 BP to 33 600 BP)
Castelperronian exists elsewhere in the site

3. Gatzarria (Basque country, France) (Laplace, 1966b; Sáenz de Buruaga, 1991)
Sequence: Mousterian
Castelperronian
Level Cnj2 = Proto-Aurignacian
Level Cnj1, Cbf, Cb = early Aurignacian (I)

4. Isturitz (Saint-Perier and Saint-Perier, 1952; Normand and Turq, colloquia 6.7 UISPP Liège)

Sequence: Mousterian
Castelperronian
Protoaurignacian (36 510, 34 630 BP)
early Aurignacian
late Aurignacian

Synthesis

Castelperronian
Protoaurignacian
early Aurignacian (35 000-32 000 BP)
late Aurignacian (32 000-30 000 BP)

Cantabrian coast

1. Cueva del Pendo (González Echegaray, 1980; Hoyos and Laville, 1982)

Sequence: Level 8 = Mix of Mousterian, Castelperronian and early Aurignacian
Levels 7-5 = late Aurignacian (II)

2. Cueva Morín (González Echegaray and Freeman, 1971, 1973)

Sequence: Mousterian
Level 8 = Castelperronian
Levels 9-6 = early Aurignacian (I) (and Protoaurignacian?)
Level 5 = late Aurignacian (II)

3. Cueva del Castillo (Cabrera, 1984; Cabrera et al., 1997)

Level 18 = Mix of Mousterian, Castelperronian and early Aurignacian

Synthesis

Castelperronian under early Aurignacian (and to be verified, Protoaurignacian)
No series of recent reliable ^{14}C dates
Results on Castillo to be confirmed by new data

Asturias

1. La Viña (Fortea, unpublished)

Sequence Level XIV = Mousterian
Level XIII = lower Aurignacian (not characterized) (36 500 BP)
Level XIII = Aurignacian (not characterized) (19 930 BP)
Level XII = Aurignacian (not characterized)
Level XI = Aurignacian (not characterized)
Level X, IX = Gravettian

Synthesis
Site not yet published limits any synthesis on Asturias
^{14}C date of 36 500 BP to be confirmed by a reliable sequence of dates

Area 3 (west Mediterranean coast, from Catalonia to Liguria)

1. Riparo Mochi (Liguria, Italy) (Blanc, 1953; Laplace, 1977; Kuhn and Stiner, 1998)
Old sequence: Mousterian
Level G = "Proto-Aurignacian"
Level F = Mix of early and late Aurignacian
New sequence: levels 50 to 6 = Aurignacian 0 = 32 280 BP to 35 700 BP

2. Grotte Rainaude (Provence, France) (Onoratini, 1986)
typological attribution to Aurignacian 0, no dates

3. L'Esquicho-Grapaou (eastern Languedoc, France) (Bazile, 1977; Bazile and Sicard, 1999)
Sequence: Cold = Mousterian (Quina)
Erosion = hiatus
SLC1b = dry/cold = Aurignacian 0 = 34 540 BP
SLC1a = oscillation = Aurignacian 0 = 31 850 BP (?)
Cold = early Aurignacian = 29 650 BP

4. La Laouza (eastern Languedoc, France) (Bazile et al., 1981)
Sequence: Level 3 = sterile
hiatus
Level 2 = oscillation = Aurignacian 0 = no reliable dates
oscillation? = hiatus
Level 1 = cold = sterile

5. Grotte de Bize (western Languedoc, France) (Sacchi, 1996)
Sequence: Level D = Mousterian
Level G = Aurignacian 0 = no reliable dates
Level F = early Aurignacian (I)

6. L'Arbreda (Catalonia, Spain) (Soler, 1979; Soler and Maroto, 1993; Maroto et al., 1996)
Sequence: Final Mousterian
Aurignacian 0 = 40 000-37 000 BP
early Aurignacian = no reliable dates
late Aurignacian = no reliable dates

