

The Swabian Aurignacian and its place in European Prehistory

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ABSTRACT Research on Swabian Paleolithic has a 140 year history. The sites from the region, and particularly the caves of the Lone and Ach valleys, preserve rich Aurignacian deposits. Recent excavations at Geißenklösterle and Hohle Fels in the Ach Valley provide large assemblages with high quality documentation. The fieldwork and dating programs at these sites have done much to clarify the place of the Swabian Aurignacian within the early Upper Paleolithic of Europe. In keeping with the goals of the Lisbon meeting, this paper presents the Aurignacian assemblages from the region. The early dates from Swabia and the many innovations that characterize the Aurignacian of the region point to the Upper Danube Valley as a key center of cultural and technological innovation during the early Upper Paleolithic. The Danube Corridor hypothesis argues that modern humans migrated into

central Europe via the Danube Valley. This would help to explain the early dates for the Swabian Aurignacian. Excavations in the caves of Swabia have yet to provide any indications of contact between the makers of the Aurignacian and late Middle Paleolithic assemblages. Thus we argue, in keeping with the Population Vacuum Model, that modern humans arrived in a depopulated region during or immediately following an unfavorable climatic phase, most likely during the continental European equivalent of Heinrich Event 4 or the following interstadial 8, roughly 40 000 years ago. The Aurignacian represents a radical break in the cultural sequence of the region, and the *Kulturpumpe* hypothesis points to inter-taxa competition, climatic stress and largely internal social-cultural and demographic factors as probable causes of the local innovations of the Swabian Aurignacian.

Introduction and history of research

While systematic paleolithic research in the region began in the 1860s, the Aurignacian of the Swabian Jura was first documented by the excavations of Ludwig Bürger (Plate 1, no. 1) at Bocksteinhöhle (Bockstein Cave) in the Lone Valley in 1883/84 (Fig. 1). Here Bürger recovered and published a number of classic Aurignacian artifacts including lithic and organic tools, as well as ornaments (Fig. 16). The significance of this work and the importance of the Swabian Aurignacian became clear in the following century as more data became available.

A key phase of research was initiated by Robert Rudolf Schmidt (Plate 1, no. 2), whose fieldwork, especially the 1906 excavation at Sirgenstein in the Ach Valley (Fig. 8-10), elevated the

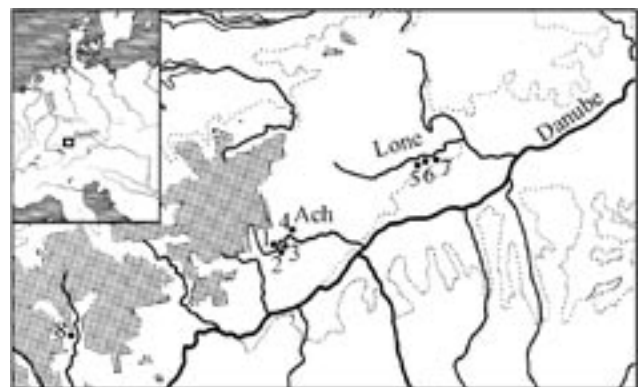


FIG. 1 – Map of southwestern Germany with the principal Aurignacian sites mentioned in the text. Ach Valley: 1. Sirgenstein; 2. Hohle Fels; 3. Geißenklösterle; 4. Brillenhöhle. Lone Valley: 5. Bocksteinhöhle and Bockstein-Törl; 6. Hohlenstein-Stadel and Hohlenstein-Bärenhöhle; 7. Vogelherd. Lauchert Valley: 8. Göpfelsteinhöhle.



