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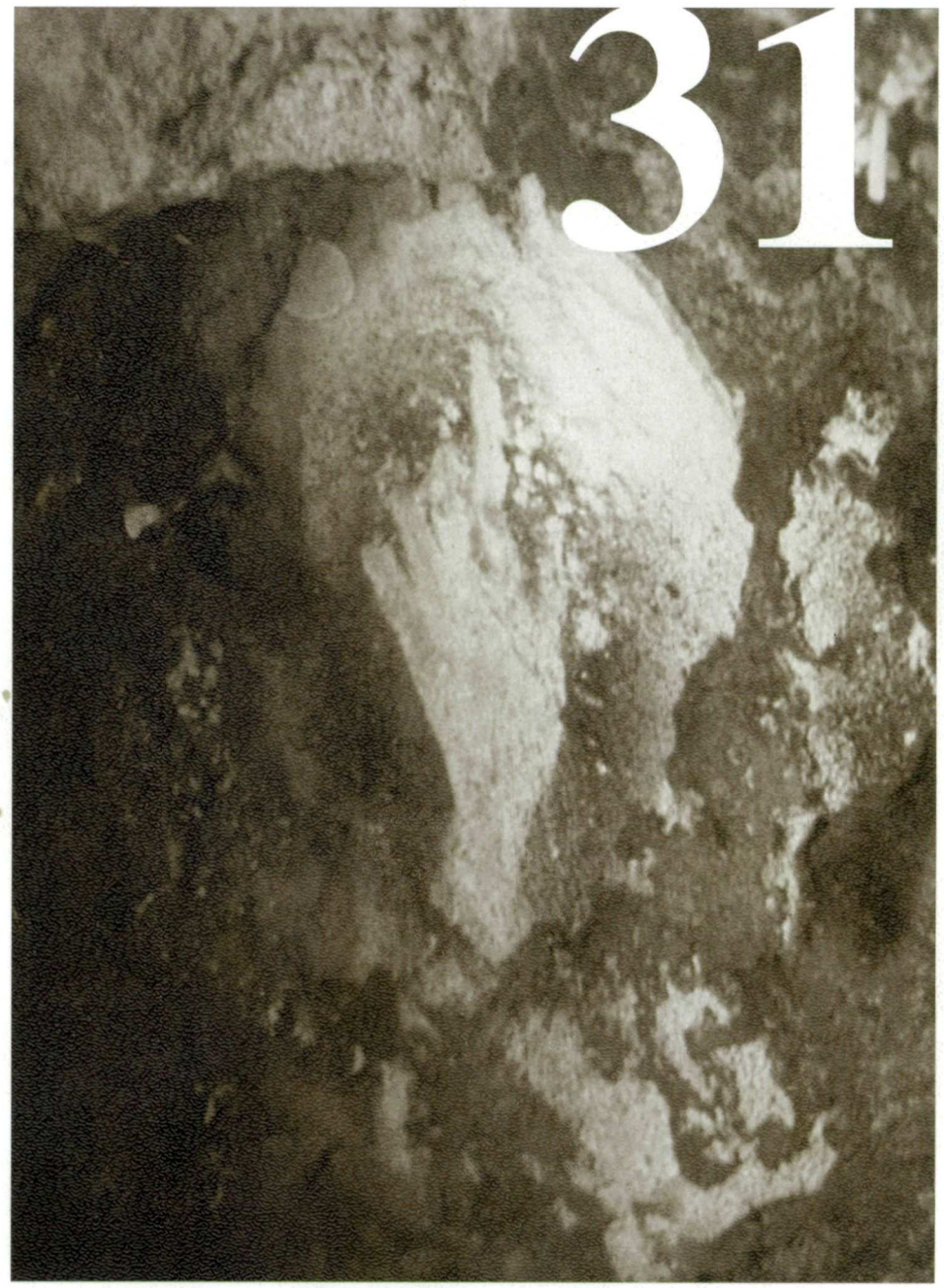

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HUNTERS OF THE GOLDEN AGE

THE MID UPPER PALAEOLITHIC OF EURASIA 30,000 – 20,000 BP

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22 The German Upper Palaeolithic 35,000-15,000 bp. New dates and insights with emphasis on the Rhineland

The paper examines the existing radiocarbon dating evidence for the German Upper Palaeolithic between 35,000 and 15,000 bp (mainly from southern Germany) and presents a number of new results from other regions (Rhineland, Thuringia) obtained in collaboration with the Oxford Radiocarbon Accelerator Unit. Critical assessment of the increased total number of dates allows the recognition of phases broadly equivalent to the Early Upper Palaeolithic (Aurignacian) and Mid Upper Palaeolithic (Gravettian), but also suggests that there may be finer subdivisions within these phases or possibly overlap between them (e.g. at Breitenbach). The question of a late gravettian survival, possibly in the form of 'aurignacoid' industries, and of the Upper Pleniglacial hiatus in settlement is discussed. It is suggested that the period between 23,000 and 13,000 bp (which traditionally separates classic gravettian industries from the Upper Magdalenian) might profitably be re-examined in detail, both in Germany and in neighbouring regions.

1. Introduction

As in much of western and central Europe, the subdivision of the German Upper Palaeolithic has traditionally been based on typology. R.R. Schmidt's (1912: 104 ff.) monograph "Die diluviale Vorzeit Deutschlands" established for Germany the French system of subdivision we today know as Aurignacian, Gravettian and Magdalenian on the basis of type fossils and a few important stratigraphies, and for many years this was the only basis for a chronological attribution of archaeological assemblages. Absolute (radiometric) chronological methods became available only later; today the most reliable of these methods is radiocarbon dating, particularly when in the form of AMS measurements of critically selected single samples, and taking into account increasing possibilities for correction of radiocarbon years to true ages.

Thanks in large part to cooperation over several years with the Oxford Radiocarbon Accelerator Unit (ORAU), it has been possible to obtain many radiocarbon AMS dates for German, and especially for Rhineland assemblages and thus to obtain a better understanding of the absolute chronology of this period (Street *et al.* 1994; Hedges *et al.* 1998a, 1998b). This has been especially the case for late glacial magdalenian sites, the chronological and geographical distribution of which is now quite well understood (Housley *et al.* 1997; Street 1998a, 1998b; Street and Gaudzinski 1998; Street and Höck 1998), whereas for the older periods there has been (with notable exceptions) a deficit in the numbers of radiocarbon dates available.