7. Abri Romani (Catalonia, Spain) (Maroto et al., 1996)
Sequence: Level A = Aurignacian 0
Level B = Aurignacian I

8. Reclau-Viver (Catalonia, Spain) (Maroto et al., 1996)
Mix of Aurignacian 0, early Aurignacian and Gravettian

Synthesis (Djindjian, 1999a; Bazile and Sicard, 1999)
No Castelperronian (but backed knifes have been found in Mousterian layers of Belvis, L'Arbreda and Reclau-Viver),
Aurignacian 0 in a Würmian interstadial environment
Aurignacian 0 well characterized by original typological features
Presence of early Aurignacian (I) and late Aurignacian (II)
Not enough reliable dates for Aurignacian 0 in Languedoc
Aurignacian ^{14}C dates for l'Arbreda to be confirmed on bone tools
Transition from the Mousterian to be studied in Riparo Mochi.

Area 5 (central Europe)

1. Geissenklösterle (Swabian Jura, Germany) (Hahn, 1988; Richter et al., 2001; Conard, this volume)
Sequence: Level IIIa = Aurignacian 0 = Würmian interstadial = 37 300, 37 800 BP
Level IIb = early Aurignacian I = Cold = 32 300 to 33 700 BP
Level Ia = early Gravettian = 29 200 BP

2. Willendorf II (Lower Austria) (Felgenhauer, 1956-59; Damblon et al., 1996)
Sequence: Level 1 = Undetermined Upper Paleolithic
Level 2 = Undetermined Upper Paleolithic = oscillation = 41 700--39 500 BP
Level 3 = Aurignacian 0 = oscillation = 38 880-37 930 BP
Level 4 = Aurignacian II = oscillation = 32 060-31 210 BP

3. Seftenberg (Lower Austria) (Neugebauer-Maresch, 1999)
Aurignacian 0 = 36 350 BP

4. Krems (Lower Austria) (Neugebauer-Maresch, 1999)
Mix of Aurignacian levels? = 35 200 BP?

5. Istallöskö (Hungary) (Vertes, 1955)
Sequence: lower level = early Aurignacian = 44 300, 39 700 BP (?) [dates are unreliable]
upper level = late Aurignacian = 31 540-30 900 BP

6. Vindija (Croatia) (Straus, 1999; Karavanic et al., 1998)
mix of Mousterian with leaf points and Late Aurignacian ("Olchevian")

7. Divje Babe (Slovenia) (Turk, 1997, oral communication)
^{14}C date of 35 300 BP is not dating the lozengic points of the late Aurignacian

Synthesis
No transitional industries between Mousterian and Aurignacian 0
Aurignacian 0 is clearly present in the upper Danube
Sequence of Aurignacian 0, I and II is demonstrated
"Olchevian" is a late Aurignacian (II) facies of short halts in high altitude caves, the mix of Mousterian and late Aurignacian is due to cave bear activity

Area 6 (Adriatic)

1. Fumane (Venetia, Italy) (Bartolomei et al., 1993)
Sequence: Levels A13-A5 = Würmian interstadial = Mousterian
Levels A4 = Undetermined Upper Paleolithic
Levels A3-A1 = Cold = Aurignacian 0 and I
Level A2 (S14) = 34 200-36 800 BP
Levels D7-D1 = Aurignacian I
Levels A1, A2 (S9, S10), D3b, D6 = 32 800-31 600 BP
Level D1d = Gravettian

Synthesis
Sequence of Aurignacian 0 and I
No other stratified Aurignacian sites in Adriatic area

Area 7 (northeastern Europe) (Bader, 1978; Pavlov and Indrelid, 2000)

1. Sungir (Vladimir, Russia)
Streletian, 27 700-25 450 BP

2. Garchi 1
Streletian, 28 750 BP

3. Byzovaia, Streletian
33 180-25 540 BP

4. Mamontovaya Kurya
Streletian?, 37 360-34 360 BP

Synthesis
A transitional facies, Streletian, with a long life time to be confirmed by new ^{14}C dates, especially at Sungir.