PLATE 1 – Key researchers of the German Aurignacian. 1. Ludwig Bürger (01.04.1844-23.02.1898); 2. Robert Rudolf Schmidt (26.05.1882-14.03.1950) in 1921; 3. Eduard Peters (09.04.1869-22.05.1948) in 1910; 4. Gustav Riek (23.05.1900-01.11.1976) in front of Vogelherd in 1931; 5. Robert Wetzel (30.09.1898-03.04.1962) working in front of Hohlenstein-Bärenhöhle, ca. 1960; 6. Joachim Hahn (12.08.1942-27.04.1997) in the early 1990s.

standards of research. Schmidt, who later founded the Research Institute for Prehistory in Tübingen — the forerunner of the current Institute of Pre- and Protohistory and Medieval Archeology — was also the first to publish a detailed summary of the information available on the German Paleolithic in the form of his monograph *Die diluviale Vorzeit Deutschlands* from 1912. Schmidt’s work emphasized the connections between what would be later known as the Aurignacian and the Gravettian. He also demonstrated discontinuity between the Middle Paleolithic and the Aurignacian, which he referred to as the “*gravettoides Aurignac*”. He based this conclusion on the presence of an archeologically sterile deposit with arctic microfauna at the base of the Upper Paleolithic sequence at Sirgenstein (Schmidt, 1912, p. 30-31).

The 1930s saw a number of key excavations of Aurignacian deposits including most notably the work of Gustav Riek (Plate 1, no. 4) at Vogelherd Cave (Fig. 12-13), Robert Wetzel (Plate 1, no. 5) at Hohlenstein-Stadel (Fig. 14) in the Lone Valley, and excavations by Eduard Peters (Plate 1, no. 3) at Göpfelsteinhöhle (Göpfelstein Cave; Fig. 18) in the Lauchert Valley. All of these digs, and especially the results from Vogelherd, played a prominent role in establishing the Swabian caves and the Upper Danube region as a whole as an area of central