2. Absolute dating of the German Early Upper Palaeolithic

2.1 State of research

Until the end of the 1980's, the only larger series of absolute dates available for the German Aurignacian were from the two south German cave sites of Vogelherd and Geißenklösterle and from the Rhineland open air site of Lommersum. These were complemented by isolated radiocarbon dates from further sites such as Hohlenstein-Stadel IV, Bockstein-Törle VII, Wildscheuer, Breitenbach (dating evidence summarised in Hahn 1977, 1989, 1993, 1995; Dombek and Hahn 1989). Overall, the dates showed a relatively clear concentration between *c.* 36,500 bp and 29,000 bp (24 dates), although eight dates were appreciably younger, and in some cases, e.g. Breitenbach (18,100 ± 200 bp; 12,320 ± 200 bp), were regarded as irrelevant for the cultural attribution of the assemblage (Richter 1987).

The appreciable number of younger, in some cases clearly too young (five dates <25,000 bp), radiocarbon dates made it difficult at this stage to establish a well-founded absolute chronological definition of the aurignacian technocomplex. The oldest dates from the Rhineland site of Lommersum were slightly younger than those from south Germany, but the series as a whole showed a parallel development.

The database available for dating the early Upper Palaeolithic has now increased appreciably (Fig. 1). In south Germany new AMS dates obtained by the ORAU suggest a relatively high age of up to 40,200 bp for layer IIIa at the Geißenklösterle (Hahn 1995), although the heterogeneity of dates from the layer generally and the high standard deviation (± 1600) of the oldest date in particular, call for caution in interpretation. Nevertheless, a degree of support for an early phase of the Aurignacian in southern Germany is provided by the recently discovered Bavarian open air site of Keilberg-Kirche, where conventional dating of charcoal

yielded a very consistent series of three ages between 38,600 and 37,500 bp (Uthmeier 1996). Together, the two sites suggest that the early Aurignacian was indeed very probably present in southern Germany by *c.* 38,000 bp. The implications of these early German dates for the transition from the Middle to the Upper Palaeolithic (e.g. Richter 1996) remain to be discussed in detail in the light of new southwestern and southeastern European evidence (D'Errico *et al.* 1998; Duarte *et al.* 1999; Pettitt and Trinkaus in press).

2.2 New AMS dates

In collaboration with the ORAU and the University of Cambridge and in the context of the project "The German Aurignacian and the colonization of Northern Europe", the present authors have recently initiated the AMS dating of three sites located further to the north in Germany. In the case of two sites previously dated by the conventional radiocarbon method, Wildscheuer III (Terberger 1993) and Breitenbach B (Pohl 1958; Richter 1987), the ORAU results revise the dates for the sites (Fig. 1), while a third site, Wiesbaden Igstadt (Terberger 1992, 1998; Serangeli 1996; Pettitt *et al.* 1998; Street and Terberger 1999), was discovered only recently and had been undated. In general terms the Oxford AMS dates provide a broader basis than the conventional radiocarbon dates for the absolute chronology of the German Early Upper Palaeolithic and related questions.

2.3 Wildscheuer III

The interior of the Wildscheuer cave (now destroyed by quarrying) in the Lahn valley, east of Limburg, was excavated during the 19th century by von Cohausen, in a period of only a few weeks (Terberger 1993). Minor excavations at the beginning of the 20th century and especially the excavation of the cave platform by H.E. Mandera during the 1950's provide the most reliable information on stratigraphy (Mandera 1954). Above a layer with a few Middle Palaeolithic finds, preserved only in a fissure at the base of the section, Mandera discovered a well-defined "*terra rossa*" sediment (Layer III), containing aurignacian artefacts. Above this were a less clearly defined gravettian level (IV) and a largely destroyed layer (V) with magdalenian material.

Ten samples of bone, antler and ivory from the Wildscheuer cave kept in the Wiesbaden Museum were chosen for AMS dating. Samples with evidence of human manipulation were preferred and a range of materials/species was selected. Most samples fulfilling these criteria were from the Mandera excavation, although three specimens were from older investigations. Attribution to aurignacian Level III was helped by features such as adhering red sediment and the typically dark stained colour of the specimens.

Of the Wildscheuer III assemblage, all but one specimen of ivory yielded a result. The dates fall between 34,200 and 20,480 bp, although the youngest date can clearly be rejected for an aurignacian context, leaving the next youngest date as 28,340 bp. Even then, the dates cover a span of almost 6,000 radiocarbon years. There is no finer patterning between age and material/species dated and the mean age of the samples is *c.* 31,750 bp.

The large range of the Wildscheuer dates (Fig. 1) can be interpreted in several ways. The relatively small size of the assemblage and the homogeneous appearance of the material make it likely that the site was occupied over a relatively short period of time. The former interpretation would imply a methodological problem with the dates, which might be related to major fluctuations in the radiocarbon record at this period (Jöris and Weninger 1998, 1999). Alternatively, the site was indeed used on different occasions over a period of several millenia and the dates accurately reflect this. A similar spread of dates can be observed at other sites (e.g. Lommersum, Geißenklösterle IIIa), so that this phenomenon must in future be examined generally in order to assess the value of radiocarbon date series for the Aurignacian.

2.4 Breitenbach B

The Breitenbach site (Pohl 1958; Richter 1987) lies in eastern Germany. Two archaeological complexes exist at present, although these clearly belong together. The assemblage designated Breitenbach A was excavated by Niklasson in 1927 over a surface of 400 m^2 and is now stored at the Halle Museum in Sachsen-Anhalt, while Breitenbach B represents material originally (*c.* 1930) from the private collection Wlost, and now kept in the German National Museum in Nuremberg.

The geochronological position of the assemblage was discussed by Hahn (1977: 159), who, following P. Wolstedt and V. Toepfer, suggests that the assemblage was found within a soil horizon and possibly dates to just before the Stillfried B oscillation. Richter (1987: 65) is more cautious and suggests that ambiguous observations made in several test trenches across the large site are possibly only locally valid. It seems that geomorphology cannot give sufficiently precise information on the geochronology of the assemblage. Although two conventional radiocarbon dates already existed (Richter 1987), they were inconsistent with each other and with an aurignacian occupation.

Samples for AMS dating were taken from the Breitenbach B faunal material kept in Nuremberg and chosen to cover a range of species/materials. It was not possible to identify samples with unambiguous human modification due to poor surface preservation, but the association of the faunal remains and the lithic assemblage is supported by labels with the material which refer to a provenance in e.g. "*Schlagplatz 3*" and "*4*".