Area 8 (central-eastern Europe)

Don Basin, Kostienki (Voronej, Russia) (Praslov and Rogatchev, 1982; Sinitsyn, 1993, 1999)
Streletian, 37 900-32 300 BP = Kostienki 1, Level 6; Kostienki 6

Spitsynian, 36 780-32 780 BP = Kostienki 17, Level 2
Markina Gora (Undetermined Upper Paleolithic), 37 240-34 490 BP = Kostienki 14, Level IVa
Gorotsovian = Kostienki 12, 36 280-28 500 BP; Kostienki 14, 33 280-28 580 BP
Aurignacian = Kostienki 1, Level 3, 32 600 BP

Dniestr-Prut Basin
Mitoc Malu Galben (Iasi, Romania) (Chirica and Borziak, 1996), Levels 12b-8b = Aurignacian = 32 730-29 410 BP

Synthesis
No early Aurignacian peopling in middle eastern Europe
Several other Upper Paleolithic facies existing since 38 000 BP

Area 9 (southeastern Europe)

1. Bacho-Kiro (Kozłowski, 1982)

Sequence:	Level 13 = Mousterian = >47 000 BP
	Level 11, IV = temperate/humid = "Bachokirian" = 38 500 BP
	Level 11, III = temperate/humid = "Bachokirian"
	Level 11, II = temperate/humid = "Bachokirian" = 37 600-34 800 BP
	Level 9 = cold/arid = early Aurignacian
	Level 8/6a = cold/arid = early Aurignacian = 33 300 BP
	Level 8 = late Aurignacian
	Level 6b = temperate/humid = Aurignacian = 32 700 BP
	Level 7 bottom = temperate/humid = Aurignacian = 32 200 BP
	Level 6a = temperate/humid = Aurignacian = 29 150 BP

2. Temnata (Kozłowski et al., 1992, 1994; Ginter et al., 2000)

Sector TD-1	Level 6 = Mousterian
	Level 4, C = temperate/humid = "Bachokirian"
	Level 4, B = temperate/humid = "Bachokirian" = 39 100-38 200 BP
	Level 4, A = temperate/humid = Aurignacian = 31 900 BP
Sector TD-V	Level 4B middle = temperate/humid = "Bachokirian" = 38 300 BP
	Level 4A bottom = temperate/humid = "Bachokirian" = 36 900 BP
	Level 4A top = temperate/humid = "Bachokirian" = 33 000 BP

Synthesis
Succession of Mousterian/Bachokirian/early Aurignacian/late Aurignacian
Bachokirian, an early blade Aurignacian industry in a temperate/humid oscillation dated around 38 000 BP
No transitional industry between Bachokirian and Mousterian

Area 10 (Iberian Peninsula)

1. Gorham's Cave (Gibraltar)
Sequence: Levels 22b-19 = Mousterian
Levels 18-16 = Undetermined Middle Paleolithic = 32 280 BP
Levels 15-9 = late Aurignacian = 30 250-28 680 BP

Synthesis
Neither Châtelperronian nor transitional industries in the Iberian peninsula.
Late Aurignacian arriving in southern Iberian peninsula during Arcy oscillation
Mousterian proposed to go on without typological changes until 27 600 BP in Andalucia (Vega, 1993) and Portugal (Zilhão, 1997), but more reliable stratigraphies, ^{14}C dates and paleoenvironmental studies are needed.