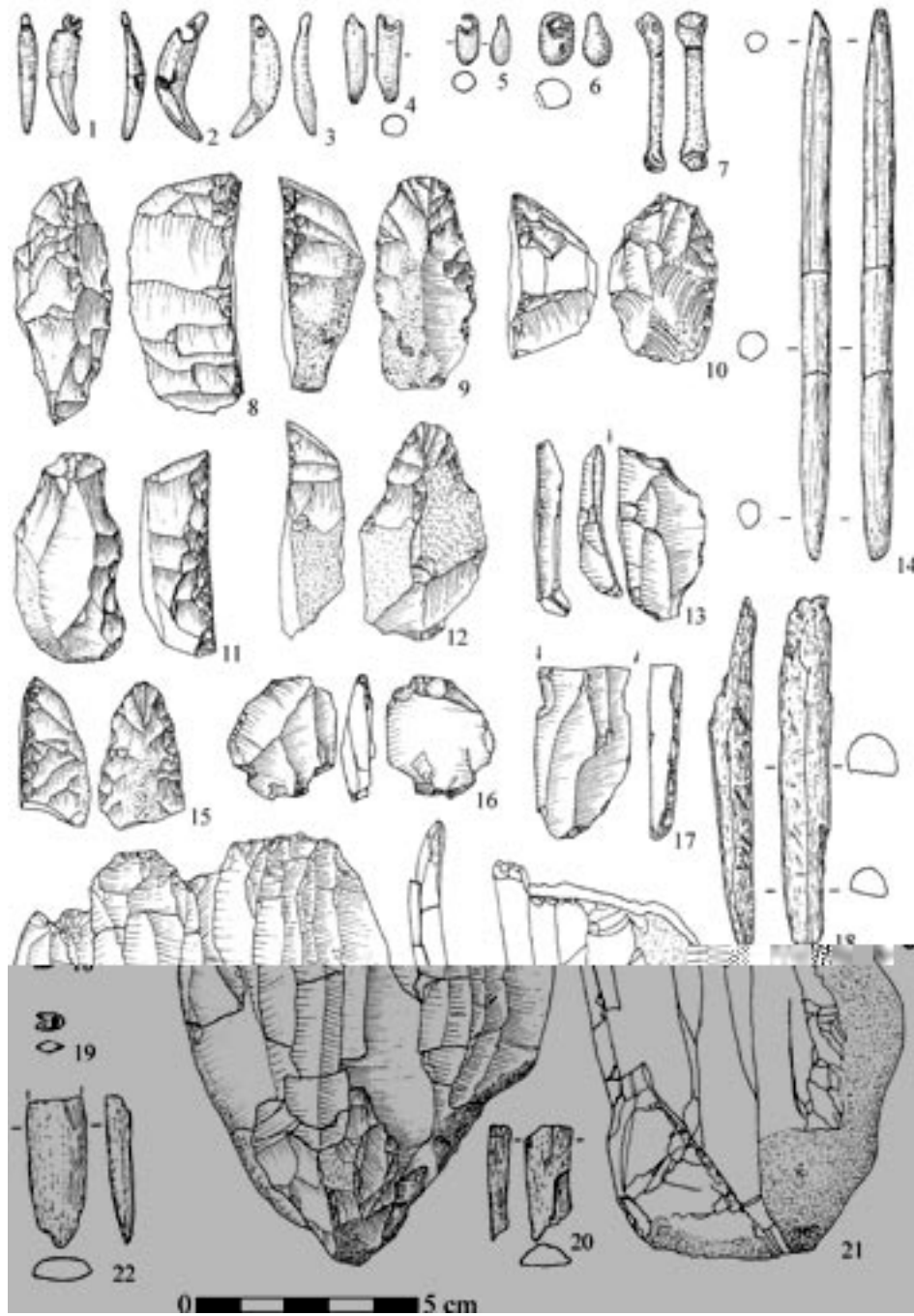


FIG. 2 – Aurignacian of Geißenklösterle, Archeological Horizon III: 1-3. perforated fox canines; 4-5. ivory pendants; 6. basket shaped ivory bead; 7. grooved bone; 8-10. carinated endscrapers; 11-12. nosed endscrapers; 13. burin on truncation; 14, 22. ivory points; 15. endscraper; 16. splintered piece; 17. burin on a break; 18. ivory rod (projectile point?)