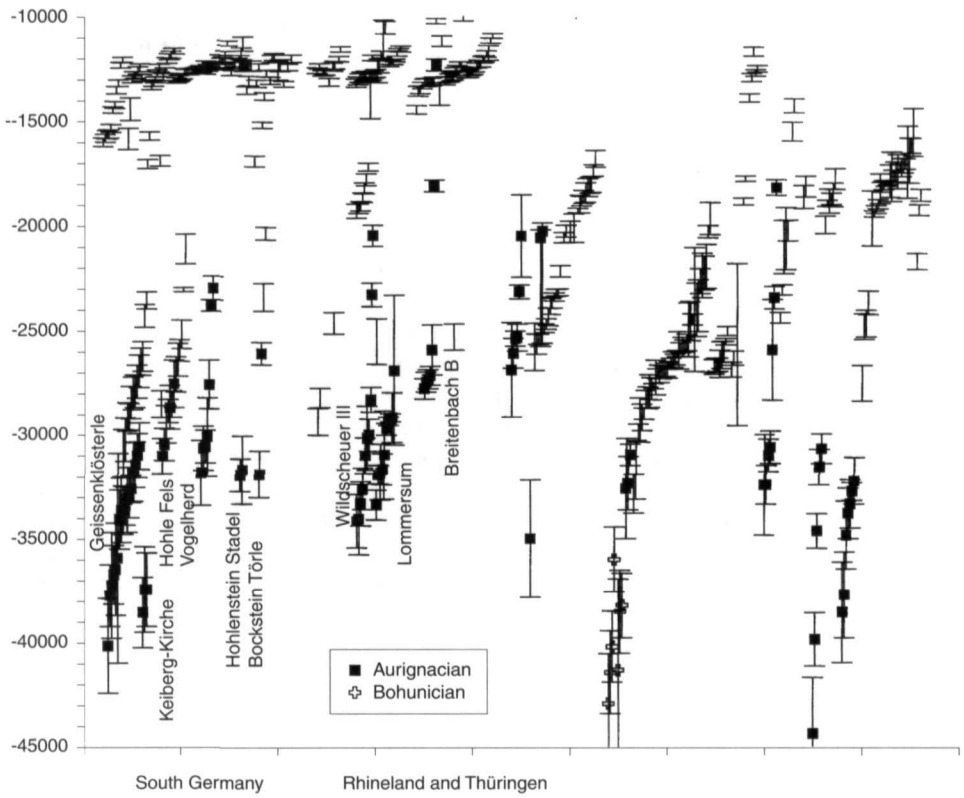

Fig. 1. Uncalibrated dates for the Aurignacian of Germany (at left of the diagram) and for selected aurignacian sites in eastern Central Europe (Austria: Alberndorf, Krems; Czech Republic: Bohunice, Stránská skála; Poland: Oblazowa Cave; Hungary: Istállóskö, Peskö; Bulgaria: Bacho Kiro). Aurignacian dates are represented by symbols; for comparison non-aurignacian dates are represented without symbol to one standard deviation.

The Breitenbach AMS results are somewhat younger than expected for an aurignacian context (Fig. 1), falling well within the period (30-20 kyr) treated by this volume. Nevertheless, the Oxford series is internally consistent and appears to be acceptable, thereby dating a very recent (youngest?) phase of the Aurignacian to the 28th millennium bp. By contrast, the reliability of a still younger conventional date (H 4059-3356: 26,133 ± 376) for the south German Bockstein Törle VII assemblage (Hahn 1977) is questionable, since a second date (H 4059-3527: 31,965 ± 790) from the same layer (Hahn *ibid.*) is appreciably older.

2.5 Implications of new aurignacian dating results

Of the 62 dates considered here, six (Table 1 in italics) are several thousand years younger than others in the series from the same site and therefore apparently have major errors. This may be due to contamination, since even a minute amount of younger material can have considerable implications for a date at this period, close to the limits of the radicarbon method (Mellars *et al.* 1987: 128; Haesaerts *et al.* 1996: 39; Pettitt this volume). The seriously deviant dates are commonly those obtained many years ago, although the new Wildscheuer series shows that even modern series of AMS dates can contain a single aberrant result. The youngest Wildscheuer AMS date (OxA-7498: 20,480 ± 360) was obtained on a specimen of ivory, a material which produced no result for a second Wildscheuer sample, and, in other contexts (e.g. magdalenian samples from Gönnersdorf and Andernach-Martinsberg) has produced anomalously young results.

The remaining, acceptable aurignacian dates show a trimodal distribution. The classic Aurignacian is present in southern Germany and the Rhineland from *c.* 34,000 bp, while in southern Germany earlier ages for the Aurignacian, obtained by both conventional and accelerator dating, are found at Geißenklösterle and Keilberg-Kirche. In view of these results it is questionable whether a proposed formal definition of the period 40-30 kyr as the Early Upper Palaeolithic (equated with the Aurignacian) is a useful concept. The third set of AMS dates from Breitenbach suggests that (at least in eastern Germany) the Aurignacian in fact persisted well into the following period of time 30-20 kyr, and specifically throw into sharper perspective the question of the absolute age of the end of the Aurignacian and its chronological distinction from and relationship to the Gravettian, and particularly to early gravettian industries such as those with Font Robert points. In particular, attention should be paid to potential regional differences.

3. Absolute dating of the German Mid Upper Palaeolithic

A review of the available German radiocarbon record (Fig. 2, Table 2) shows that most dates for gravettian industries fall before the last Pleniglacial, between 30,000 and 23,000 bp, results which are consistent with the European Gravettian/Pavlovian/*Périgordien supérieur* generally. The oldest potentially gravettian dates fall around 31,000 bp, although not all the dated samples can be unequivocally associated with clearly gravettian, rather than non-diagnostic industries, and there is thus a definite overlap between dates for the German Gravettian and for the Aurignacian until *c.* 27,000 bp (Breitenbach). The majority of gravettian dates lie before 25,000 bp, a feature shown particularly by the two sites with the largest series of dates, Hohle Fels and Geißenklösterle, where only two and three of the nine and fourteen 'gravettian' dates respectively are younger than this. Both dates from the Weinberghöhle also lie at the centre of this distribution.