Area 11 (Italian Peninsula)

1. La Cala (Campania, Italia) (Palma di Cesnola, 1993; Gambassini, 1993)
Sequence: Mousterian
Stalagmitic floor Beta
Aurignacian = 29 850 BP?
Gravettian

2. Castelcivita (Campania, Italia) (Gambassini, 1997)
Sequence: Levels 32-18 = Würmian interstadial = Mousterian
Levels 14-10 = colder = Uluzzian = 33 300-32 470 BP
Levels 9-8 = Cold = Aurignacian = 32 930 BP
Levels 7-6 = Arcy oscillation = Aurignacian = 31 950 BP

3. Paglicci (Puglia, Italia) (Palma di Cesnola, 1975, 1989, 1993)
Sequence: Level 26 = Mousterian
Level 25 = Sterile
Level 24 = Aurignacian = 34 000 BP, 29 300 BP
Levels 23-18 = Gravettian = 28 300-20 160 BP

Synthesis
Uluzzian under Aurignacian
Uluzzian lasts up until 33 000-34 000 BP
Not enough reliable ^{14}C dates for the Uluzzian
North-south expansion of the Aurignacian across the Italian peninsula from 34 000 BP
Acculturation of final Uluzzian by Aurignacians

Area 12 (Peloponnese)

1. Klissoura Cave 1 (Koumouzelis et al., 2001)
Sequence: Levels X-VI = Mousterian
Level V = Transitional Upper Paleolithic = 40 100 BP
Level IV = early Aurignacian = 32 400-29 950 BP
Level III = early Aurignacian = 34 700 BP
Level II = Epigravettian

Synthesis
The discovery of a new transitional Upper Paleolithic industry with curved backed pieces and geometric microliths shows the arrival of an early Aurignacian only during the first cold period of late Würm. The single date for level V needs to be confirmed. The apparent continuation of the Aurignacian until 22 000 BP is due to unreliable dates on carbonates.

Area 13 (Crimea)

1. Siuren 1 (Crimea) (Vekilova, 1957; Otte et al., 1996)
Level Fb1 = late Aurignacian = 29 550 BP (?) or mixed mousterian-Epigravettian layer (?)

2. Buran-Kaya III (Crimea) (Marks and Monigal, 1999)
Sequence: Level B = Mousterian (Micoquian) = 28 840 BP, 28 520 BP
Level C = Streletian = 32 350 BP, 32 200 BP
Level E = early Upper Paleolithic blade industry

Synthesis (Chabai, this volume)
Recent results suggest an interstratification between final Mousterian and Streletian, coming from mid-eastern Europe, and, finally, late Aurignacian (to be confirmed).

Conclusions

The 40 000-35 000 BP period

During the 40 000-35 000 BP interval, several archeological levels, attributed by various authors to the Aurignacian 0, are to be rejected, on the basis of contradictions and faults in the available data: for Area 1, Trou Magritte (3) and Grotte du Renne (VII); for Area 2, Saint-Césaire (EJO+), La Ferrassie (E'), Caminade Est (G), Le Piage (J, K), Roc de Combe (9), La Rochette (5D), Dufour, Font-Yves, Pendo (8), Castillo (18); for Area 5, Krems, Istállóskö (lower), Divje Bab and Vindija.

During the same interval, several archeological levels may be attributed to an earlier Aurignacian tradition, which is denominated here under the more general designation of "Initial Aurignacian":

Area 1: Castelperronian, Lincombian, Ranisian
Area 2: Castelperronian

Area 3: west Mediterranean Initial Aurignacian (Mocchi, Rainaude, L'Esquicho-Grapaou, Laouza, Bize, L'Arbreda)
Area 4: Jerzmanowician
Area 5: mid-Mediterranean Initial Aurignacian (Fumane)
Area 6: upper Danube Initial Aurignacian (Geissenklösterle, Willendorf 2-3), Szeletian (Hungary, Slovakia, Moravia)
Area 7: Streletian
Area 8: Streletian, Spytsinian, Gorotsovian, Initial Upper Paleolithic of the Don
Area 9: lower Danube Initial Aurignacian (Temnata, Bacho-Kiro)
Area 10: Mousterian
Area 11: Uluzzian
Area 12: Transitional industry and Mousterian (?)
Area 13: Mousterian

During the 40 000-35 000 interval, several cultural complexes are contemporaneous: Initial Aurignacian (Areas 3, 5, 6, 9), Castelperronian (Areas 1, 2), Uluzzian (Area 11), Szeletian (Area 5), Jerzmanowician, Lincombian and Ranisian (Areas 1, 4, 5), Streletian (Areas 7, 8), Spitsynian and Gorotsovian (Area 8), late Mousterian (Areas 10, 12, 13).

