Current Research on the Gravettian of the Swabian Jura

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Abstract: *The Gravettian of the Swabian Jura developed roughly 30,000 years ago, and no clear stratigraphic break separates the lowest Gravettian from the uppermost Aurignacian deposits which also date to roughly 30,000 years ago. A chronological reversal in the radiocarbon sequence at Hohle Fels could reflect taphonomic processes at the site or peaks in radiocarbon production. Unlike the Aurignacian that is well documented in both the Lone and Ach Valleys, the Gravettian is found primarily in the Ach Valley, where particularly rich assemblages are known from sites including Brillenhöhle, Hohle Fels and Geißenklösterle. After 27,000 BP evidence for Gravettian occupations in the region decreases and only scant traces of occupation are visible during the Last Glacial Maximum. As research and excavations proceed, a coherent picture of the Gravettian of the Swabian Jura is beginning to emerge. Future work needs to address patterns of variability and cultural change during the Gravettian.*
Keywords: *Upper Paleolithic, Gravettian, Swabian Jura, Lithic technology, Organic technology, Chronostratigraphy, Cultural stratigraphy*

Aktuelle Forschungen zum Gravettien der Schwäbischen Alb
Zusammenfassung: R. R. Schmidt bemerkte bereits 1912 in den so genannten Herdzonen II und III der „mittleren Diluvialschichten" des Sirgensteins Gerätetypen, die sich von denjenigen des Spätaurignacien abzusetzen schienen. Während das Vorkommen von Gravettespitzen, schmalen Klingenkratzern und einer hohen Stichelanzahl in diesen Schichten als charakteristisch für ein Spätaurignacien galt, führte ihn das Vorkommen einer Blattspitze neben anderen Geräten mit Flächenretusche dazu, dieses Inventar als Proto-Solutréen anzusprechen. In den nächsten Jahrzehnten ergab sich durch neue Grabungen und verfeinerte Grabungsmethoden ein komplexeres Bild der archäologischen Realität. Mit den Grabungen von D. Peyrony (1933) in Laugerie-Haute in den 1930er Jahren wurde erstmals das lineare Evolutionsschema der steinzeitlichen Kulturen, wie es zuletzt Abbé Breuil vorgeschlagen hatte, in Zweifel gezogen. Peyrony ersetzte die Begriffe des Früh- und Spätaurignacien durch die eines unteren und oberen Périgordien. Seine Annahme war dabei, dass das Périgordien parallel zum typischen Aurignacien existiert hätte. D. Garrod (1938) sah den Ursprung der „Gravette-Font-Robert-Kultur" Mittel- und Osteuropas im Nahen Osten, was sie veranlasste, die Industrien mit rückengestumpften Geräten und Stielspitzen bzw. Kerbspitzen, die durch das Vorkommen von Venus-Statuetten gekennzeichnet waren, einheitlich als östliches Gravettien zu benennen. Das Périgordien supérieur von D. Peyrony wurde als westliches Gravettien bezeichnet. Diese terminologischen Auseinandersetzungen fanden in der südwestdeutschen Forschung keine Resonanz. In der Folge neuer Grabungen in Willendorf, Dolní Věstonice und Pavlov lehnten auch Felgenhauer (1952) und Klima (1959) den Begriff eines Spätaurignacien, der sich für die unterschiedlichen Inventarprägungen der jeweiligen österreichischen und mährischen Fundstellen als unpassend erwiesen hatte, ab. Als sich Zotz (1955), gestützt auf die Variabilität der mitteleuropäischen Inventare, für eine bessere Charakterisierung und neue Begrifflichkeit der süddeutschen Inventare aus dieser Zeit aussprach, fanden auch diese Worte in Südwestdeutschland keinen Widerhall. Riek (1973) sprach im Zuge seiner Grabungen in der Brillenhöhle bezüglich des Inventars aus Schicht VII von einem „späten Aurignac mit Gravette-Einschlag" und kam zu dem Schluss, dass von einem reinen Spätaurignacien nicht die Rede sein könne. Zudem zog er Parallelen mit Lacorres (1960) unterstem Gravettien-Bereich, dem sog. „niveau à fléchettes", aus der Fundstelle La Gravette.
Mit J. Hahns Grabungen im Geißenklösterle von 1973 bis 1991 konnten in Zusammenarbeit mit A. Scheer neue hoch auflösende Daten für diese Zeit gewonnen werden. Dabei wurde der Begriff des Gravettien in Anlehnung an die französische Terminologie übernommen. Heutzutage dient der Begriff Gravettien zur Benennung der Inventare, die zwischen dem Aurignacien und dem Magdalénien liegen. Während in den letzten Jahren der Gliederung des Aurignacien viel Aufmerksamkeit geschenkt wurde, ist über die Entste-

hung und die Variabilität des Schwäbischen Gravettien bislang kaum diskutiert worden. Stattdessen war die Erforschung der schwäbischen Höhlen auf eine Rekonstruktion der eiszeitlichen Lebensweise und der kulturellen Adaptationen an die Umwelt fokussiert. Durch eine Fülle neuer AMS Radiokohlenstoff-Datierungen, neue Erkenntnisse zur Abfolge der Gravettien-Schichten im Zuge der laufenden Grabungen im Hohle Fels, nicht zuletzt durch laufende Magister- und Doktorarbeiten, ist die Datenlage ausreichend, um die Frage des kulturellen Wandels vom Aurignacien zum Gravettien erneut aufzugreifen.
Auf der Schwäbischen Alb setzt das Gravettien vor ca. 30.000 Jahren ein, wobei kein klarer Schnitt in der Schichtenabfolge zwischen dem unteren Gravettien und dem oberen Aurignacien, das vor ca. 30.000 Jahren endet, zu erkennen ist.
Es wird angenommen, dass eine chronologische Umkehrung der Radiokohlenstoff-Datierungen innerhalb der gravettienzeitlichen Schichtenabfolge des Hohle Fels auf taphonomische Prozesse bzw. auf Schwankungen in der atmosphärischen Radiokohlenstoff-Erzeugung zurückzuführen ist. Während die Zeit des Aurignacien sowohl im Ach- als auch im Lonetal gut dokumentiert ist, ist das Gravettien dagegen fast ausschließlich in den Höhlen des Achtals nachgewiesen. Dort haben die Brillenhöhle, der Hohle Fels sowie das Geißenklösterle ein reiches Inventar an Steinartefakten und Artefakten aus organischen Materialien geliefert. In der Zeit nach 27.000 Jahren vor heute bricht die Funddichte ab und die spärlichen Spuren, die für die Zeit des letzten Kältemaximums belegt sind, lassen auf ein mehr oder weniger vollständiges Bevölkerungsvakuum in Schwaben schließen. Weitere Arbeiten sind in Zukunft nötig, um verschiedene Fragen beantworten zu können. Es ist bis heute ungewiss, welche Faktoren sowohl sozioökonomischer als auch umweltklimatischer Art nach dem Denekamp-Interstadial bei der Entstehung der Gravettien-Kulturgruppe eine Rolle spielten. Weiterhin ist zu klären, welche Bedeutung der Variabilität von Inventaren innerhalb einer Mikro-Region, wie z.B. des Achtals, zukommt. Nicht zuletzt stellt sich die Frage, in wie weit sich die Aufenthaltsdauer und die Aktivitäten am Ort in den materiellen Hinterlassenschaften einer Fundstelle widerspiegeln.
Schlagwörter: Jungpaläolithikum, Gravettien, Schwäbische Alb, Steintechnologie, Organische Technologie, Chronostratigraphie, Kulturstratigraphie

History of Research

Systematic research into the Gravettian of the Swabian Jura extends back to the work of Robert Rudolf Schmidt in the first decade of the twentieth century. Schmidt drew explicit parallels between assemblages from Archaeological Horizons (AH) II and III that he excavated in 1906 at Sirgenstein in the Ach Valley and a number of classic European assemblages from France, Belgium and Austria (Fig. 1 and 2). While Schmidt´s team no doubt missed some of the smallest artifacts, they systematically screened the sediments of the excavation, and the quality of the recovery was well beyond the typical standards of the early 20th century (Pasda 1993, 7). Schmidt noted the presence of Gravette points and stemmed points at Sirgenstein and made comparisons with sites including La Font-Robert, La Gravette, Le Trilobite, and Willendorf (Schmidt 1912, 27). Due to the presence of a bifacial leaf point in the upper Aurignacian horizon, Schmidt ultimately used the term "Proto-Solutréen" to refer to his assemblages from Sirgenstein. In his summary table he refers to the same period as the *"Font-Robert-Kultur"* and describes this horizon as a transition between the late Aurignacian and the Solutrean (Schmidt 1912, 112-113, 139). Illustrations of artifacts from Sirgenstein can be found in Schmidt's *"Die diluviale Vorzeit Deutschlands"* (Schmidt 1912, Tables I-X), from which examples are reproduced in Figure 4. The leaf point from Sirgenstein can not simply be dismissed as an intrusion of older material of the *Blattspitzenkultur* since material from this cultural group is not otherwise documented at the site, and the stratigraphic position of the piece is clear (Schmidt 1912, 27-28). The presence in Sirgenstein of shouldered points, *pointes à cran périgordiennes*, is not in contradiction with this picture, since comparable specimens with smooth shoulders have been found at Předmosti and Petřkovice together with leaf points (Absolon and Klima 1977, fig. 37-39, 52; Klima 1955, 13).

In the following decades, the increasing number of excavated sites and improved methods of excavation revealed a more complex archaeological picture than had been documented before. In the thirties, the excavation at Laugerie-Haute led Denis Peyrony (1933) to reject the linear evolutionary model established by Henri Breuil (1912) and to coin the term Perigordian. Peyrony observed the existence of an intermediate layer at Laugerie-Haute between deposits of the early Aurignacian (of Châtelperron type) and the upper Aurignacian (of Gravette type); this deposit contained a lithic assemblage with blunted-back blades different from the Aurignacien *sensu stricto* or middle Aurignacian documented at La Ferrassie. Based on these observations, he renamed the early and upper Aurignacian, the early and upper Perigordian. Peyrony viewed the Perigordian assemblages as being phylogenetically related and existing parallel to the Aurignacian cultural sequence. He subdivided the Perigordian into seven stages. The upper Perigordian, which corresponds to the actual western Gravettian, was subdivided into stages IV, Va/b/c (Peyrony 1933; 1936).