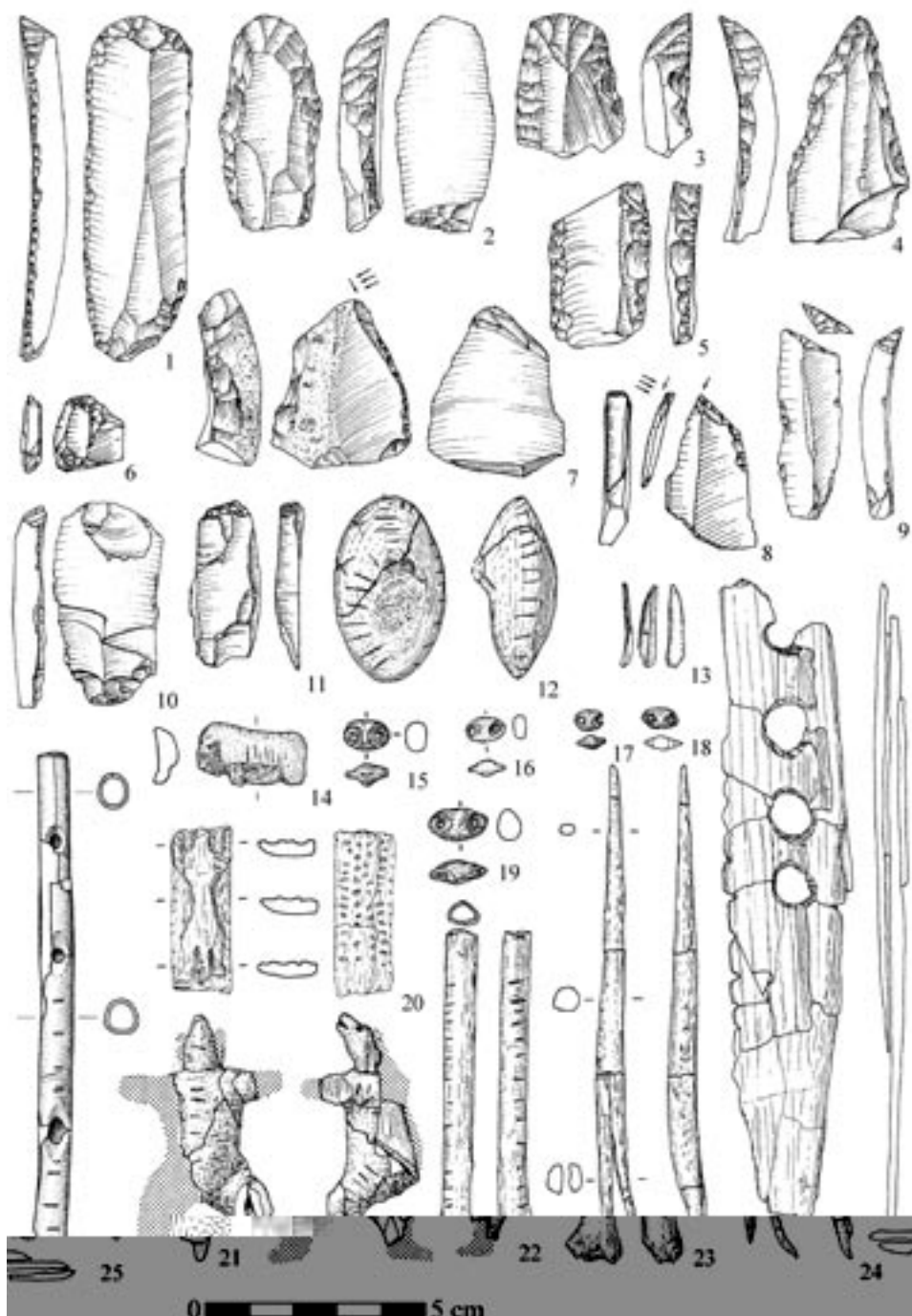


FIG. 3 – Aurignacian of Geißenklösterle, Archeological Horizon II: 1-3. endscrapers; 4. pointed blade (Spitzklinge); 5. laterally retouched blade; 6, 10-11. splintered pieces; 7. busked burin; 8. burin on truncation; 9. truncated blade; 12. antler pendant; 13. Dufour bladelet; 14, 20, 22. ivory figurines; 15-19. double perforated ivory beads; 21. bone flute; 23. decorated bone; 24. antler point with split base; 25. *bâton percé* made of ivory. After Hahn, 1986 (14, 20, 22) and Hahn, 1988 (1-13, 15-19, 23-25).