The few dates from Obere Klause in Bavaria, the Kniegrotte in Thuringia and the Magdalenahöhle in the Eifel fall at the younger end of this range close to 25,000 bp. The Kniegrotte result, on a bear bone with clear marks of chopping, apparently documents human activity at the well-known magdalenian site at a period which was not hitherto demonstrated by the lithic assemblage, although some tools were described as "Gravette-Spitzen" (Feustel 1974).

Although the Gravettian of southwestern Germany is quite well dated by radiocarbon (see also Hahn, this volume and Scheer, this volume), the Rhineland Gravettian (Hahn 1969; Bosinski *et al.* 1985; Bosinski 1992, 1995a, 1995b, 1995c, this volume) is still inadequately dated by absolute methods. Only one western German site, the Magdalenahöhle, close to Gerolstein in the Eifel (Weiß 1978), is radiocarbon dated to the time range dealt with by this volume. Weniger (1990: 174) quotes a date of 25,540 ± 770 bp, given by Weiß (1978: 105) as 23,590 bc, and the single date for reindeer may not, in fact, be relevant to human activity at all.

Work is now in progress by the authors to obtain dates for the Gravettian in western Germany using samples stored in museums which were recovered by previous investigations at the sites of Metternich near Koblenz (Hahn 1969), Sprendlingen (Bosinski *et al.* 1985; Bosinski 1995a), Mainz-Linsenberg (Hahn 1969; Bosinski 1995b), and Wildscheuer IV (Mandera 1954; Terberger 1993) in the Lahn Valley.

4. The problem between 23-13 kyr

Although they are not numerous, a special problem is presented by radiocarbon dates younger than the main range established for the Gravettian, specifically those lying

Table 1. Uncalibrated dates for the German Aurignacian. Potential explanations for six dates rejected as too young from Vogelherd, Wildscheuer III and Breitenbach B (in italics) are discussed in the text.

KEILBERG-KIRCHE (Uthmeier 1996)		
	38,600 ± 1200	KN-4692
	37,500 ± 1450	KN-4690
	37,500 ± 1250	KN-4691
GEIßENKLÖSTERLE (Hahn 1995; Housley *et al.* 1997)		
IIIa	40,200 ± 1600	OxA-4595
IIIa	37,800 ± 1050	ETH-8267
III	37,300 ± 1800	OxA-5163
IIa	36,800 ± 1000	OxA-4594
III/8	36,450 ± 1570	H-5316-4909
III/7	36,000 ± 3560	H-5315-4908
III/6	34,140 ± 1000	H-5118-4600
IIa	33,700 ± 1100	OxA-5160
III/4	33,700 ± 825	H-4751-4404
IIIa	33,500 ± 640	ETH-8269
IIb	33,200 ± 1100	OxA-5162
IIIa	33,100 ± 680	ETH-8268
IIb/3	32,680 ± 470	Pta-2116
IIb/1	31,870 ± 1000	Pta-2270
IIa/2	31,525 ± 770	H-4279-3534
IIb/2	31,070 ± 750	Pta-2361
IIa/1	30,625 ± 796	H-4147-3346
VOGELHERD (Hahn 1977, 1993)		
V/7	31,900 ± 1100	H 4056-3208
IV/4	30,730 ± 750	H 4053-3211
V	30,650 ± 560	GrN-6661
V/5	30,162 ± 1340	H 4054-3210
IV-V	27,630 ± 830	GrN-6662
IV-V	*23,860 ± 190*	*GrN-6583*
V/6	*23,020 ± 400*	*H 4055-3209*
HOHLENSTEIN STADEL (Hahn 1977, 1995)		
IV	32,000 ± 550	H-3800-3025
IV	31,750 ± 1150	ETH-2877
BOCKSTEIN-TÖRLE VII (Hahn 1977, 1993)		
	31,965 ± 790	H-4059-3527
	26,133 ± 376	H 4059-3356

between 23,000 bp and the well-dated lateglacial Upper Magdalenian at around 13,000 bp (Fig. 3, Table 3). Dates of this period can be subdivided into different categories:

1. A first group of dates for both the Gravettian and the Aurignacian can clearly be regarded as aberrant and unreliable since they differ from larger series of older dates from the same context. This group can be rejected.
2. A second group is formed by dates from unclear context, such as the faunal remains from Aschenstein in Lower Saxony (Weniger 1990) dated to 18,820 ± 180 bp, but where an association with human activity is not demonstrated. Similarly, the dates of 25,000-15,000 bp from the Hohle Fels site must be excluded due to the presence of mixed samples and stratigraphic problems (Hahn 1995).
3. Dates which potentially indeed date a late Gravettian are those of 23,440 and 20,400 bp (mean = 21,920 bp) for Bockstein Törle VI. The dates, which were obtained many years ago, are associated with the industry containing a number of "aurignacoid"features (Hahn 1977: 297). The validity and interpretation of the Bockstein dates cannot be decided in the context of this paper, but comparable dates are also known from Austrian sites (Table 4) described variously as late Aurignacian like Alberndorf (Bachner *et al.* 1996), or late Gravettian, for example Langmannersdorf A and B, 20,260 bp and 20,580 bp respectively (Hahn 1977: 168), and Rosenburg, 20,120 bp (Ott 1996). In the case of Alberndorf only the two youngest dates (20,500 and 23,170 bp) lie in the problematic time range, while four dates are appreciably older, if still too young for a classic Aurignacian. In this they resemble rather the AMS date series from Breitenbach (see above). Furthermore, the interpretation of the Alberndorf dates is complicated by problems of stratigraphy and potential reworking of material (Bachner *et al.* 1996). Nevertheless, late 'aurignacoid' industries similar to Bockstein VI are also known from further east in Europe (Kozlowski 1996; Oliva 1996), being perhaps an equivalent to the contemporary French "Aurignacien V" (Peyrony and Peyrony 1938; Bazile 1996; Djindjian 1996), and this entire phenomenon has been recently examined in some detail (Palma di Cesnola and Montet White 1996). In the light of this it therefore seems possible that German industries with combinations of aurignacian and gravettian features could indeed also date to the period just before 20,000 bp.
4. A further group comprises dates which convincingly demonstrate a human presence during the period in question. Here must be mentioned the series of dates from the Hessian site of Wiesbaden-Igstadt (Terberger 1998; Street and Terberger 1999). The lithic assemblage was believed to be Aurignacian and the site was included in the ORAU and University of Cambridge dating project described above. Whereas the consistent

Table 1 continued.