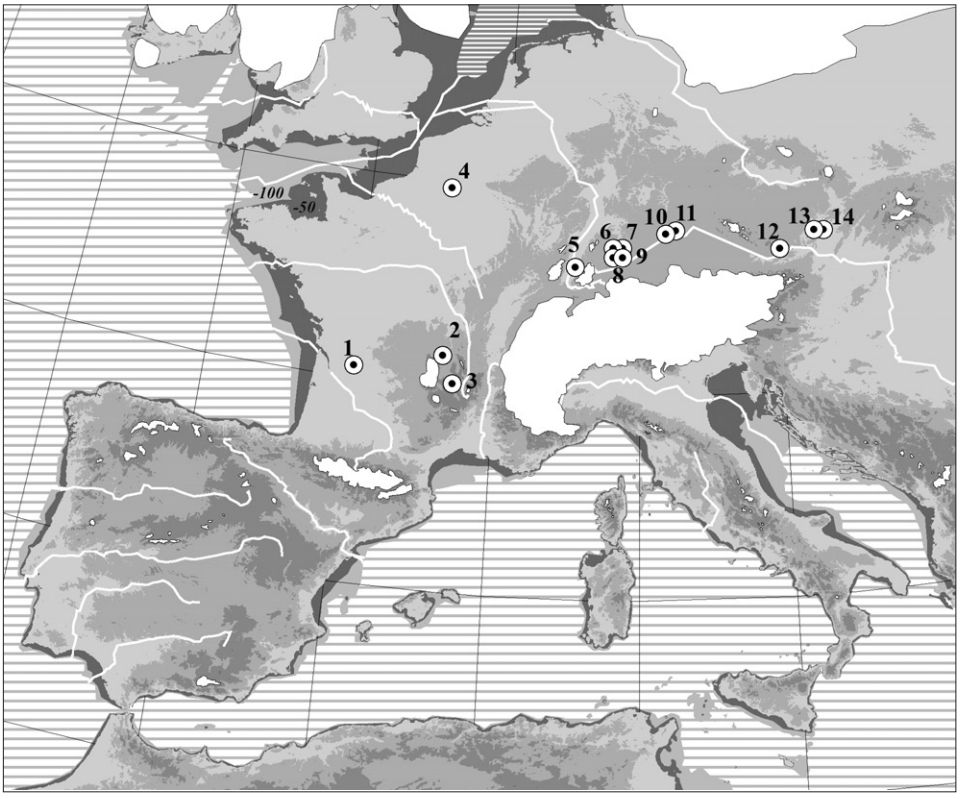

Fig. 1: *Map of central and western Europe with the early Gravettian sites mentioned in the text: 1 Abri Pataud (Les Eyzies-de-Tayac, Dordogne) – Le Sire (Mirefleurs, Dpt. Puy-de-Dôme) – 3 La Vigne Brun (Villerest, lieu-dit du Saut-du-Perron, Dpt. Loire) – 4 Maisières-Canal (Escaut Basin, Hainaut Province) – 5 Steinacker (Rhine Basin, Black Forest) – 6 Sirgenstein (Ach Valley, Swabian Jura, Baden-Württemberg) – 7 Brillenhöhle (Ach Valley) – 8 Hohle Fels (Ach Valley) – 9 Geißenklösterle (Ach Valley) – 10 Weinberghöhlen (Bavaria) – 11 Obere Klause (Bavaria) – 12 Willendorf II (Wachau, Lower Austria) – 13 Pavlov (Pavlov Hills, Moravia) – 14 Dolní Věstonice (Pavlov Hills, Moravia). Background map with coastal lines and icesheets during the Last Glaciation Maximum after Serangeli (2004).*

In 1938 Dorothy Garrod suggested a Near Eastern origin of the "Gravette-Font-Robert" industry in central and eastern Europe. She stressed that whereas in France the distinction between the Gravette level with blunted-back blades and the overlying Font-Robert level with tanged and shouldered points was quite clear, in central and eastern Europe the shouldered point stage predominated and was associated with the distinctive female statuettes. She proposed the general term, Gravettian, to refer to this industry, distinguishing between a Lower and an Upper Gravettian for Western Europe where the two phases are closely related. Despite this suggestion, the term of Gravettian did not take hold in Swabia. This is in part due to the lack of new excavations that produced important assemblages from this period.

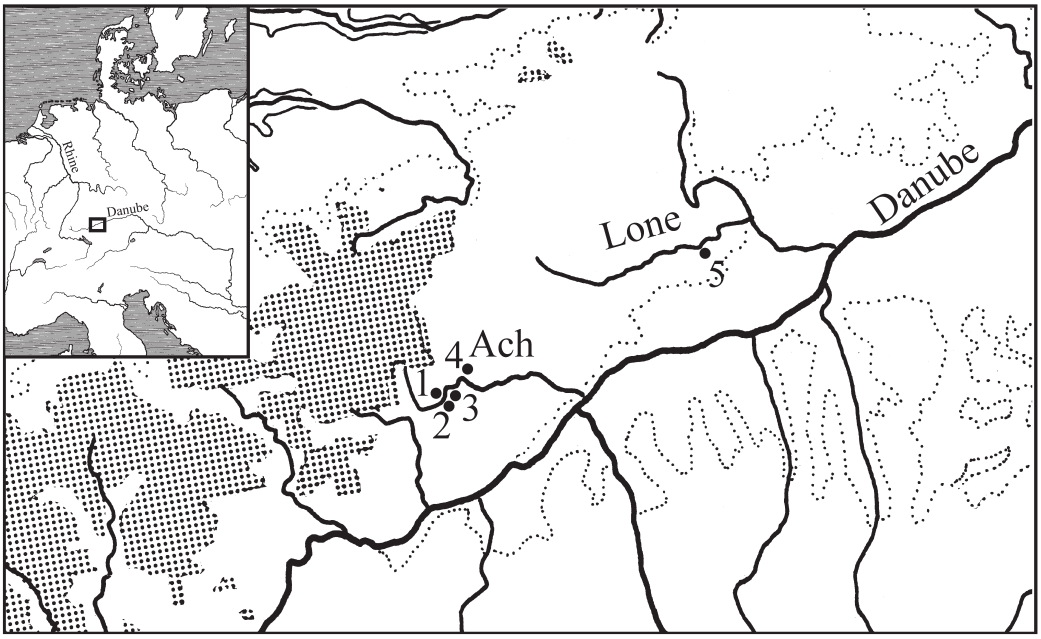

***Fig. 2**: Map of the Swabian Jura with the principal sites mentioned in the text. Ach Valley: 1 Sirgenstein – 2 Hohle Fels – 3 Geißenklösterle – 4 Brillenhöhle: Lone Valley: 5 Vogelherd.*

Until the 1950s central European archaeologists including Zotz (1955, 82) and Prošek and Ložek (1954) used the term "upper or late Aurignacian" instead of the term 'upper Perigordian' of Peyrony or the 'Gravettian' proposed by D. Garrod. In the light of new excavations at Pavlov and Dolní Věstonice and the work of Felgenhauer (1952) at Willendorf, Klima (1959, 16) stressed the problems associated with the use of the term Aurignacian in Moravia. In contrast to Absolon (1947), Klima stressed that the Moravian assemblages fall outside the range of variability of the Aurignacian and advocated dropping the term. Klima applied the general term of Gravettian, as proposed by Garrod, but suggested the use of the term Pavlovian to reflect the regional character of what he interpreted as a single local cultural group. He also addressed the question of the relationship between the Aurignacian and Gravettian and argued for a local origin of the Gravettian which arose out of the local Szeletian and Aurignacian (Klima 1959, 42).

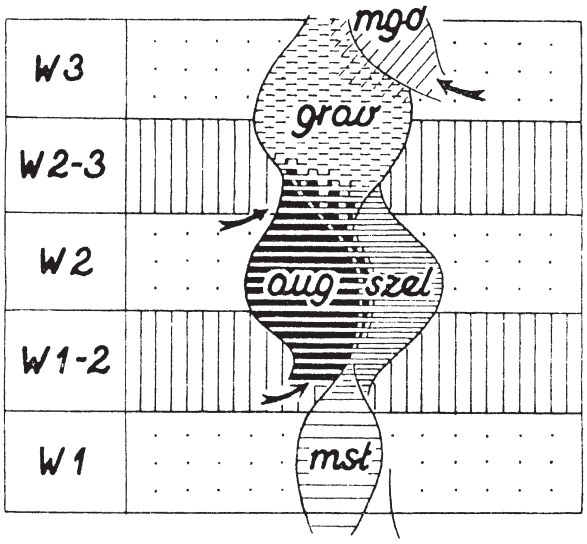

Fig. 3: *Schematic representation of the Upper Palaeolithic evolution in the Czech Republic. After Klima 1959, fig. 1.*

This research had little impact in Swabia. Given the complete absence of the Châtelperronian in Swabia, and the lack of evidence for a long Perigordian tradition, researchers in Swabia saw little need to enter into these debates that focused more on French and Moravian sites.

As new discoveries were made in the caves of the Swabian Jura, research on the Gravettian became more important in southwestern Germany. Excavations at Brillenhöhle by Gustav Riek produced Gravettian material about 1km N of Sirgenstein in the Ach Valley. The excavation at Brillenhöhle ran from 1955-1963 and was published in detail by Riek (1973). Here archaeological horizon VII, which Riek referred to as *"das gravettoide Aurignac"* produced a rich Gravettian lithic assemblage with diverse organic artifacts including numerous ornaments (Fig. 5 and 6). Riek (1973, 148-150) discussed the presence of both Aurignacian and Gravettian elements within the assemblage and noted the similarities between the assemblage from AH VII at Brilllenhöhle and Aurignacian and Gravettian assemblages from France. He compared finds from Brillenhöhle in relation to the cultural and chronostratigraphy of the Moravian Gravettian. He also presented a radiocarbon date of >25ka as a first estimate of the age of the assemblage. The rich assemblage from Brillenhöhle showed in Riek's view affinities with the Aurignacian from his excavation at Vogelherd, but does not represent a pure late Aurignacian. He noted the similarities between Brillenhöhle VII and Lacorre's (1960, 49) *"niveau à fléchettes"* from the basal Gravettian layer at La Gravette as well as the lack of clear examples of Venus figurines, that one might expect in a rich Gravettian assemblage. Riek pointed, for example, to the abundance of tear-drop shaped pendants at Brillenhöhle, the Weinberghöhlen near Mauern (Bavaria) and Obere Klause near Kelheim (Franconian Jura) as a characteristic form for this period. In comparison with the time of R. R. Schmidt's research, much more information was available to Riek. In his discussion of layer VII he states:

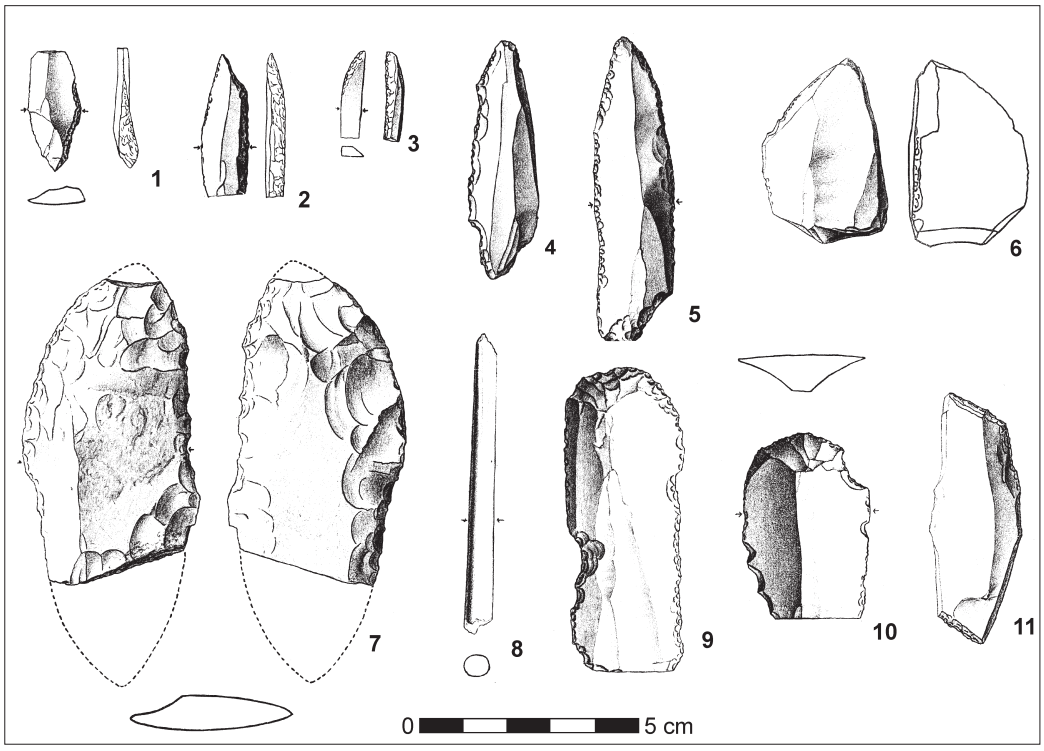

Fig. 4: *Sirgenstein. Lithic assemblage and organic artifact, AH II and III. (1) atypical stemmed point, (2) backed point, (3) microgravette point, (4-5) stemmed points, (6) flat-faced burin, (7) foliate point, (8) bone point, (9-10) end scrapers, (11) burin on truncation. After Schmidt 1912, plates VII-IX.*

Der in diesem späten Aurignac vorhandene Gravette-Einschlag tritt sowohl in den Steinartefakten als auch in den Knochenartefakten hervor. Die kulturelle Entwicklung des Aurignac ist trotz dessen Nachweisung in der Sirgensteinhöhle (R. R. Schmidt 1912) und der Vogelherdhöhle (G. Riek 1934) noch nicht abschlußreif klärbar, zumal das nächstgelegene Siedlungszentrum in Westeuropa immer noch als abseits gelegen zu betrachten ist. (Riek 1973, 148)[1]

Eine verdichtete Aussage über ein reines spätes Aurignac in der Brillenhöhle ist nach diesen Darlegungen nicht empfehlenswert. Trotzdem stellen die Funde aus Schicht VII eine unerwartete Bereicherung unserer bisher so dürftigen Kenntnisse über ein gravettoides Aurignac in Süddeutschland dar. (Riek 1973: 150)[2]

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[1] The late Aurignacian contains a Gravettian influence among both the lithic and organic artifacts. The cultural development of the Aurignacian, despite its presence at Sirgenstein (R.R. Schmidt 1912) and Vogelherd (G. Riek 1934), is not yet definitively clear. This is all the more the case since the developments documented in major areas of occupation in western Europe took place in very distant regions.