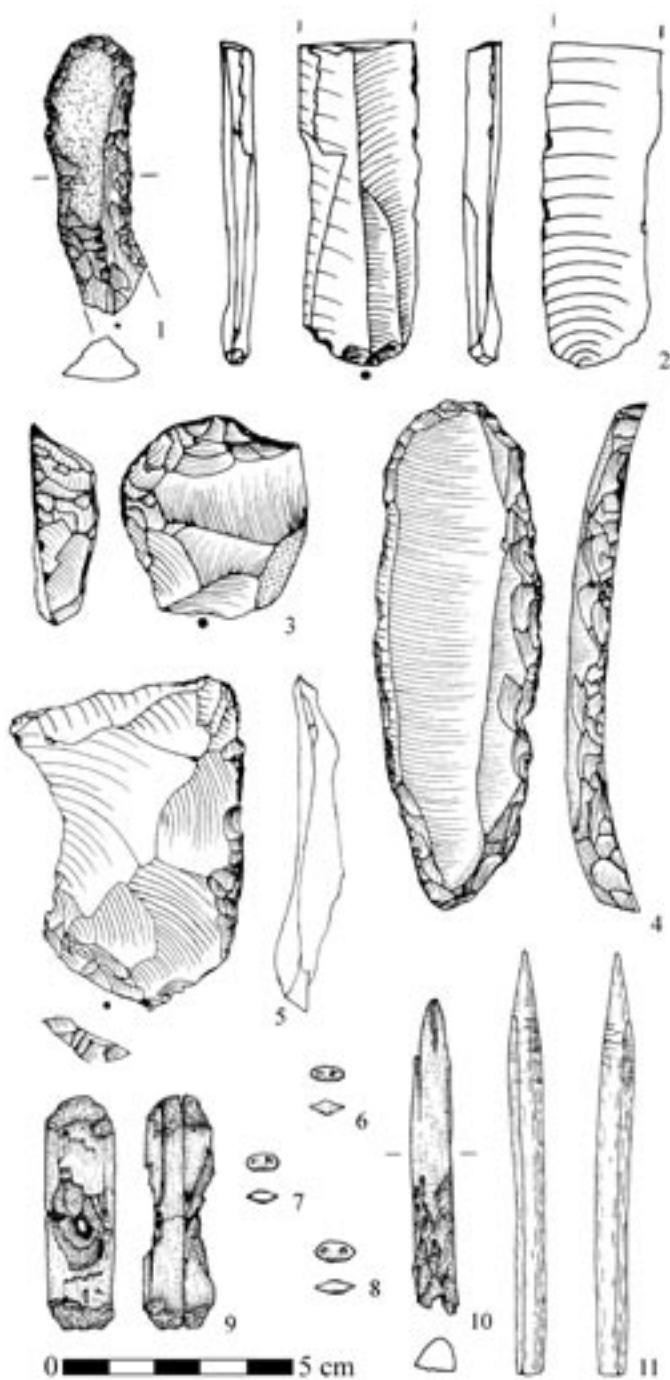


FIG. 4 – Aurignacian of Hohle Fels, Archeological Horizon V: 1. laterally retouched endscraper; 2. blade fragment; 3. nosed endscraper; 4. endscraper combined with pointed blade; 5. sidescraper; 6-8. double perforated ivory beads; 9. perforated ivory object; 10-11. ivory points. After Conard et al., 2002 (3-4) and Conard et al., 2003b (5, 11).

importance for the study of the Aurignacian. The discovery of multiple examples of figurative art in the form of small depictions in mammoth ivory added to the interest in the region.

Joachim Hahn (Plate 1, no. 6), like the earlier Tübingen researchers, Schmidt, Riek and Wetzel, focused his research on the Swabian Paleolithic. His work gained notability, when he and students from Tübingen discovered the famed statue of the *Löwenmensch* (lion-man; Fig. 14, no. 20), while taking an inventory of Wetzel's collections from Hohlenstein-Stadel in 1969 (Hahn, 1970; Schmid, 1989). Following upon earlier work by Eberhard Wagner in 1973, Hahn began long-term systematic excavations at the site of Geißenklösterle in the Ach Valley (Fig. 2-3) in 1974 (Hahn, 1988). The results from Geißenklösterle provided the first fine-grained data from the Swabian Aurignacian and helped set standards for modern excavations. To gain a second stratigraphic sequence documented with modern methods, Hahn began work at the nearby site of Hohle Fels, where Oscar Fraas and Gustav Riek had dug generations earlier. Hahn's work at these sites played a key role in establishing the importance of the Swabian caves within the cultural developments of the European Upper Paleolithic (Hahn, 1986, 1988).

Following Hahn's death in 1997, work on the Swabian Aurignacian has continued under Nicholas Conard's direction and in collaboration with Michael Bolus, Susanne Münzel, and many other colleagues and students (see acknowledgements). This work has focused on comparative studies and new excavations at Geißenklösterle and Hohle Fels (Fig. 4-7) that provide the key data for this overview of the region and its significance (Conard, 2002a; Conard and Bolus, 2003; Bolus, 2003). Recently, we have also begun re-excavation of the backdirt from Riek's excavation at Vogelherd in 1931 (Conard and Malina, in press).

Aurignacian assemblages

In keeping with the objectives of the meeting in Lisbon, the main goal of this paper is to provide an empirical description of the Aurignacian assemblages from Swabia. More detailed discussions of organic and lithic technology, the context of the finds, the chronostratigraphy, cultural affiliations, and interpretations of figurative art and musical instruments from the Swabian Aurignacian can be found in many recent publications (Liolios, 1999; Richter et al., 2000; Bolus and Conard, 2001; Münzel, 2001; Bolus, 2003, 2004; Conard and Bolus, 2003; Conard et al., 2003a, 2003c, 2004c; Teyssandier, 2003; Münzel and Conard, 2004; Niven, 2006; Conard, 2005a, 2005b).