LOMMERSUM (Hahn 1989)		
IIc-1	33,420 ± 500	GrN-6191
IIc-2	31,950 ± 320	GrN-6699
IIc-3	31,882 ± 950	H 4148-3356
IIc-5	31,700 ± 520	Pta-2753
IIc-4	31,000 ± 1500	H 4745-4144
IIc-8	29,730 ± 150	Pta-2937
IIc-7	29,390 ± 140	Pta-2912
IIc-6	29,210 ± 140	Pta-2918
IIc-8	29,200 ± 850	Pta-3079
IIc-7	26,930 ± 2540	Pta-2939
WILDSCHEUER III (Pettitt *et al.* 1998)		
	34,200 ± 900	OxA-7394
	34,100 ± 1200	OxA-6920
	33,350 ± 750	OxA-7393
	32,650 ± 700	OxA-7390
	31,050 ± 600	OxA-7392
	30,200 ± 1100	OxA-7499
	30,050 ± 550	OxA-6807
	28,340 ± 420	OxA-7391
	23,300 ± 400 ?	*KN-3595*
	20,480 ± 360 ?	*OxA-7498*

BREITENBACH B (Richter 1987: 92; Street and Terberger, this volume)			
	27,800 ± 340	OxA-8512	*Mammuthus primigenius* mandible?
	27,480 ± 340	OxA-8511	*Equus* sp. pelvis
	27,340 ± 320	OxA-8509	*Rangifer tarandus* skull
	27,180 ± 320	OxA-8510	*Rangifer tarandus* shed antler
	25,950 ± 850	OxA-8513	*Mammuthus primigenius* limb bone shaft
	18,100 ± 200 ?	*KN-3332*	*Mammuthus* bone (mandible)
	12,320 ± 200 ?	*KN-3620*	*Mammuthus* ivory

Table 2. Uncalibrated dates for the German Gravettian. The interpretation of dates younger than 23,000 bp from Hohle Fels, Bockstein VI and Geißenklösterle (italics) is discussed in the text. The date for the Magdalenahöhle is possibly unconnected to human activity.

MAGDALENA-HÖHLE (Weiß 1978)		
	25,540 ± 770	BONN-1568
HOHLE FELS SCHELKLINGEN (Weniger 1990; Hahn 1995; Housley *et al.* 1997)		
IV-12	31,100 ± 600	OxA-4600
III-13	30,550 ± 550	OxA-4601
	29,550 ± 650	OxA-5007
IIc-11	28,920 ± 400	OxA-4599
	28,750 ± 750	OxA-4980
I-9	28,580 ± 460	OxA-4597
	27,600 ± 800	OxA-4979
	27,150 ± 600	OxA-4978
	26,450 ± 550	OxA-4976
IIc-10	26,000 ± 360	OxA-4598
	25,240 ± 480	OxA-4974
IIb	23,100 ± 70	Pta-2746
IIb	*21,160 ± 500*	*H 5314-4899*
GEIßENKLÖSTERLE Ia (Hahn 1995; Housley *et al.* 1997)		
	30,950 ± 800	OxA-4856
Ic	30,300 ± 750	OxA-5161
It	29,200 ± 500	OxA-4593
It	29,200 ± 460	OxA-4592
It	28,500 ± 550	OxA-5228
Is	28,050 ± 550	OxA-5227
It	27,950 ± 550	OxA-5229
Ir	27,500 ± 550	OxA-4857
Ir	27,000 ± 550	OxA-4855
It	26,540 ± 460	OxA-5226
Ir	26,300 ± 500	OxA-5159
	24,360 ± 380	OxA-5157
Ia	23,625 ± 290	H-5117-4568
	16,940 ± 380	*OxA-5156*
WEINBERGHÖHLE (Weniger 1990)		
	29,410 ± 470	GrN-5000
	28,265 ± 325	GrN-6059
OBERE KLAUSE (Hedges *et al.* 1997)		
	24,680 ± 360	OxA-5721

Table 2 continued.

BOCKSTEIN-TÖRLE VI (Hahn 1977; Weniger 1990)		
	23,440 ± 290	*H-4058-3526*
	20,400 ± 220	*H 4058-3355*
KNIEGROTTE (Street and Höck 1998)		
	25,340 ± 440	OxA-4847

dating results for Wildscheuer III (Pettitt *et al.* 1998) and Breitenbach B confirmed the expected aurignacian age of the assemblages, results from Wiesbaden-Igstadt were completely unexpected, yielding a *quasi* Pleniglacial age for the assemblage (Pettitt *et al.* 1998). It is now believed that the assemblage can possibly be compared with contemporary French Badegoulian industries (Schmider 1971, 1989, 1990) and also shows similarities with industries further east such as Grubgraben Layer III in Austria (Montet White 1990; Brandtner 1996) (Table 4).

5. A final group consists of dates (Table 5) which possibly reflect a magdalenian presence in Central Europe earlier than the Upper Magdalenian which is well attested in northern Europe by *c.* 13,000 bp (Charles 1993, 1996; Housley *et al.* 1997). Dates for the southern German open air site of Munzingen have been discussed as possibly representing such an early phase of magdalenian occupation (Pasda 1994, 1998) and in northwestern Switzerland an assemblage from Kastelhöhle-Nord (Leesch 1993) must also be mentioned in the context of early magdalenian occupation, although no radiocarbon dates are yet available. Work is now in progress to obtain new dates for the relevant middle layer of the cave and for other sites with potentially early magdalenian occupation.

Although the subject of the post Pleniglacial recolonisation of central and northern Europe (Housley *et al.* 1997) lies outside the scope of this paper, it can at least be stated that the idea that Europe was totally deserted by man from the onset of the Pleniglacial at 20,000 bp until the appearance of upper magdalenian industries after *c.* 13,500 bp (e.g. Gamble 1986; Bosinski 1990; Soffer and Gamble 1990; Weniger 1990) must probably be revised or at least qualified. If before 23,000 bp the region was occupied by 'classic' gravettian industries, after this period we can recognise a number of industries with broadly 'aurignacoid' characteristics, dating to *c.* 23,000-20,000 bp and 19,000-17,000 bp, while still younger dates have been interpreted as showing a relatively early magdalenian presence.