[2] Based on this presentation, a detailed assessment of a pure late Aurignacian in Brillenhöhle cannot be recommended. Nonetheless, the finds from Layer VII provide an unexpected improvement of our previously so limited knowledge of the gravettoides Aurignac of southern Germany.

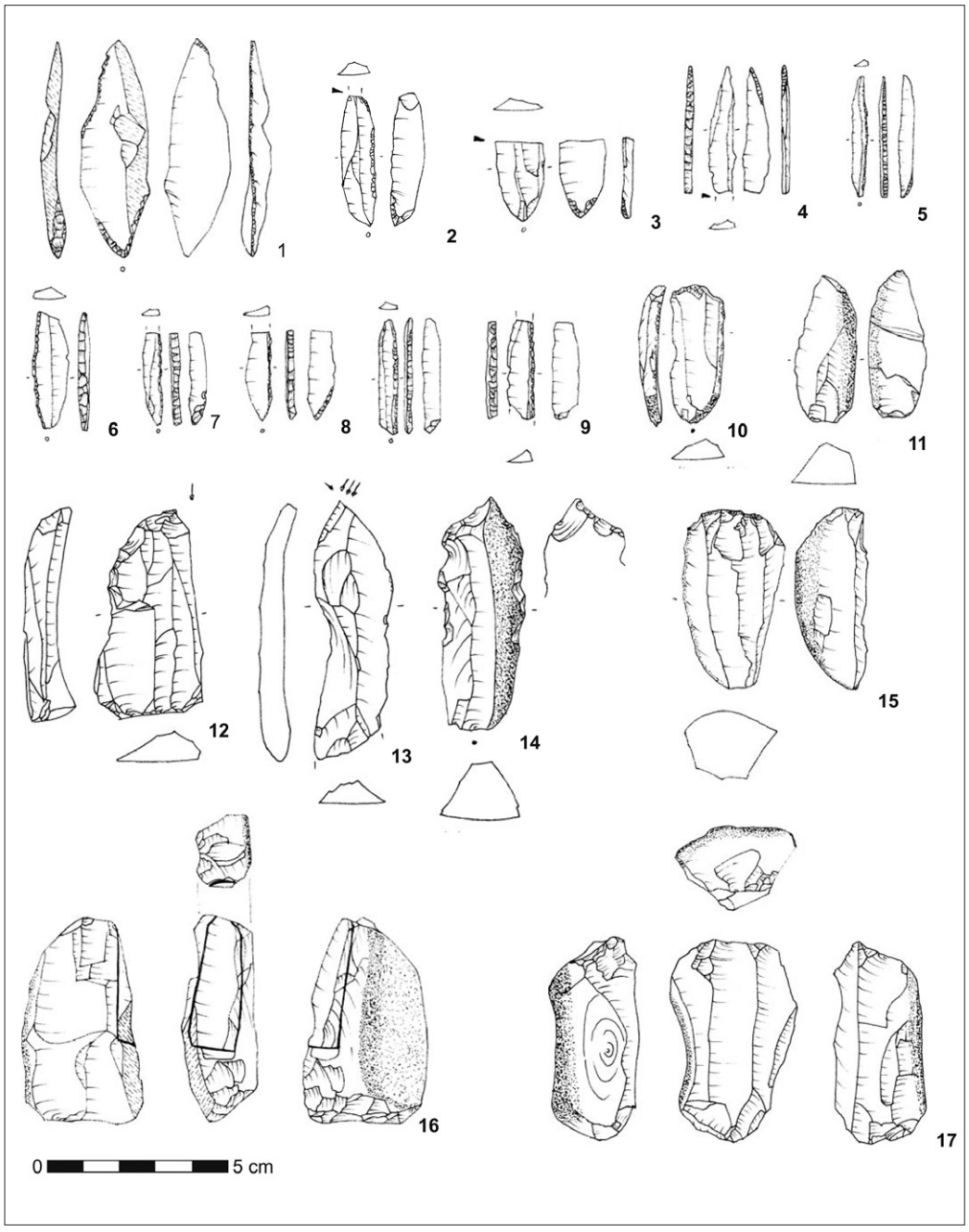

Fig. 5: *Brillenhöhle. Lithic assemblage, layer VII. (1-3)* fléchettes *(the black arrows mark macroscopic impact fractures), (4-5, 7-9) microgravette points, (6) backed bladelet, (10) end scraper, (11) splintered piece, (12) burin on truncation, (13) dihedral burin, (14) borer, (15) exhausted unidirectional core, (16) bladelet core on thick cortical flake, (17) exhausted bidirectional core. Drawings (1-17) by L. Moreau.*

For both Schmidt and Riek, what we now call the Gravettian of Swabia had similarities with rich Aurignacian of the region as well as Gravettian elements that were known in regions of central and western Europe. Throughout much of the early work on what we now refer to as the Gravettian, Schmidt and Riek emphasized the continuity between the Aurignacian and the Gravettian.

In 1973, the year that Riek published his monograph on Brillenhöhle, Eberhard Wagner conducted an exploratory excavation at Geißenklösterle. After this initial year of study, Joachim Hahn continued the excavation with some breaks until 1991. Hahn's work at Geißenklösterle introduced higher standards of excavation with careful piece-plotting of artifacts to the region. His close collaboration with Anne Scheer at Geißenklösterle produced a wealth of new results and provided a key assemblage of Gravettian material which has been presented in a number of articles over recent decades (Hahn 1976, 1982, 1987, 1995, 2000; Hahn and Owen 1985; Scheer 1985, 1986, 1990, 1993, 2000).

With the work of Hahn, Scheer and others since the 1970s, the term Gravettian became widely accepted in Swabia. This occurred in a pragmatic way without much discussion of issues of nomenclature in the scientific literature. We are not aware of publications dealing with the Swabian Gravettian that specifically address these questions of nomenclature.

Riek saw strong affinities between the Swabian Aurignacian and the Gravettian as seen, for example, in the quotations above, but he was not anxious to transplant what he saw as a non-local system of nomenclature to Swabia. Hahn, on the other hand, worked closely with French colleagues and had few reservations about adopting the term Gravettian for assemblages dating after the Aurignacian and before the Magdalenian. Meanwhile elsewhere in Germany, Gerhard Bosinski rarely used the term and instead wrote of the Early, Middle and Late Upper Paleolithic. While often using the terms Aurignacian and Magdalenian as synonymous for the Early and Late Upper Paleolithic, Bosinski (1979, 1982, 2000), Bosinski et al. (1985), Erwin Cziesla (1984), Harald Floss (1991) and other German colleagues have also tended to avoid the use of the term Gravettian for this nearly pan-European culural group. Since relatively few new excavations took place in this period, these questions of nomenclature were rarely discussed explicitly.

Today the term Gravettian is used for virtually all Swabian assemblages that postdate the Aurignacian and predate the Magdalenian. Unlike the Swabian Aurignacian that has been the subject of several synthetic publications by Hahn (1977, 1986, 1988) and recent updates by Bolus and Conard (Bolus and Conard 2001; Conard and Bolus 2003, in press; Bolus 2003, 2004), no synthetic work on the Swabian Gravettian has been published. Abundant data on the Gravettian are, however, available in numerous brief excavation reports, conference symposia, and Riek's (1973) monograph on Brillenhöhle.

In recent years a nucleus of researchers and students in Tübingen has begun to address the Gravettian of the region more systematically. One impetus for this work comes from recent excavations in the Gravettian deposits in Hohle Fels, where many years of excavations have produced large, well documented Gravettian assemblages that along with Hahn and Scheer's work at Geißenklösterle provide a wealth of high quality data. Much of the background to current research in the Ach Valley has recently been summarized and will not be repeated here (Conard 2002b).

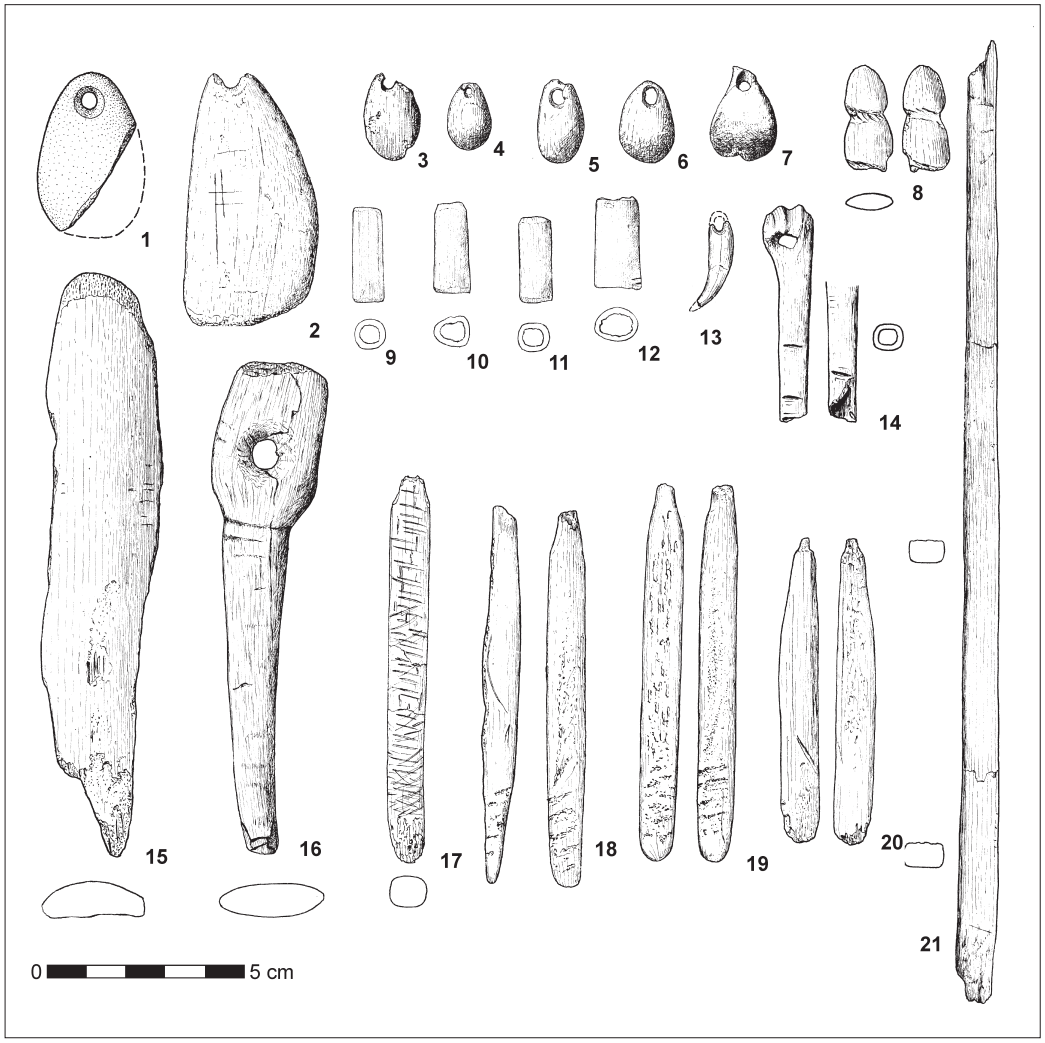

Fig. 6: *Brillenhöhle. Organic artifact assemblage, layer VII. (1-7) drop-shaped ivory pendants, (8) notched preform for the production of pendants, (9-12) tubular beads, (13) perforated fox canine, (14) notched hare bone, (15) burnisher, (16)* Lochstab*, (17-21) projectile points on mammoth ribs. After Riek 1973.*