The 35 000-32 000 period

Several major events take place during the 35 000-32 000 period, which corresponds to the first cold episode of the late Würm: the Jerzmanowician, the Lincombian and Ranisian disappear, due to the deterioration of the environment, and leave their territories free for settling by other groups of people; the Castelperronian progressively deserts the territory of Area 2 towards the southern part of Area 1 and disappears before 32 000 BP; the Szeletian and the Uluzzian also disappear at the same time.

Conversely, the early Aurignacian expands, increasing the Aurignacian territory with the inclusion of Area 2 to the detriment of the Castelperronian, the whole of Area 5 to the detriment of Szeletian, Area 11 (Italian Peninsula) to the detriment of the Uluzzian, and, gradually, the western part of the Levant.

The 32 000-30 000 period

The 32 000- 30 000 interval corresponds to the maximal expansion of the late Aurignacian (II), during the Arcy oscillation. All the transitional industries have disappeared, but the Streletian persists in Area 7, the Gorotsovian in Area 8, and the late Mousterian in Areas 10, 12, 13 (?).

Segregation, co-habitation or acculturation?

During the 40 000-35 000 BP interval, the improving environment allows, in major regions of Europe, a generalized process of climatic adaptation, which takes different forms in the artifact assemblages, and concerns what are called transitional industries, generally considered as deriving from various Mousterian substrates. Their characteristics differ from region

to region as a reflection of their different origins in earlier more closed European traditions. Paradoxically, a Mousterian with no artifact evolution seems to persist in southern regions such as the south of the Iberian Peninsula, Thessaly and the Crimea. At the same time, the Initial Aurignacian appears in several areas corresponding apparently to a migration from unknown areas of the Middle East. No influences between artifact assemblages are indicated, and segregation between populations seems to be the framework of European settlement at this time.

During the 35 000-32 000 BP interval, different industrial variants appear due to the contact between transitional industries and the Aurignacian. Some, such as the Jerzmanowician, the Lincombian or the Ranisian eventually disappear apparently with no contact with the Aurignacians. Others have contact with the Aurignacians, resulting in some acculturation before complete disappearance: the Castelperronian in Area 1, the Szeletian in Area 5 and the Uluzzian in Area 9. Others still have contact with the Aurignacians, resulting in some acculturation but without disappearance: this seems to be the case with the Streletian in Area 7, where ^{14}C dates seem to confirm a continuity in settlement until 25 000 BP, and with the Gorotsovian in Area 8. The late Mousterians seem to survive without any acculturation in Areas 10, 12, 13.

Between 32 000 and 30 000 BP, in a European territory where the late Aurignacian is widespread, only the Streletian in Area 7, the Gorotsovian in Area 8, and the late Mousterian in Areas 10, 12 and 13 survive, even if more reliable dates have to confirm the exact period of disappearance. J. Kozłowski suggests that the possibility of an evolution of the Szeletian into the Pavlovian and of the Jerzmanowician into the Maisierian (early Gravettian) cannot be discarded.

The last point is, of course, the issue of the migration of Aurignacian modern humans, versus the alternative hypothesis of differentiated adaptations of local groups during the Würmian interpleniglacial until the ultimate success of the Aurignacian solution. Unfortunately, at present, with no secure results concerning well stratified and precisely dated osteological data on the people of the Aurignacian, any convergence between models of physical anthropology (i.e., the immigration of modern humans) and the structuration of artifact assemblages is premature.

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