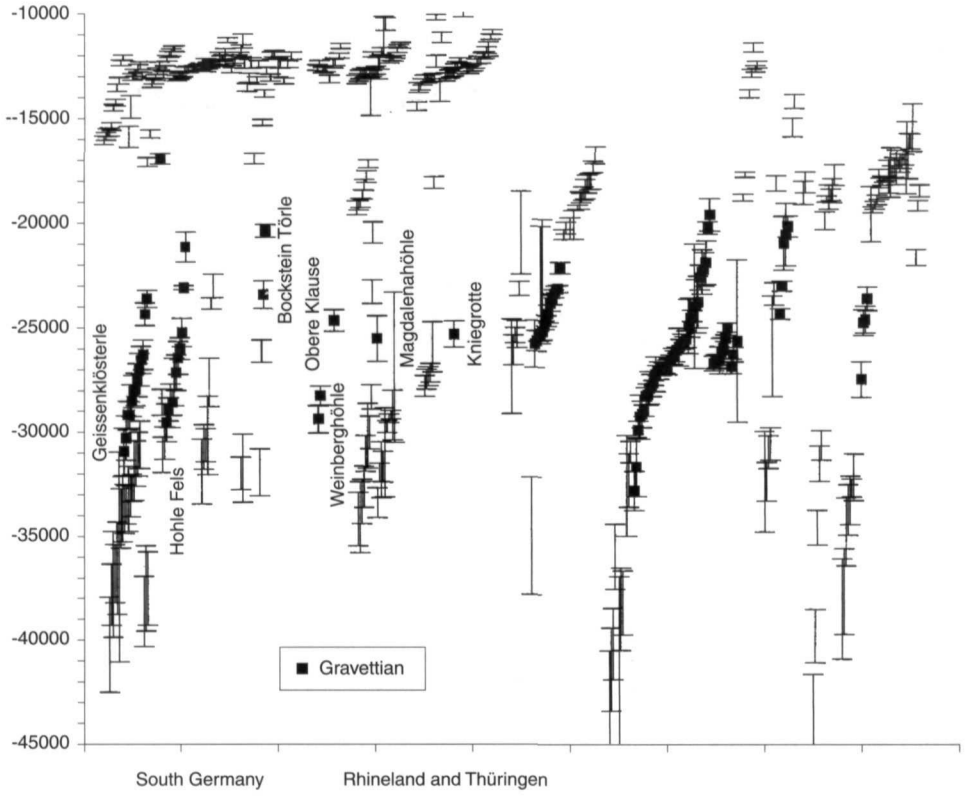

Fig. 2. Uncalibrated dates for the Gravettian of Germany (at left of the diagram) and for selected gravettian sites in eastern Central Europe (Austria: Willendorf; Czech Republic: Dolní Věstonice, Pavlov, Předmostí, Bulhary; Poland: Spadzista Street; Roumania: Mitoc Malu Galben). Gravettian dates are represented by symbols; for comparison non-gravettian dates are represented without symbol to one standard deviation.

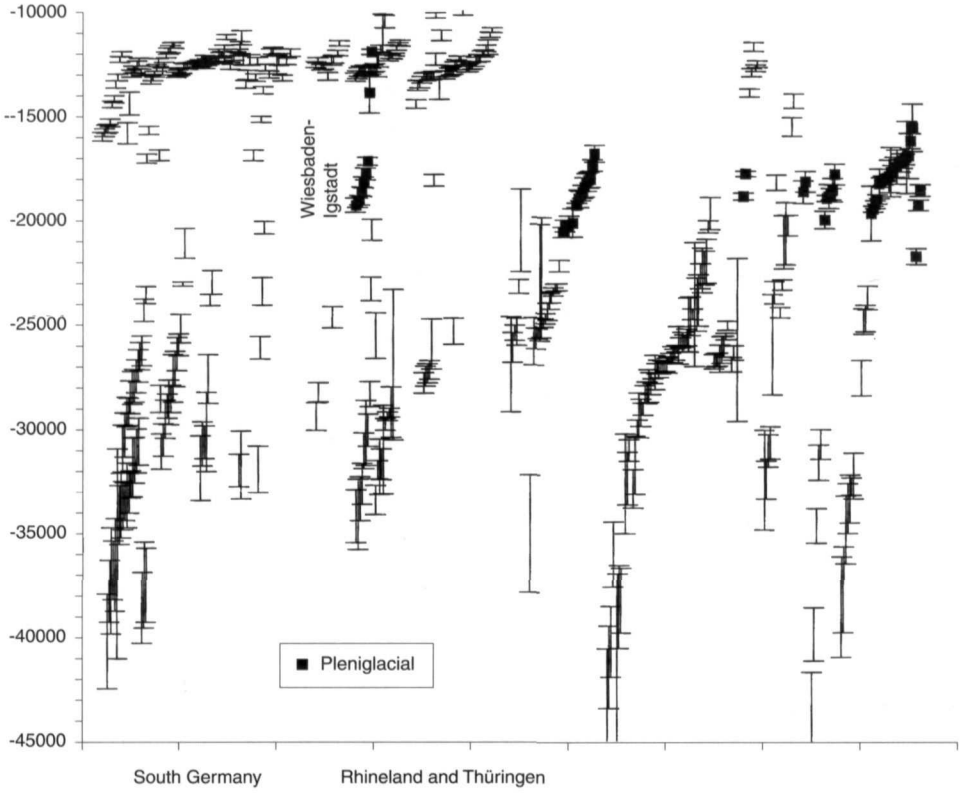

Fig. 3. Uncalibrated dates for the Pleniglacial of Germany (at left of the diagram) and for selected Pleniglacial sites in eastern Central Europe (Austria: Grubgraben; Czech Republic: Stránská skála IV; Slovakia: Kasov, Moravany-Zalovska; Hungary: Mogyorós-bánya, Sagvar, Madaras, Arka, Jászefelsószentgyörgy; Moldavia: Cosautsi, Ciuntu Cave, Brinzeni). Pleniglacial dates are represented by symbols; for comparison non-Pleniglacial dates are represented without symbol to one standard deviation.

Table 3. Uncalibrated German dates close to the Pleniglacial. The dates in italics are to be rejected either on methodological grounds (Wiesbaden-Igstadt) or are probably unassociated with human activity (Aschenstein, see text).