Chronostratigraphy

Riek published the first radiocarbon date of >25ka for Brillenhöhle layer VII in 1973. Since then numerous reports of the chronology of the Swabian Upper Paleolithic have been published (Hahn 1995; Housley et al. 1997; Richter et al. 2000; Street and Terberger 2000; Conard 2002a; Conard and Bolus 2003). Today, several dozen radiocarbon dates are available for the region, and, as a result of dating programs initiated in Tübingen and by colleagues of the AMS laboratory at Oxford, a reliable chronology for the Gravettian

is beginning to emerge. Radiocarbon dates for the sites of Brillenhöhle, Geißenklösterle, Hohle Fels, Sirgenstein, and Vogelherd are presented in Tables 1-5. Street and Terberger (2000) have recently summarized the radiocarbon dates from Swabia and other regions of Germany, and much information on the chronology of the Swabian Upper Paleolithic can be found in a review article by Conard and Bolus (2003). Verpoorte (2005, 275-276) has also published on this topic. Although we agree with Verpoorte and many colleagues including Svoboda et al. (1996), Otte et al. (1996), Otte and Noiret (2004), Kozłowski (1986), that clear regional signatures exist within the Gravettian, many of the dates for the Gravettian in other parts of Europe post-date the main phase of occupation in Swabia. This observation and the early dates of the Ach Valley Gravettian relative to those from western Europe led to the formulation of the *Kulturpumpe* hypothesis (Conard 2000). While clearly new Gravettian adaptations and cultural features such as Venus figurines, fired clay technology and complex burial practices do not originate in Swabia, the hypothesis that the technological shift between Aurignacian and Gravettian took place at an early date in Swabia has yet to be refuted by earlier dates of major Gravettian occupations in other regions. We suggest that when better chronological control becomes available, we will see a complex picture of spatial variation that reflects innovations from Swabia and other regions including the Central Danube region. The early dates from Willendorf II/5 (Damblon et al. 1996), for example, suggest a mosaic picture of cultural development around 30 ka BP.

Work by Michael Hofreiter and colleagues (2003, 2004) has documented the population dynamics of cave bears, and the team from Tübingen has demonstrated that the caves of the Swabian Jura served as shelters both for people and cave bears. Even though we can rarely separate the specific occupations of bears and humans, the faunal and taphonomic data indicate competition between humans and bears for the use of the caves and human exploitation of cave bears for food, hides and ornaments (Münzel and Conard 2004). The best evidence for hunting of cave bears comes from AH IIcf at Hohle Fels where a thoracic vertebra of a young cave bear was recovered with a chert artifact imbedded in it (Münzel et al. 2001). While in the Middle Paleolithic Neanderthals competed with cave bears for the use of the caves, their impact on the bear populations was slight. Over the course of the Aurignacian and Gravettian cave bear populations declined and by the time of the Last Glacial Maximum they were locally extinct, presumably as a result of human agency combined with environmental causality. The radiocarbon dates from faunal remains of cave bears are also summarized in Tables 1 and 3. These dates together with many thousands of cave bear bones that accumulated at the sites due to natural mortality demonstrate alternating use of the caves by bears and humans and document the close ecological relationship between both species.

Defining the beginnings of the Gravettian and distinguishing the last Aurignacian deposit from the first Gravettian is not always easy. The Gravettian of the Swabian Jura follows directly after the Aurignacian. At both Hohle Fels and Geißenklösterle there is no sterile horizon between the two archaeological periods. This can be seen in the stratigraphic profiles of the two sites (Fig. 7). At Hohle Fels the crucial strata are AH IId and IIe. The lithic assemblages from these deposits are relatively poor in artifacts, but based on the presence of small numbers of microgravettes, carinated burins and a nosed end scraper, both Gravettian and Aurignacian are present. The assemblage also includes small bidirectional blade cores, and the raw material spectrum falls within the range of

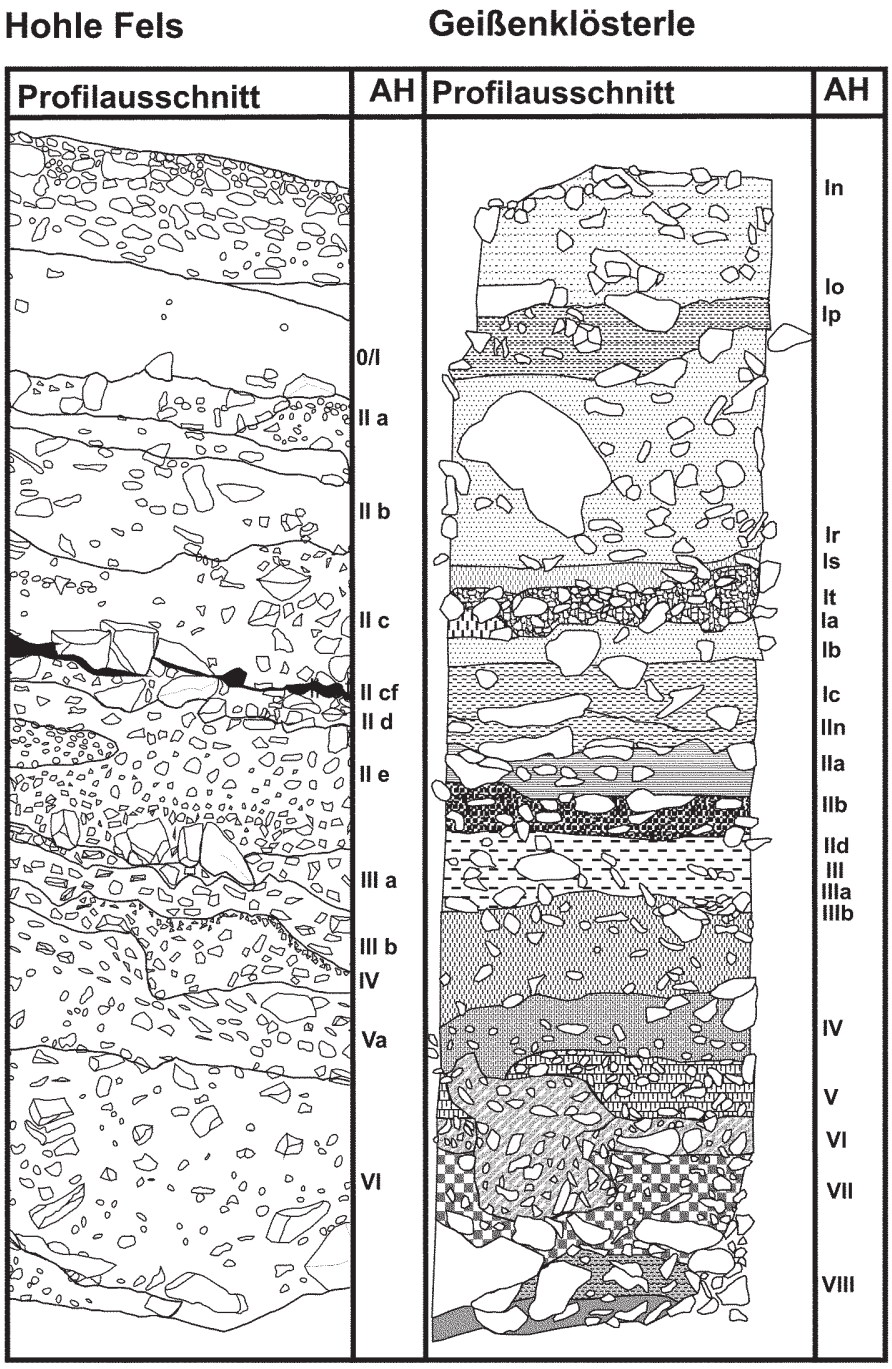

Fig. 7: *Stratigraphic profiles of Hohle Fels and Geißenklösterle with indication of the Archaeological Horizons (AH).*

Gravettian assemblages (Floss and Kieselbach this volume). Aside from several bone and ivory tools, the organic assemblage includes an ivory figurine which resembles the head of a horse and is a typical Aurignacian find. A piece of the cheek of the figurine comes from the deeper horizon IIIa and supports the Aurignacian origin of the find. As we will see below, the radiocarbon dates from AH IId slightly predate 30ka and are more in line with expectations for the Aurignacian than the Gravettian. Finally, AH IId contains personal ornaments including five finds of perforated horse incisors that seem to be restricted to the stratigraphic position between the Aurignacian and the Gravettian. This find horizon lacks both Gravettian teardrop-sharped pendants and Aurignacian double perforated ivory beads.

At Geißenklösterle, the deepest Gravettian stratum is AH Ic, and the highest Aurignacian stratum is AH IIn. These layers are segmented by a thin zone of cryoturbated sediments (Laville and Hahn 1981; Hahn 1988, 46, Beilage 1). AH IIn contains one Dufourbladelet, an Aurignacian type, while AH Ic lacks any classic indicators of the Gravettian. Scheer (1990) argued for placing the finds from AH Ic in the Gravettian complex based on the presence of lithic refits with the overlying Gravettian deposits. An argument for continuity between the Aurignacian and Gravettian at Geißenklösterle is the consistent pattern in the use of raw materials between AH II and AH Ic. As is typically the case, local Jurassic chert dominates the assemblage of AH Ic, while *Bohnerzhornstein* is more abundant than radiolarite. In most of the Gravettian deposits radiolarite is the second most abundant raw material. Finally, while no truly diagnostic pieces are present in AH Ic, the dominance of end scrapers over burins is atypical for the Gravettian.

Based on a series of TL dates on burnt flints from Geißenklösterle, the Aurignacian appears to begin around 40ka. The earliest radiocarbon dates for the Aurignacian fall between 35 and 40ka. The bulk of the uncalibrated radiocarbon dates for the Aurignacian fall between 35 and 30ka BP. The stratigraphic pattern provided by the radiocarbon dates from Geißenklösterle and Hohle Fels, the only sites with high quality information on the provenience of the dated samples, presents a very noisy signal that appears to result from a combination of taphonomic processes and variations in the atmospheric levels of radiocarbon (Richter et al. 2000; Conard and Malina 2002; Conard 2002a; Conard and Bolus 2003). The initial phase of the Aurignacian seems to begin suddenly and includes numerous kinds of artifacts that are lacking in the later Middle Paleolithic of the region. Based on sterile and archaeologically poor assemblages underlying the Aurignacian, it seems that local population densities prior to the Aurignacian were low. No evidence for interstratification of Middle Paleolithic and Aurignacian deposits has been documented (Conard 2005), and we have suggested the working hypotheses of a relatively early migration of modern humans along the Danube Corridor to explain these observations. The "population vacuum" hypothesis posits an initial colonization of the largely depopulated Upper Danube including Swabia by modern humans in connection with the rapid climatic amelioration of IS 8 following the extremely cold period correlated with the Heinrich 4 event (Conard and Malina 2002; Conard and Bolus 2003; Conard 2003a; Müller 2003). Recent radiocarbon measurements demonstrate that the well known human fossils from Vogelherd date to the Neolithic rather than to the basal Aurignacian as Riek claimed (Riek 1934; Gieseler 1937). Thus questions about the makers of the Aurignacian can not be answered with certainty (Churchill and Smith 2000; Conard et al. 2004). Although the evidence is ambiguous, we favor the interpretation, that modern humans

are responsible for the artifacts from the Swabian Aurignacian. Attempts to improve the chronological and paleoenvironmental data for the Aurignacian of the Swabian Jura are ongoing and are of crucial importance for documenting the beginnings of the Gravettian in the region.