Here we consider the stratified Aurignacian assemblages known from Swabia. It is noteworthy that all of the 17 assemblages presented here (Fig. 2-18; Table 1-2) come from the excavations at the caves mentioned in the introduction to this paper. This emphasis on caves should not be construed as meaning that the Aurignacian inhabitants of the region lived primarily in caves. The bias toward cave sites is clearly affected by the history of research, which has long focused on caves and the well preserved deposits they contain. Unfortunately, while we are convinced that the region contains many open-air sites, this conclusion is based to a high degree on speculation. This speculation, however, fits with several observations. First, Münzel's (1997) studies of seasonality based on faunal analyses clearly point to the use of caves in the colder times of the year. This result is not entirely surprising, since we would expect the caves to be used in seasons when the weather outside the caves was worse than the cool, dark and at times damp conditions within the caves. Another less developed source of information on this question is the apparent presence of open-air Aurignacian sites in the region, such as the unpublished site of Königsbach-Stein (Floss, personal communication 2004). It is probably

the geological setting in Swabia in which open-air sites are either deeply buried or eroded that provides the misleading impression that Aurignacian people lived primarily in caves.

TABLE 1
Synthesis of key lithic artifacts from the Swabian Aurignacian.

	GK III (Fig. 2)	GK II (Fig. 3)	HF V (Fig. 4)	HF IV (Fig. 5)	HF III (Fig. 6)	HF II d/e (Fig. 7)	SI VI (Fig. 8)	SI V (Fig. 9)	SI IV (Fig. 10)	BrH XIV (Fig. 11)	VG V (Fig. 12)	VG IV (Fig. 13)	HS (Fig. 14)	HB (Fig. 15)	BT VII (Fig. 17)	BoH (Fig. 16)	GÖ (Fig. 18)
cores																	
blade/ bladelet core	●	●		●	●	●			●		●	●	●		●		●
flake core	●	●		●	●	●	●		●		●	●	●		●		●
discoidal core	●					●			●		●	●					
carinated artifacts																	
carinated endscraper	●			●	●	●		●	●		●	●	●	●			●
nosed endscraper	●	●	●	●	●	●		●	●		●	●	●	●			●
carinated burin	●			●	●	●					●	●	●	●	●	●	●
busked burin		●		●	●	●			●		●		●		●	●	●
other tools																	
endscraper	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●
burin on truncation	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●
dihedral burin		●		●			●	●	●		●	●	●	●	●	●	●
burin on a break	●	●		●	●	●	●		●		●	●	●	●			
<i>Spitzklinge</i> (pointed blade)	●	●	●	●				●			●	●	●	●		●	
truncated blade	●	●		●	●	●	●	●	●		●	●	●		●		
borer/ zinken	●	●		●	●	●		●	●		●	●	●		●		●
Dufour bladelet		●															
splintered piece	●	●		●	●	●		●	●		●	●	●	●	●		
sidescraper			●		●		●	●	●		●	●	●	●	●		

GK: Geißenklösterle, HF: Hohle Fels; SI: Sirgenstein; BrH: Brillenhöhle; VG: Vogelherd; HS: Hohlenstein-Stadel; HB: Hohlenstein-Bärenhöhle; BT: Bockstein-Törle; BoH: Bocksteinhöhle; GÖ: Göpfelsteinhöhle. The Roman numerals refer to the Archeological Horizons or layers as mentioned in the figure captions. Bold symbols - abundant; secondary bold symbols - frequent; light symbols - rare. The data for Sirgenstein, Vogelherd, Hohlenstein-Stadel, Hohlenstein-Bärenhöhle, Bockstein-Törle, Bocksteinhöhle, and Göpfelsteinhöhle are based mainly on Hahn (1977), supplemented from own analyses; the data for Geißenklösterle are based on Hahn (1988) and own analyses, supplemented from Teyssandier (2003) and Teyssandier and Liolios (2003); all data for Hohle Fels are based on own analyses.