WIESBADEN-IGSTADT (Pettitt *et al.* 1998)	
19,320 ± 240	OxA-7502
19,200 ± 160	OxA-7406
19,080 ± 160	OxA-6808
18,670 ± 160	OxA-6809
18,220 ± 180	OxA-7501
17,820 ± 200	OxA-7500
17,210 ± 135	UZ-3768
13,940 ± 690	*Hd-15742-15440*
12,000 ± 90	*UZ-3767*
ASCHENSTEIN (Weniger 1990)	
18,820 ± 180	*KN-2712*

5. Summary

This paper has attempted to review the German Upper Palaeolithic absolute dating evidence for the period 30,000-20,000 bp against the background of the preceding and succeeding periods. The quantity and quality of the evidence is very different according to region and period. Generally, southern Germany has until now had the larger and more comprehensive series of absolute dates, although even here the total number of dated sites is not large.

Certain general trends can be recognised. The German aurignacian dates show a tripartite division. One group of dates before 35,000 bp is found only in southern Germany at Geißenklösterle and Keilberg-Kirche, obtained both by conventional and AMS measurement of wood charcoal and bone respectively. The second and largest group of dates lies between 35,000 and 29,000 bp and includes sites in southern Germany and the Rhineland. Younger than this is the series of dates between 28,000 and 27,000 bp for Breitenbach B in Thuringia (with a potential parallel in Alberndorf, Austria), which are therefore similar to dates for the Gravettian. It is unclear whether this perhaps implies a more complex relationship between the two traditions than a simple chronological succession. Further series of dates are necessary to verify whether the apparent overlap between the Aurignacian and Gravettian of some 3,000 radiocarbon years can be confirmed at other sites, and how this potentially parallel existence of different lithic traditions (in different regions?) could be interpreted (a question discussed by Weißmüller 1997). It should however be stressed that no interstratification of the two traditions is yet known from

Table 4. Selected uncalibrated dates for the 'Epi-Aurignacian', 'Epigravettian' and Badegoulian / Lower Magdalenian of neighbouring regions. It is unclear whether the youngest dates from Alberndorf (italics) can be accepted as valid or are to be rejected on methodological grounds. Dates for the Moldavian sites of Cosautsi (Damblon *et al.* 1996) and Ciuntu Cave (Hedges *et al.* 1996) are not listed here, but they are included in Fig. 3.

AUSTRIA:	
LANGMANNERSDORF A and B (Hahn 1977)	
20,580 ± 170	GrN-6659
20,260 ± 200	GrN-6660
GROßWEIKERSDORF (Gilot 1997)	
20,300 ± 360	Lv-1755
ROSENBURG (Ott 1996)	
20,120 ± 480	Lv-1756
ALBERNDORF (Bachner *et al.* 1996)	
26,900 ± 1600	VRI-1374
26,100 ± 500	VRI-1537
25,400 ± 260	ETH-13040
25,350 ± 450	VRI-1536
23,170 ± 230	*ETH-13041*
20,500 ± 1400	*VRI-1272*
GRUBGRABEN (Damblon *et al.* 1996)	
19,270 ± 80	GrN-21790
18,960 ± 290	AA-1746
18,820 ± 160	GrN-21893
18,620 ± 220	Lv-1822
18,400 ± 330	Lv-1680
18,170 ± 300	Lv-1660
18,070 ± 270	Lv-1823
18,030 ± 270	Lv-1810
17,350 ± 190	Lv-1821
16,800 ± 280	Lv-1825
CZECH REPUBLIC:	
STRÁNSKÁ SKÁLA IV (Svoboda *et al.* 1991)	
18,820 ± 120	GrN-13945
17,740 ± 90	GrN-14351
SLOVAKIA (Hromada and Kozlowski 1995: 84):	
KASOV	
18,600 ± 390	Gd-6569

Table 4 continued.

MORAVANY-ZAKOVSKA	
18,100 ± 350	Gd-4915
CEJKOV (Bárta and Bánesz 1987: 24)	
19,600 ± 340	KN-14
19,755 ± 240	"Berlin"
HUNGARY (Hromada and Kozlowski 1995: 84): MOGYORÓSBÁNYA	
19,930 ± 300	Deb-1169
SAGVAR (lower level)	
18,900 ± 100	GrN-1783
MADARAS	
18,805 ± 405	Hv-1619
ARKA	
18,700 ± 190	A518
JÁSZEFELSÓSZENTGYÖRGY	
18,500 ± 400	Deb-1647
SAGVAR (upper level)	
17,760 ± 350	GrN-4038
FRANCE: LAUGERIE HAUTE EST (Délibrias *et al.* 1976)	
18,260 ± 360	Ly-972
17,040 ± 440	Ly-973
CUZOUL DE VERS (Chollet 1989)	
18,400 ± 200	Gif-6798
18,300 ± 200	Gif-6370
16,800 ± 170	Gif-6371
15,980 ± 150	Gif-6638
ABRI FRITSCH (Chollet 1989; Schmider 1990)	
17,980 ± 150	Gif-1124
17,130 ± 350	Ly-1121
PÉGOURIÉ (Séronie-Vivien *et al.* 1981; Lorblanchet 1989)	
17,490 ± 520	Ly-1394
17,420 ± 390	Ly-1836
17,320 ± 460	Ly-1834
LASSAC (Délibrias *et al.* 1976)	
16,750 ± 250	Gif-2981

Table 5. Uncalibrated dates for selected German sites with a possibly early magdalenian presence.

HOHLE FELS (Weniger 1990; Hahn 1995; Housley *et al.* 1997)	
17,100 ± 150	H-5120-4569
15,760 ± 140	H-5313-4898
MUNZINGEN (Weniger 1990; Hahn 1995; Housley *et al.* 1997; Pasda 1998)	
16,060 ± 140	OxA-4785
15,870 ± 135	H-4156-3373
15,700 ± 135	ETH-7499
15,670 ± 140	OxA-4786
15,400 ± 130	OxA-4783
14,510 ± 110	OxA-4784
14,270 ± 120	OxA-4788
13,560 ± 120	ETH-7500
13,230 ± 110	OxA-4820
12,370 ± 100	OxA-4787
12,130 ± 95	H-4738-4660
SPITZBUBENHÖHLE (Weniger 1990)	
15,230 ± 100	H-4149-3348
13,840 ± 120	H-4314-3715
12,747 ± 110	H-4052-3212

Germany or indeed from Central Europe. By contrast, all well-documented and dated stratigraphies suggest that the Gravettian replaced the Aurignacian by *c.* 30,000 bp (Hahn 1995; Haesaerts *et al.* 1996).