The best cultural and chronological data for the Gravettian come from the Ach Valley, with Geißenklösterle (Table 1) and Hohle Fels (Table 3) providing the most numerous and reliable radiocarbon dates. At both sites, there is an overlap between the youngest dates for the Aurignacian and the earliest dates for the Gravettian around 30 ka BP. The modern excavations at Geißenklösterle and Hohle Fels provide the only high qualitiy spatial data for the Gravettian, and in the present context, the piece plotted finds that have been radiocarbon dated with AMS are of particular importance. Both sites provide little evidence for temporal break in the radiocarbon dates between the Aurignacian and the Gravettian. There is also no evidence for significant sterile zones between the two cultural units. Although the early Gravettian assemblages have not yet been published systematically, typical forms for the Gravettian seem to overlap slightly with the last Aurignacian artifacts. Thus the data currently available are consistent with Schmidt's and Riek's suggestions that what we now call the Gravettian of Swabia evolved out of the Swabian Aurignacian. This appearance of in situ evolution could, of course, result from mixing between the archaeological horizons of the Aurignacian and the Gravettian, but preliminary geoarchaeological results and taphonomic results do not suggest that major mixing has occurred between AH I and AH II at Geißenklösterle and between AH II and AH III at Hohle Fels. This being said, it would be unrealistic to think that excavators can completely separate the material remains from both cultural units in cave sediments that have been affected by humans, bears and geological processes.

Taken as a whole, the bulk of the radiocarbon dates for the Gravettian of the caves of the Ach and Lone Valleys lies between 26 and 30ka. Here only the AMS dates have been included, since there is reason to believe that the conventional radiocarbon dates on mixed bone samples could reflect a mixture of bones of different ages.

Particularly interesting is the massive layer of burnt bones at Hohle Fels designated AH IIcf. Here four dates yielded ages clustering between 27 and 28ka. These ages post-date many of the results from a higher stratigraphic position in AH IIb and AH IIc.

There are at least two possible explanations for this observation. The older material from the interior of the cave could have been reworked and deposited above the layer of burnt bone, or the comparatively young ages of the samples for AH IIcf could reflect a period of increased concentrations of atmospheric radiocarbon. It has long been known that the main movement of sediments in Hohle Fels is from the inner part of the cave outward toward the entrance (Hahn 2000). Thus it is possible that older material from inside the cave could be deposited above the burnt deposit of AH IIcf. Preliminary results from Voelker et al. (2000) and Beck et al. (2001) indicate that the radiocarbon signal around 30 ka, while not as variable as by the time of the Laschamp magnetic excursion about 40 ka ago, was by no means stable. Thus the inversion of the radiocarbon dates could also be the result of a peak in radiocarbon production during the archaeological occupation corresponding to AH IIcf. Futher geoarchaeological research should allow us to test these two hypotheses.

In any case it seems clear that the most intense period of Gravettian occupation corresponds to the period between about 27 and 29 ka BP. The refitting artifacts between Hohle

Fels AH II and Brillenhöhle AH VII and between Geißenklösterle AH I and Brillenhöhle AH VII (Scheer 1986, 1993) also come from deposits that date to this time range and indicate an intense period of occupation.

Questions related to the later phases of the Gravettian and the possibility of occupations during the Last Glacial Maximum (LGM) have received considerable attention in recent years. More specifically, Terberger's excavations at Wiesbaden-Igstadt raised questions about the postulated depopulation of northern Europe during the LGM (Terberger 2001; Street and Terberger 2000). The data from the Swabian Jura have played a role in this discussion, since there are some examples of radiocarbon dates after the main phase of Gravettian occupation, which ended around 26-27 ka BP. At Hohle Fels the richest Gravettian deposit is the burnt bone dump of AH IIcf. Overlying AH IIcf are the much thicker deposits of AH IIc and AH IIb. Overlying AH IIb in the southern and central part of the excavation, AH IIa is present and represents a reworked mixture of Magdalenian and Gravettian materials (Hahn 2000). Still higher in the stratigraphic sequences is the rich Magdalenian complex of AH I. In the northern part of the excavation, AH IIa is overlain by a sterile *Mondmilch* deposit of precipitated $CaCO_3$ that formed during the Last Glacial Maximum, a period during which the site was not occupied by people or cave bears. Thus there is a clear stratigraphic break and a long period of low population densitiy or complete depopulation separating the Gravettian and Magdalenian occupations in Swabia. A similar pattern can be seen at Geißenklösterle, where the rich Gravettian deposits of AH I are overlain by sterile deposits followed by the low density Magdalenian deposits of AH Io.

In this context it is prudent to focus our attention on bones that have been directly AMS dated, since the mixed bone samples from sites including Hohle Fels and Bockstein-Törle in the Lone Valley may reflect results from bones of multiple ages (Conard and Bolus 2003). Some of the conventional radiocarbon dates are probably reliable, but it remains preferable to begin by looking at the results of directly dated bones and particularly bones that show anthropogenic modification or are from the species routinely hunted or used by humans. When this is done, we see evidence for occupations postdating 27ka from Vogelherd (Conard et al. 2003). While an occasional later Gravettian occupation of the caves of the Swabian Jura after 27ka seems likely, it is clear that the intensity of settlement in the region remained low until the Magdalenian with its many radiocarbon dates around 13ka.

Cultural stratigraphy and artifact variability

While in recent years major progress has been made in establishing the chronology of the Swabian Upper Paleolithic, many questions about the changing patterns of technology and artifact variability remain unanswered. Especially concerning the Gravettian much work remains to be done. At present there are no detailed publications that address the patterns of assemblage variability over the course of the Gravettian. There have been few attempts made to isolate patterns of temporal or functional variation. Here we present the main assemblages of lithic and organic artifacts known from the key sites.

The richest assemblages of lithic and organic artifacts are known from the excavations at Brillenhöhle, Geißenklösterle and Hohle Fels. Fig. 4 - 6, 8 - 11 present the lithic and organic assemblages from these sites as well as from Sirgenstein. The Gravettian lithic

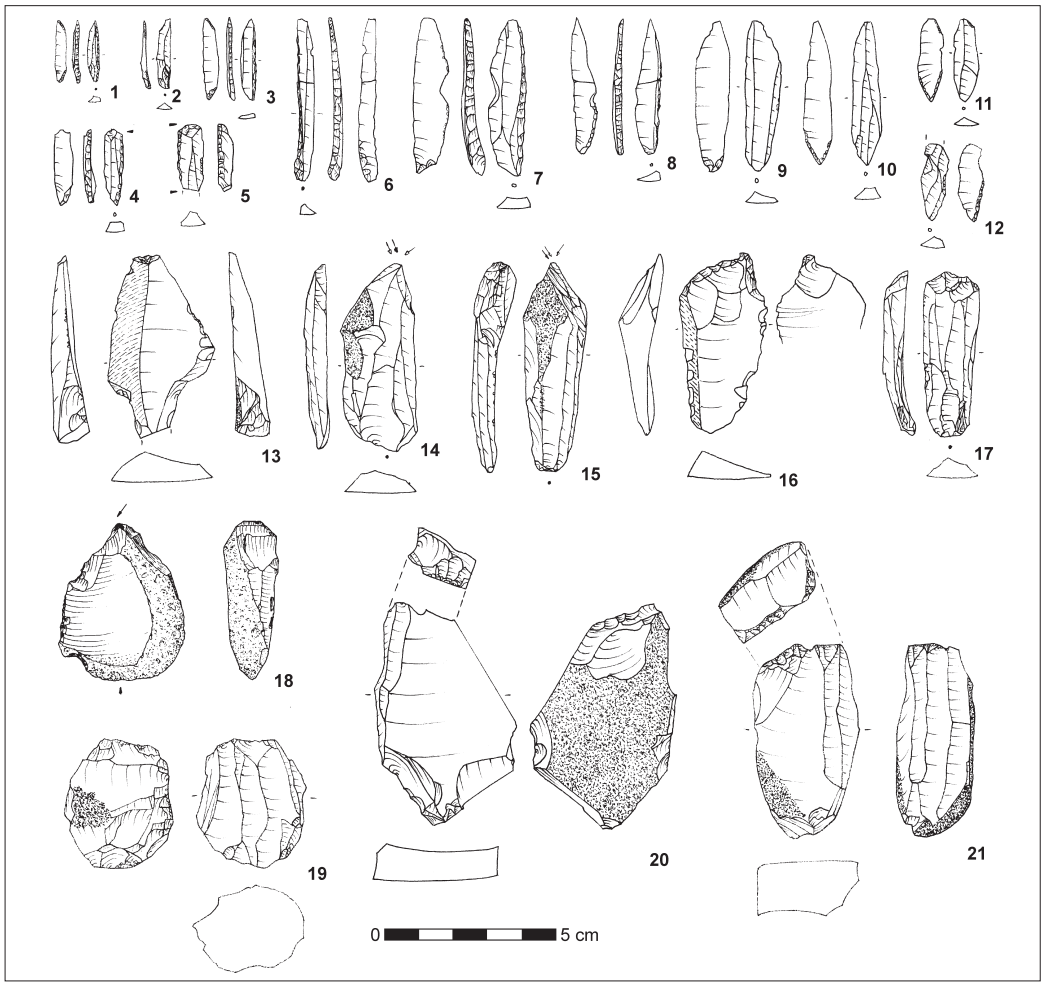

Fig. 8: *Geißenklösterle. Lithic assemblage, AH I. (1-4, 6-8) microgravette points, (5) backed bladelet (the black arrows show macroscopic impact fractures), (9-12) fléchettes, (13) tanged point, (14-15) dihedral burin, (16) borer, (17) end scraper on blade, (18) burin on truncation, (19) exhausted bidirectional core, (20) Raysse burin, (21) unidirectional bladelet-core. (18) After Scheer 1989, drawings (1-17) and (19-21) by L. Moreau.*

assemblages from these sites all contain a high percentage of artifacts made on local Jurassic chert. The next most abundant raw material is fine-grained radiolarite from the gravels of drainages flowing out of the Alps (Burkert 1996, 2001; Conard et al. 2000; Floss and Kieselbach this volume). Other raw materials including *Bohnerzhornstein*, tertiary chert from the Randecker Maar, Wittlingen chert, and *Blutjaspis* are less common.

Compared with the Aurignacian, the Gravettian assemblages are richer in high quality radiolarite. This shift in the use of raw material can be interpreted as reflecting the requirement of the production of regular blades and bladelets in the Gravettian. Additionally, Hahn and Kind (1997) have suggested that periods of erosion following the Denekamp Interstadial may have made this desirable raw material more accessible.

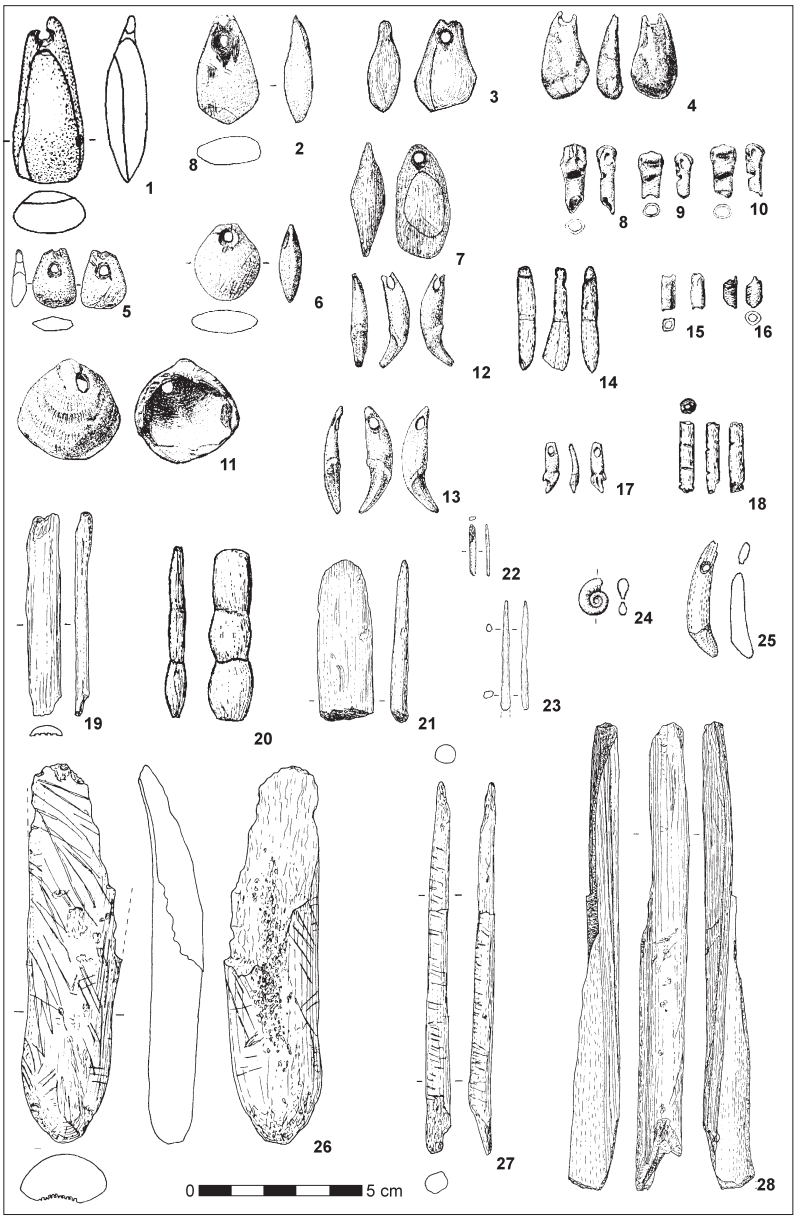

Fig. 9: Geißenklösterle. Organic artifact assemblage, AH I. (1-3, 5-7) drop-shaped ivory pendants, (4) perforated upper eyetooth, (8-10) deeply incised longbone fragments, (11) Glycymeris *sp., (12-13) perforated fox canines, (14) notched incisor of an ibex, (15-16, 18) tubular bone artifacts, (17) perforated incisor of a juvenile fox, (19) fragmented projectile point, (20) notched ivory rod for the serial production of ivory pendants, (21) burnisher, (22-23) needle-like tool fragments of bone, (24) ammonite, (25) perforated cave bear canine, (26) basis of a bone point with incisions, (27) bone point with incisions, (28) bone demonstrating the use of groove and splinter technique. After Hahn 1980 (14, 18), Hahn et al. 1985 (2, 7), Scheer 1985 (1, 20), 1989 (5, 19, 25-27), Hahn et al. 1985 (28), Conard 2003b (3, 4, 6, 8-13, 15-17, 24), Conard and Bolus 2003 (21-23, 28).*

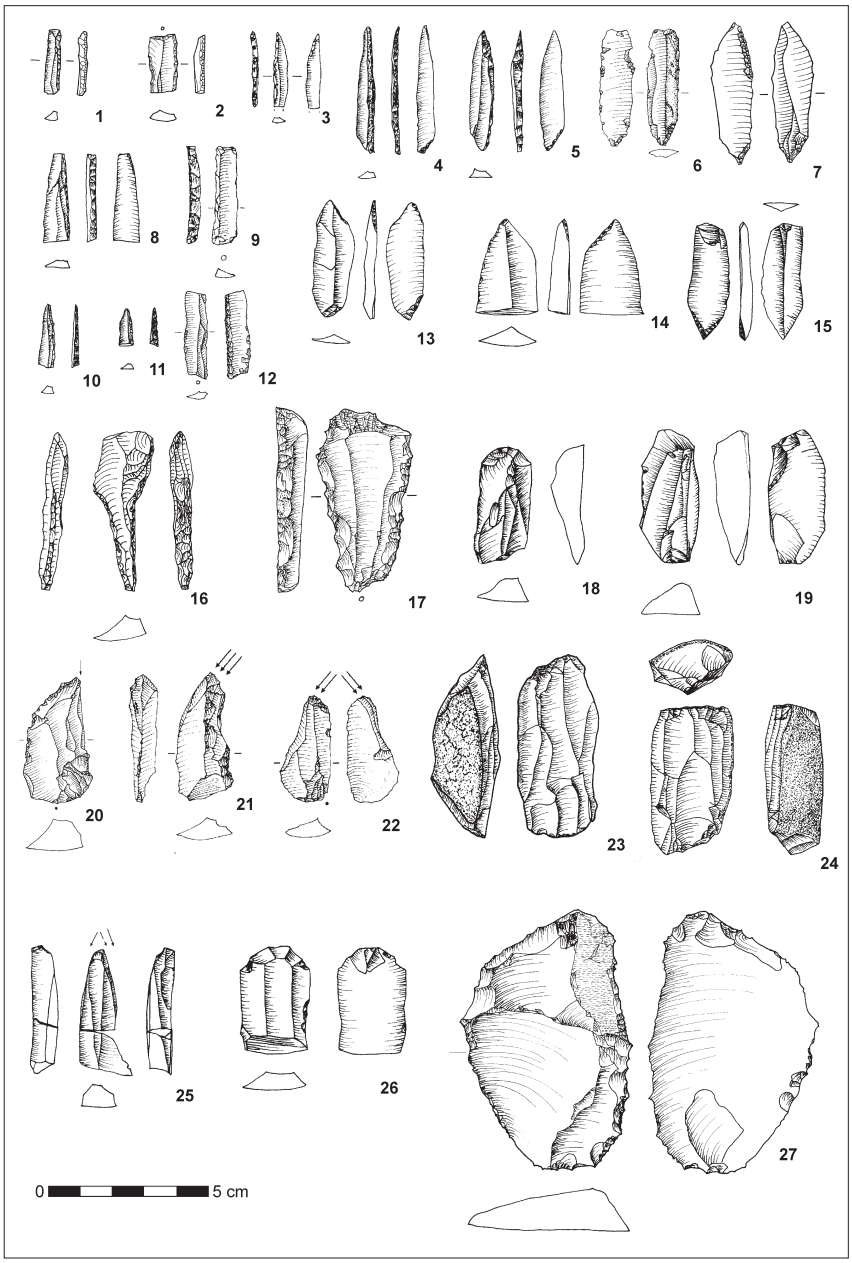

Fig. 10: *Hohle Fels. Lithic assemblage, AH IIb, IIc, IIcf, IId, IIe. AH IIb: (3) microgravette point, (9, 12) backed bladelets; AH IIc: (6-7) fléchettes, (20) burin on truncation; AH IIcf: (4, 5, 8) microgravette points, (10-11, 13-15) fléchettes, (16) Font-Robert point, broken; (18) end scraper; (19) splintered piece, (23-24) exhausted bidirectional cores, (25) dihedral burin, (26) end scraper, (27) side scraper; AH IId: (1) backed bladelet, (2) truncated backed bladelet, (17) nosed end scraper, (21) carinated burin; AH IIe: (22) busked burin. After Conard et al. 2000 (6, 12, 20), Conard et al. 2001 (4-5, 10, 17, 23), Conard and Uerpmann 1999 (3, 9, 16). Drawings (1-2, 7-8, 11, 13-15, 18-19, 21-22, 24-27) by S. Feine and P. Kieselbach.*

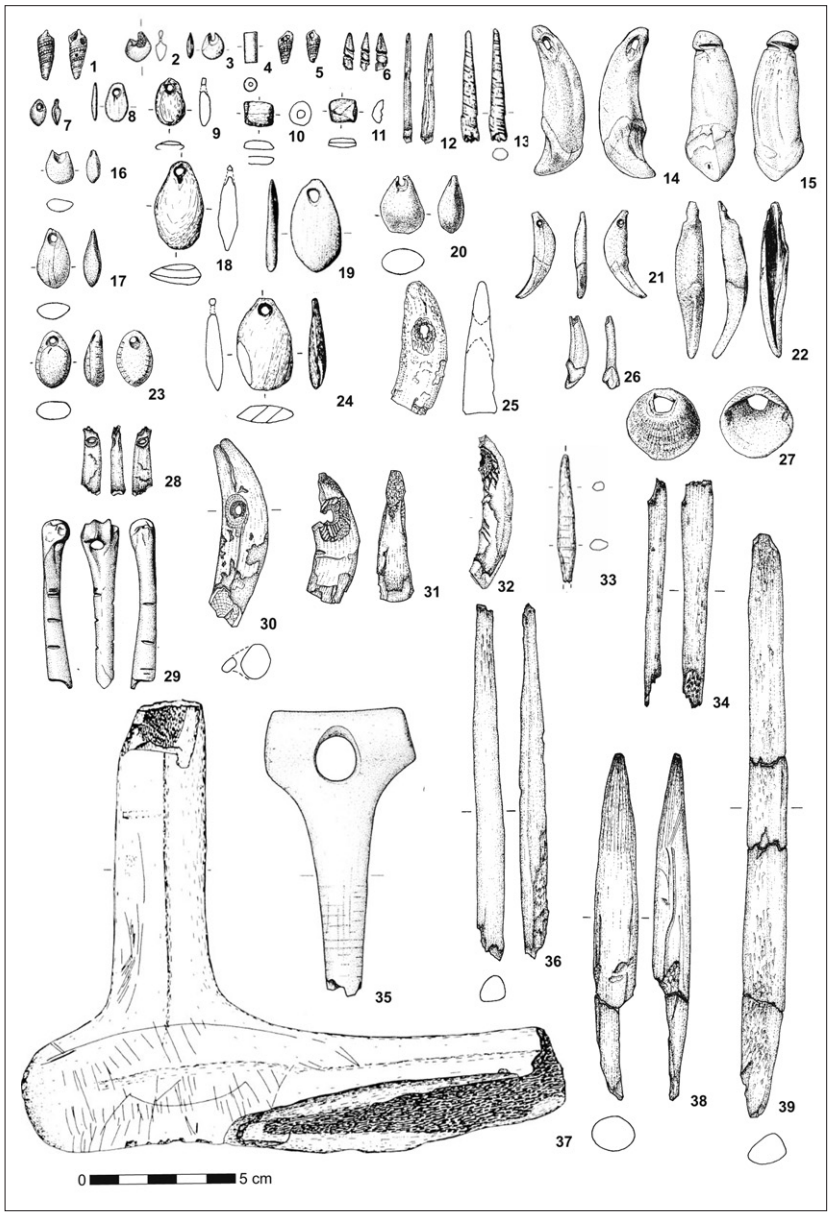

Fig. 11: *Hohle Fels. Organic artifact assemblage, AH IIb, IIc, IIcf, IId. AH IIb: (5) perforated snail, (2, 17) drop-shaped ivory pendant, (4) Dentalium sp., (35)* Lochstab*, (34, 39) projectile points on mammoth ribs; AH IIc: (27) Glycymeris sp. perforated, (9, 16, 18, 19-20, 23-24) drop-shaped pendants, (14) perforated cave bear incisor, (15) notched cave bear incisor, (29) notched hare humerus, (5) perforated snail, (13) worked bone point, (33) ivory point, (36) projectile point on mammoth rib, (37) decorated antler adze; AH IIcf: (7-8) drop-shaped ivory pendants, (22) perforated wolf canine, (26) perforated baby bear incisor, (12) bone point; AH IId: (6) worked ivory piece, (25, 30-32) horse incisors, (38) ivory projectile point, (28) perforated tooth. After Scheer 1994 (37), Conard and Uerpmann 1999 (3, 8, 13, 15, 19, 20, 29, 35), Conard 2003b (1, 4, 5, 9, 16, 17-24, 27). Drawings (2, 6-7, 12, 10-12, 14, 25, 26, 28, 30-34, 36, 38, 39) by S. Feine.*

Given the strong correlation between the use of radiolarite for new artifact forms including standardized Gravette and micrograveTte points and backed bladelets, we favour the technological arguments for the increased amount of radiolarite in the Gravettian relative to the Aurignacian.