There is still an urgent need to obtain absolute dates for the Rhineland gravettian sites, and this work is now in progress by the authors and the ORAU laboratory. By contrast, the south German sites of Hohle Fels and Geißenklösterle have consistent series of gravettian dates between 31,000 and 25,000 bp, and most dates from other, less comprehensively dated south German gravettian sites fall into the same range, only a few dates being younger. Almost all of the younger 'gravettian' dates can probably be rejected on methodological or contextual grounds, although the existence of a younger, 'aurignacoid' gravettian assemblage at Bockstein Törle VI must still be considered a possibility.

It would be desirable to re-examine, and where possible, critically date this phenomenon of 'aurignacoid' industries in order to understand better the nature of the changes which took place at the end of the Gravettian, probably as a reaction to the onset of Pleniglacial conditions. That the Pleniglacial cooling did not simply lead to the rapid and complete desertion of Central Europe seems increasingly

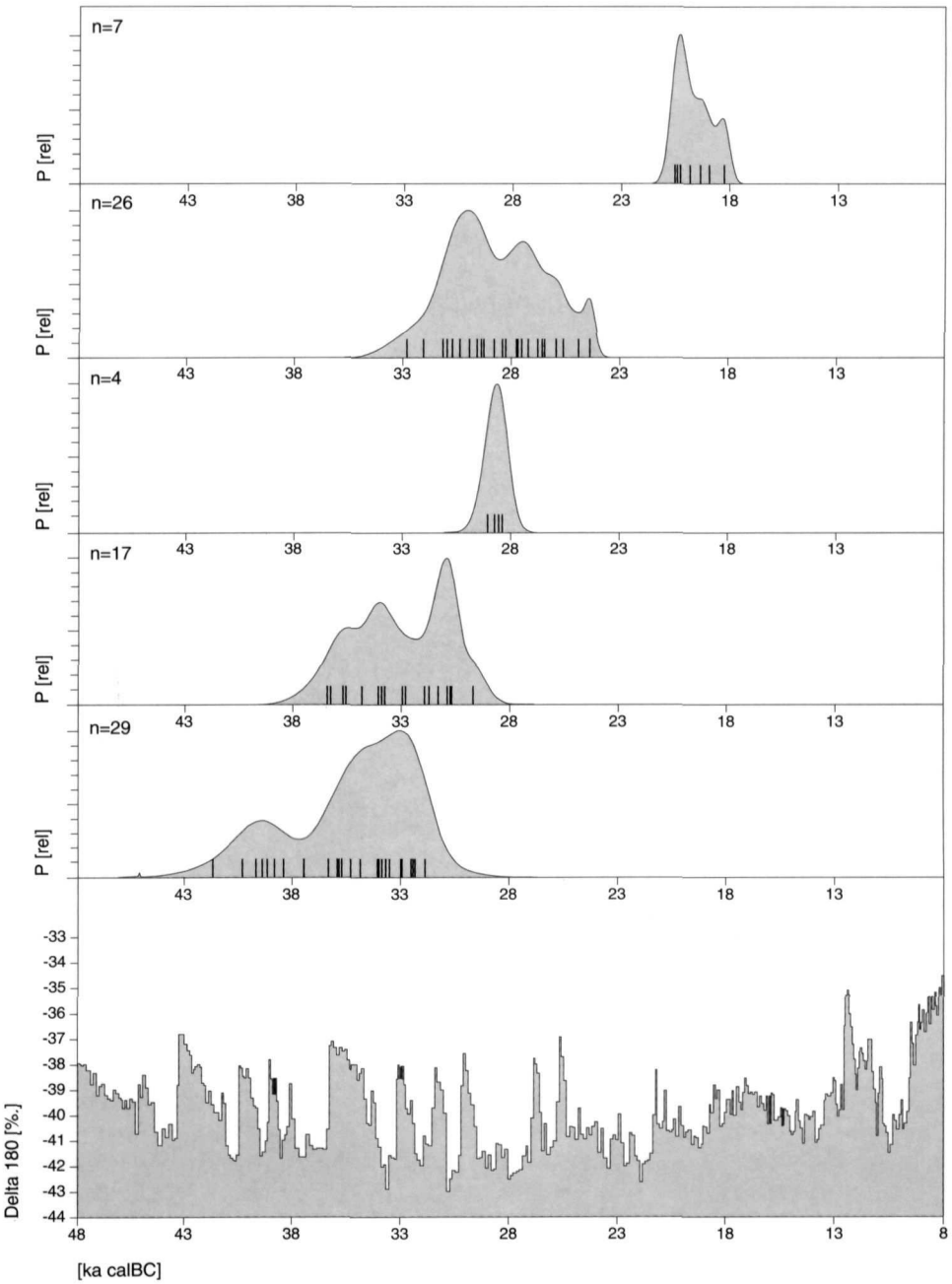

Fig. 4. Calibrated dates for the south German Aurignacian, the Rhineland and Thuringian Aurignacian, the German Gravettian and the quasi Pleniglacial Rhineland site of Wiesbaden-Igstadt (calibration using the CalPal program of Jöris and Weninger, version August 1999). The comparison of calibrated radiocarbon ages with climatic data derived from Greenland ice cores (here GISP2) will potentially allow critically dated Upper Palaeolithic archaeological assemblages to be precisely attributed to specific climatic events (see also Weißmüller 1997).
The uncalibrated dates which form the basis of the calibration (after O. Jöris and B. Weniger perhaps more neutrally expressed as "calendric conversion") are listed in tables 1-3. Not included in the 'calendric conversion' are all the dates from the tables printed in italics, although an exception was made in the case of the Magdalenahöhle (where human association is not clear), since this *is the only radiometrically dated site* from the period in the Rhineland. Also left out of the conversion are five aurignacian dates from southern Germany (Vogelherd, Hohle Fels, Bockstein-Törle) and the Rhineland (Lommersum), which appear too young in comparison with the remaining dates from the respective sites. Only the four very coherent dates from Breitenbach B were included in figure 4.

probable. Evidence for the complex and rapid succession of short-term climatic events preserved in Greenland ice cores makes it more likely that Central Europe could have been visited sporadically on several occasions during much of the period between 23,000-15,000 bp (Fig. 4). Wiesbaden-Igstadt, apparently contemporary with the French Badegoulian, probably represents one such 'incursion' and similar events may potentially have taken place earlier, in the form of 'aurignacoid' gravettian industries or later, in the form of typologically more ancient magdalenian industries. It nevertheless seems clear that these phenomena remained ephemeral and that the main upper magdalenian expansion only occurred in the late glacial between *c.* 13,500 and 12,500 bp.

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