Many of the new Gravettian lithic tools were used as projectiles. Gravette, micrograveTte points, *fléchettes* and occasional Font-Robert points are present in these assemblages. Some of them show evidence of impact fractures on their tips, confirming their use within a new system of projectile technology. New forms of organic points also appear in the Swabian Gravettian (Barth this volume).

In addition to these new forms of projectile technology, backed bladelets, burins, end scrapers, splintered pieces, and combination tools are common in the Gravettian assemblages of the Ach Valley. Typically burins are more numerous than end scrapers, and in some assemblages, including those at Geißenklösterle and Brillenhöhle, splintered pieces and borers are well represented. The latter forms seem to be in part associated with the production of ivory pendants at these caves. At Geißenklösterle flat burins with facetted platforms (Raysse burins) are present. This form has been viewed as characteristic for later Gravettian assemblages and is unusual within early Gravettian assemblages (Klaric et al, 2002)

The key Gravettian sites from the Ach Valley have also provided a wealth of organic artifacts. There are notable differences between the organic artworks of the Aurignacian and the Gravettian. While ivory figurines are well known in the Swabian Aurignacian, they are lacking in the Gravettian. Initially, the stratigraphic association of the horse head carved from mammoth ivory from the transition between AH IId and AH IIe was unclear (Conard et al. 2001; Conard and Floss 2001). Subsequently Bettina Hiller succeeded in refitting a fragment of the animal's cheek originating from AH IIIa to the main piece (Hiller 2002; Conard 2003c). Two radiocarbon dates from the base of AH IId near the main piece of the figurine date to about 29.5 and 30 ka, and dates from AH IIIa typically produced results around 31ka. These dates suggest that this figurine, like the lower lying waterfowl and *Löwenmensch*, and the ivory figurines from Vogelherd, Hohlenstein-Stadel and Geißenklösterle belong to an Aurignacian context. The most important organic artwork from the Swabian Gravettian is an engraved animal representation on an antler tool (Fig. 11,37) that was originally published by Scheer (1994). Unlike the situation in the Aurignacian, where three flutes have been recovered from Geißenklösterle, no definite musical instruments have been found in Gravettian contexts in the Swabian Jura. Finally, while a small number of examples of painted rocks are known from the Aurignacian and Magdalenian, the region has yet to produce convincing examples from Gravettian contexts (Floss and Conard 2001)

The caves of the Swabian Jura have, however, produced a wealth of personal ornaments, and these finds have been studied and published in some details by Riek (1973), Hahn (1992), Scheer (1985, 1995), and Conard (2003b). The most abundant and characteristic forms of ornament are the teardrop shaped pendants of mammoth ivory. Several dozen of these finds have been recovered from the caves of Brillenhöhle, Geißenklösterle, and Hohle Fels. At all three sites, diverse examples of these artifacts have been recovered in all stages of production and use. But, whereas there are only a few notched rods found at Hohle Fels (IIc) and Brillenhöhle (VII), Hiller (2003, 17) notes that the production of

ivory pendants played an important role in the Gravettian of the Geißenklösterle. Other ornaments include perforated horse canines from the transitional deposits between the main Aurignacian and Gravettian deposits at Hohle Fels and perforated canines of carnivores and small bone tubes. Notched and incised bone artifacts are common.

Work by Riek (1973), Münzel (2001) and Barth (this volume) have documented diverse bone and antler artifacts. These artifacts include several antler *Lochstäbe* and numerous bone points and awls. Examples of these artifacts are illustrated in Figures 6, 9 and 11.

Finally, recent research at Hohle Fels has led to the discovery of a siltstone phallus which has also served as a hammerstone from AH IIcf (Conard and Malina 2005). This unique find documents a shift from the predominance of animal imagery in the Aurignacian to the presence of sexual imagery in the Gravettian. Unlike other regions, where female representations are common in the Gravettian, no convincing examples of Venus figurines have been documented in the region.

The Swabian Gravettian in a European Context

Following this summary of research in Swabia we now comment briefly on the position of the Swabian Gravettian in a broader European context. Given the early dates for the Swabian Gravettian, we discuss some of the evidence for the presence of early Gravettian assemblages elsewhere in Europe.

In recent years, several new radiocarbon dates have been published, that place the beginnings of the French Gravettian between 27 and 28ka BP. The open air site of Le Sire (Mirefleurs, Dpt. Puy-de-Dôme), with only one cultural facies subdivided into three horizons (3A, 3B, 3C), was attributed to the early Gravettian, based on one uncalibrated date of 27,300 +/-330 BP (OxA-10820) (Surmely et al. 2003). A date of 29,350 +/-310 BP (Beta-145820) should be considered with caution, since it came from the upper layer 3A which was probably disturbed. The assemblage was attributed to an early Gravettian on the grounds of the important proportion of microgravette points (36% of the tools), the presence of one Font-Robert point and the radiocarbon dates (Surmely et al. 2003, 35).

Another potential early Gravettian site, the open air locality of La Vigne Brun (Villerest, Dpt. Loire), shows similarities with Le Sire, based on the importance of the microgravette points, the presence of Font-Robert points and the dominance of horse in the faunal assemblage (Surmely et al. 2003, 36). The presence of *fléchettes* at La Vigne Brun shows similarities with basal layer 5 of Abri Pataud and with the Swabian sites mentioned above. The dates from La Vigne Brun fall mostly around 23,000 BP. Digan (2003, 806) questions the validity of the dates and points to the need for new AMS measurements for the site.

Abri Pataud near Les Eyzies-de-Tayac, Dordogne, is, together with La Ferrassie and Laugerie-Haute, a key reference-site for the French Upper Palaeolithic chronostratigraphy. Sixteen radiocarbon dates have been published from the lowermost Gravettian deposits at Abri Pataud layer 5. These dates fall between 21,780 +/-215 BP (GRN-4631) and 28,400 +/-1100 BP (OxA–169) (Bricker 1995, 29). Bricker (1995, 165) notes that the high proportion of *fléchettes* from basal layer 5 on the site's terrace is comparable to the "bayacian" level of La Gravette and attributes the assemblage from this part of the site to

the beginning of the middle Perigordian. A doctoral thesis on the technology of the lithic assemblage of layer 5 is in preparation (Leoz 2001).

West of the Rhine, another important early Gravettian site is the open-air locality of Maisières-Canal in the Hainaut Province of Belgium. Here J. de Heinzelin excavated a Gravettian assemblage, at the so-called "Champ de Fouilles" locality, which was dated to 27,965 +/-260 BP (GrN-5523) using humiferous samples from the archaeological horizon (de Heinzelin 1973). Haesaerts and de Heinzelin (1979) attributed the Gravettian occupation to a warmer episode following the Denekamp Interstadial, which they designated as "oscillation de Maisières". More recently, two bones from the archaeological level itself were AMS radiocarbon dated to 28,240 +/-300 BP (GrN-23292) and 28,130 +1020/-900 BP (GrA-9273) confirming the earlier date (Haesarts and Damblon 2004). The assemblage was described as northern Upper Perigordian or Maisiérien and is characterized by the high proportion of dihedral burins, the frequent use of the flat retouch (*retouche plate)*, and the presence of stemmed tools (de Heinzelin 1973; Otte 1976). Both the flat retouch and the stemmed points are rare in the Swabian Gravettian. Due to the well-documented stratigraphic position of the early Gravettian deposit, the site can serve as a useful reference for studying assemblage variability. The finds from Maisières-Canal suggest that we need to be cautious and avoid uncritical acceptance of assumptions that cultural stratigraphic signatures will provide meaningful chronological markers between regions.

In Germany, most of the Gravettian sites including Sprendlingen, Mainz-Linsenberg, Wiesbaden-Adlerquelle and others (Bosinski 1979; Bosinski et al. 1985, 1995; Hahn 1969, 1976, 1982, 1987; Floss 1991, 1994; Cziesla 1984) appear on chronostratigraphic and techno-typological grounds to postdate the main occupation phases documented in the caves of the Swabian Jura (Bosinski 2000; Street and Terberger 2000). Brunnacker and Hahn (1978, 47) attributed the rarity of the Aurignacian and Gravettian occupation layers in the Rhineland loess to the intensive geological reworking that took place before and after the Last Glacial Maximum. While the population decline they postulated for

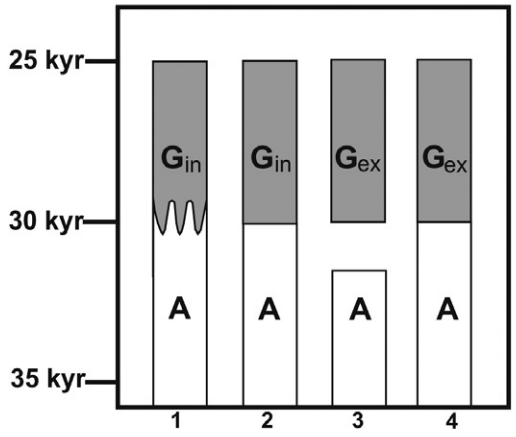

Fig. 12: *Schematic representation of four hypothetical scenarios for the appearance of the Gravettian in Swabia. 1 gradual endogenous evolution; 2 rapid endogenous evolution; 3 reoccupation after a period of depopulation; 4 exogenous appearance and rapid spread of technologies with or without migration. After Conard et al. 2004, fig. 2.*

the period of the maximum extension of the ice sheets remains probable, the discovery of Wiesbaden-Igstadt and a re-examination of the radiocarbon dates for central Europe led Terberger and Street to argue that small populations occasionally occupied the region during the millennia around the LGM (Terberger 2001; Street and Terberger 1999).

Nearer to Swabia, the site of Steinacker near the village of Müllheim in the Black Forest is the only Gravettian open-air site in Baden-Württemberg. Holdermann´s (1996) study of this unique site documents the presence of Font-Robert points, which are characteristic for the early Gravettian, the Perigordian Va in Peyrony's cultural chronology. The site has produced an AMS radiocarbon age of 16,860 +/-180 BP (OxA–5240) on the root of a horse-tooth; this date, however, is problematic due to the low collagen content of the sample (Holdermann 1996, 88). The presence of two backed bladelets of *Blutjaspis* and *Bohnerzhornstein* from Geißenklösterle (see also Floss and Kieselbach this volume) demonstrates a connection between the Swabian sites and the Freiburg Basin. In this sense, Steinacker lies in the territory of hunter-gatherer groups that occupied the Swabian caves in the winter and early spring months (Münzel 2004) and possibly moved in spring or early summer to the Southwest where high quality Jaspis raw material was readily available.

East of the Swabian Jura, the Pavlovian cultural group, centered in the area of Moravia and Lower Austria, provides another important point of comparison. Building on the work of Klima (1959, 1961), Valoch (1961), Otte (1981, 1991), Kozłowski (1986), and Kozłowski and Sobczyk (1987), J. Svoboda and colleagues (1996) place the Pavlovian within an early facies of the central European Gravettian in contrast with the later Willendorfian-Kostienkian stage with shouldered points of the Kostienki type. Here the key localities of Pavlov I and Dolní Věstonice I (DV I) have provided impressive assemblages of lithic and organic artifacts, artworks and diverse features and burials. Unlike the complete chronological sequences of well stratified sites like Willendorf II and Molodova V, the large Moravian sites appear to represent a cultural horizon that devloped during a longer period with little loess deposition (Svoboda et al. 1996, 135). The earliest phase of occupation dates to ca. 27-29ka (DV I and DV II), although no closed assemblages are associated with these early dates, and the richest occupation horizons typically date between 25 and 27ka (Svoboda et al. 1996, 134, 136; Jöris and Weninger 2004).

The stratigraphic position of the central European Gravettian is generally assessed using the important loess profile of the site of Willendorf II (Layers 5-9) in the Wachau of Lower Austria. At Willendorf II the lower Gravettian layer 5 corresponds to the Schwallenbach III Interstadial, called the Stillfried B soil. AMS radiocarbon dates on charcoal produced an uncalibrated age of 30,500 BP (Haesaerts et al. 1996). The assemblage of layer 5 has a well-developed Gravettian techno-typological character, with microgravette points, *éléments bipointes*, backed bladelets, *fléchettes* and a few geometric microliths, but also some Aurignacian forms including carinated and nosed end scrapers (Felgenhauer 1956-1959, fig. 29, 30). The assemblage of layer 5 has been attributed to an Early Pavlovian (Svoboda et al. 1996, 141). The dates for layer 5 fall in the vicinity of the earliest dates for the Swabian Gravettian and suggest that the region contains Gravettian occupations prior to the main phase of the Pavlovian of Moravia. As is the case at Hohle Fels, the earliest Gravettian at Willendorf II (layer 5) also contains artifacts that are usually associated with the Aurignacian. It remains to be demonstrated, which model for the development of the Gravettian (Fig. 3 and 12) provides the best explanation for the beginnings of this cultural group (Klima 1959; Conard et al. 2004; Kozłowski 2005).

Turning to the Gravettian from Bavaria, Klima (1968) stated that the assemblage from the Weinberghöhlen near Mauern (Bavaria), in a tributary valley of the Danube, is related to the Pavlovian. He based this interpretation on the stratigraphic position of the assemblage directly above a loamy horizon identified as the BK I-soil (Stillfried-B soil), as is the case for the Moravian sites, as well as on the abundance of tools made from mammoth bone, and the teardrop-shaped ivory pendants. Klima also stressed the presence of characteristic Pavlovian lithic tool types including microgravette points and splintered pieces in the Weinberghöhlen assemblage. Weinberghöhlen upper layer C (Bohmers 1951; Zotz 1955), which corresponds to Zone 1 as defined by von Koenigswald and colleagues (1974), provided conventional radiocarbon dates of 29,410 +/-470 BP (GrN-5000) and 28,265 +/-325 BP (GrN-6059). These dates fall within the range of the Swabian Gravettian and suggest a degree of chronological contemporaneity. Scheer (1985) has argued for cultural connections between the Weinberghöhlen and the Swabian sites on the basis of similar kinds of personal ornaments, in particular the presence of numerous teardrop-shaped ivory pendants. Kozłowski (1991), in contrast, compared the tool distributions of several German Gravettian sites from the Rhineland, Swabia and Bavaria and came to the conclusion that the regions show dissimilar signatures.

In our view, we first need to consider local cultural dynamics and assemblage variability before we can determine the extent to which the Swabian Gravettian fits within patterns documented in other regions. Clearly the Swabian Gravettian has a very early component that precedes many other early Gravettian assemblages. This leads to the problem that, even assuming that the cultural stratigraphic scheme from southwestern France is valid in that region, it is not applicable in the Swabian Jura, where, as discussed above, the stratigraphically relevant forms do not conform to chronological expectations derived from western Europe. Thus we must, for the moment, reject the notion of a pan-European cultural stratigraphic sequence for the Gravettian, and instead focus on establishing better regional sequences. The immediate problems in this area relate to testing explanations for the apparent radiocarbon inversions, as seen in AH IIcf at Hohle Fels. At the same time we need to gain a better understanding of how assemblages reflect short and long-term settlement dynamics and the functional requirements of residents of the Ach Valley.

Unanswered Questions and Goals for the Coming Years

In recent decades the Swabian Gravettian has not received as much attention as the region's well-known Aurignacian assemblages. The emphasis has been more on excavation, chronostratigraphy (Conard and Bolus 2003), specific geoarchaeological topics (Schiegl et al. 2003; Goldberg et al. 2003), and reporting on the highlights of the ongoing fieldwork in the annual reports in *Archäologische Ausgrabungen in Baden-Württemberg*. The work that has been done has been characterized by a combination of typological, technological and functional approaches. Recent work has also addressed issues related to raw material procurement and reduction sequence, which can be linked to study the territoriality of the groups (Scheer 1993; Burkert 1996, 2001; Floss and Kieselbach this volume). Hahn and Owen (1985) assessed some technological aspects of the Aurignacian and Gravettian lithic assemblages from Geißenklösterle, but more work is needed in these areas. Studies of core reduction, the manufacture and use of blanks have yet to be published in detail. Through the analysis of artifacts within a reduction sequence, additional information on social and economic organisation can be obtained. The sequences of

production consist of raw material procurement, stone knapping and the use and discard of tools that enable us to reconstruct the technological behaviour of a given period. The new study of the assemblages from the caves of Geißenklösterle, Brillenhöhle and Sirgenstein in the context of a doctoral thesis (Moreau in prep.) and ongoing research at Hohle Fels aims at an integrated analysis of typo-technological and socio-economic organisation. Geißenklösterle and Hohle Fels are especially appropriated for this kind of study, since they were excavated with modern standards including systematic waterscreening and three dimensional recording of the finds (Hahn 1988; Conard 2002b).

One of the current topics of research is the analysis of evidence for cultural contacts between Swabian and other regional Gravettian populations. Work on the lithic assemblages will be complimented by Martina Barth's research on organic artifacts from the Swabian Gravettian (Barth in preparation). As the refittings between the caves of Geißenklösterle and Brillenhöhle led to the interpretation of a more or less contemporaneous character of occupation (Scheer and Lauxmann 1986), the technological similarities between the two sites (Moreau in prep.) confirm the close links between the Gravettian sites in the Ach Valley. Once the comparisons of these technological features are better documented, we should be able to gain a better understanding of the cultural connection between regions situated in and beyond the Danube Corridor. As work on the faunal assemblages progresses, we anticipate better data on subsistence and seasonality, which we hope to integrate with studies of past environments and Gravettian settlement dynamics to provide improved models of the behavioural adaptations that characterized life in the Swabian Jura between the beginnings of the Gravettian about 30,000 years ago and the Last Glacial Maximum. The quality of data from the sites in the Ach Valley provide every reason to believe that our knowledge of the Swabian Gravettian will soon rival that of the Aurignacian and Magdalenian, that have traditionally been the focus of research.

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Lab. Number	Site	Date	AH	Material	Modification	Cultural gr.	First publication
OxA-5157	Geißenklösterle	24360 +/- 380	Ip	hare pelvis		Gravettian	Housley et al. 1997
OxA-4855	Geißenklösterle	27000 +/- 550	Ir	reindeer phalange		Gravettian	Housley et al. 1997
OxA-5159	Geißenklösterle	26300 +/- 500	Ir	lynx mandibule		Gravettian	
OxA-4856	Geißenklösterle	30950 +/- 800	Ir	horse radius		Gravettian	Housley et al. 1997
OxA-4857	Geißenklösterle	27500 +/- 550	Ir	horse rib	cutmark	Gravettian	Housley et al. 1997
G126 (161020)	Geißenklösterle	27870 +/- 190	Ir	cave bear, 2.incis inf.		Gravettian	
G039 (161018)	Geißenklösterle	27340 +/- 180	Ir	cave bear, 2.incis inf.		Gravettian	
G121 (161019)	Geißenklösterle	27240 +/- 200	Ir	cave bear, 3.incis sup.		Gravettian	
G123 (143243)	Geißenklösterle	26740 +/- 120	Ir	cave bear, 3.incis sup.		Gravettian	
G124 (143244)	Geißenklösterle	26530 +/- 120	Is	cave bear, 3.incis sup.		Gravettian	
OxA-5227	Geißenklösterle	28050 +/- 550	Is	horse femur		Gravettian	Housley et al. 1997
OxA-5226	Geißenklösterle	26540 +/- 460	It	reindeer tibia	impact	Gravettian	Housley et al. 1997
OxA-5229	Geißenklösterle	27950 +/- 550	It	mammoth rib	cutmarks	Gravettian	Housley et al. 1997
OxA-5228	Geißenklösterle	28500 +/- 550	It	mammoth rib		Gravettian	Housley et al. 1997
OxA-4592	Geißenklösterle	29200 +/- 460	It	reindeer phalange		Gravettian	Hahn 1995
OxA-4593	Geißenklösterle	29200 +/- 500	It	bone		Gravettian	Hahn 1995
OxA-5706	Geißenklösterle	29220 +/- 500	Ia	red deer antler		Gravettian	Richter et al. 2000
OxA-5161	Geißenklösterle	30300 +/- 750	Ic	reindeer metacarpal	impact	Gravettian	Housley et al. 1997

Table 1: *AMS Radiocarbon dates for the Geißenklösterle Gravettian*

Lab. Number	Site	Date	AH	Material	Modification	Cultural group	First publication
KIA 13079	Sirgenstein	27250 +180/-170	II	bone	point	Gravettian	Conard and Bolus 2003
KIA 13080	Sirgenstein	30210 +/-220	III	bone	burnisher	Aurignacian/ Gravettian	Conard and Bolus 2003

Table 2: *AMS Radiocarbon dates for the Sirgenstein Gravettian.*

Lab. Number	Site	Date	AH	Material	Modification	Cultural group	First publication
H911 (161023)	Hohle Fels	28170 +/-220	IIb	cave bear tooth		Gravettian	
OxA-4598	Hohle Fels	26000 +/-360	IIc	bear femur		Gravettian	
OxA-4599	Hohle Fels	28920 +/-440	IIc	reindeer antler	tool (decor. adze)	Gravettian	Hahn 1995
OxA-5007	Hohle Fels	29550 +/-650	IIc	reindeer antler	tool (decor. adze)	Gravettian	Housley et al. 1997
H141 (156093)	Hohle Fels	28170 +/-180	IIc	cave bear tooth		Gravettian	
H856 (161022)	Hohle Fels	27840 +/-190	IIc	cave bear tooth		Gravettian	
KIA 3503	Hohle Fels	27030 + 250/-240	IIcf	horse rib		Gravettian	Conard 2003c
KIA 17742	Hohle Fels	27690 +/-140	IIcf	horse tibia	cutmark + impact	Gravettian	Conard 2003c
KIA 17744	Hohle Fels	27780 +/-150	IIcf	mammoth/rhino rib	point	Gravettian	Conard 2003c
KIA 17743	Hohle Fels	27830 +/-150	IIcf	bear vertebra with embedded chert point		Gravettian	Conard 2003c
KIA 17741	Hohle Fels	27970 +/-140	IIcf	reindeer antler	worked	Gravettian	Conard 2003c
H145 (156094)	Hohle Fels	28060 +/-170	IId	cave bear tooth		Aurignacian/ Gravettian	
KIA 8965	Hohle Fels	30010 +/-220	IId (base)	reindeer antler		Aurignacian/ Gravettian	Conard and Bolus 2003
KIA 8964	Hohle Fels	29560 +240/-230	IId (base)	rhino-mammoth rib		Aurignacian/ Gravettian	Conard and Bolus 2003
KIA 16040	Hohle Fels	30640 +/-190	IIe	horse pelvis	cutmark + impact	Aurignacian/ Gravettian	

Table 3: *AMS Radiocarbon dates for the Hohle Fels Gravettian.*

Lab. Number	Site	Date	AH	Material	Modification	Cultural group	First publication
KIA 8957	Vogelherd	26160 +/-150	IV	long bone fragment	cutmarks	?	Conard and Bolus 2003
KIA 19542	Vogelherd	29620 +/-210	?	brown bear canine	incised	?	Conard et al. 2003
KIA 8957	Vogelherd	22980 +/-160	IV	burned bone, long bone fragment?	cutmark	?	
OxA-10198	Vogelherd	26110 +/-310	III	giant deer tooth dentin (root)		?	Conard et al. 2003
OxA-10196	Vogelherd	25780 +/-250	III	mammoth tooth dentin (root)		?	Conard et al. 2003
GrN-6662	Vogelherd	27630 +/-830	IV/V	charred bone		?	Hahn 1977

Table 4: *AMS Radiocarbon dates of Gravettian age from Vogelherd.*

Lab. Number	Site	Date	AH	Material	Modification	Cultural group	First publication
B-492	Brillenhöhle	>25000	VII	charred bone		Gravettian	Riek 1973
KIA 19553	Brillenhöhle	25870 +/-230	VII	mammoth/rhino rib	point	Gravettian	
KIA 19549	Brillenhöhle	27030 +/-180	VII	mammoth/rhino rib		Gravettian	

Table 5: *AMS Radiocarbon dates for the Brillenhöhle Gravettian.*

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