Constraints of space and time prohibit a detailed numerical approach to the assemblages. The ongoing research at Hohle Fels and Geißenklösterle, and the new excavations in the backdirt at Vogelherd, make it impossible at present to provide final counts of artifact classes or final statistical assessments of the assemblages. Since all of the sites fall within the same technological systems for working organic and lithic materials (Hahn, 1977, 1988; Lio-

lios, 1999; Bolus, 2003; Conard and Bolus 2003; Teyssandier, 2003), we will focus this presentation on a semi-quantitative approach to address the content and variation within the assemblages (see Tables 1-2).

TABLE 2
Synthesis of key organic artifacts, ornaments, and art from the Swabian Aurignacian.

	GK III (Fig. 2)	GK II (Fig. 3)	HF V (Fig. 4)	HF IV (Fig. 5)	HF III (Fig. 6)	HF II d/e (Fig. 7)	SI VI (Fig. 8)	SI V (Fig. 9)	SI IV (Fig. 10)	BrH XIV (Fig. 11)	VG V (Fig. 12)	VG IV (Fig. 13)	HS (Fig. 14)	HB (Fig. 15)	BT VII (Fig. 17)	BoH (Fig. 16)	GÖ (Fig. 18)
tools																	
split base point		●								●	●	●					●
bone/antler point	●	●		●		●		●	●	●	●	●	●		●	●	●
ivory point/rod	●	●	●	●		●	●	●	●		●	●			●	●	
<i>bâton percé</i>		●									●	●					
burnisher		●			●				●		●	●	●	●			●
bone awl	●	●			●		●	●	●		●	●	●		●	●	●
retoucher bone/antler	●	●									●	●	●				
retoucher tooth				●							●	●					
antler percussor	●	●															
personal ornaments																	
double perforated bead	●	●	●	●	●	●			●		●						
basket shaped bead	●				●	●											
fox canine pendant	●			●									●				
horse tooth pendant						●								●			
bear canine pendant											●					●	
other tooth pendant				●	●	●									●		
other personal ornament	●	●	●	●	●	●						●	●				
art and music																	
decorated object		●		●		●			●		●	●	●				●
figurative art		●		●		●					●	●	●				
painting		●															
flutes		●															

GK: Geißenklösterle; HF: Hohle Fels; SI: Sirgenstein; BrH: Brillenhöhle; VG: Vogelherd; HS: Hohlenstein-Stadel; HB: Hohlenstein-Bärenhöhle; BT: Bockstein-Törle; BoH: Bocksteinhöhle; GÖ: Göpfelsteinhöhle. The Roman numerals refer to the Archeological Horizons or layers as mentioned in the figure captions. Bold symbols - abundant; secondary bold symbols - frequent; light symbols - rare. The data for Sirgenstein, Brillenhöhle, Vogelherd, Hohlenstein-Stadel, Hohlenstein-Bärenhöhle, Bockstein-Törle, Bocksteinhöhle, and Göpfelsteinhöhle are based mainly on Hahn (1977), supplemented from own analyses; the data for Geißenklösterle are based on Hahn (1988) and own analyses, supplemented from Teyssandier (2003) and Teyssandier and Liolios (2003); all data for Hohle Fels are based on own analyses.

Here we cannot present the stratigraphic background to the sites individually, but the published radiocarbon dates for the sites are presented in Tables 3 and 4 with the relevant references (for the TL dates see Richter et al., 2000). Similarly, where the data for the compilations reflected in Tables 1 and 2 are not based on our ongoing excavations and analyses, the sources of the data are provided. Prior to this summary, the best available data stem from Joachim Hahn's (1977) monograph on the Aurignacian of central Europe. We base many of the results presented here on Hahn's work and the primary publications cited in the table and figure captions.

Although the quality of excavation in Swabia was generally very good, it will come as no surprise that the modern excavations at Geißenklösterle and Hohle Fels provide the most diverse assemblages of smaller finds. This being said, the re-excavation of the backdirt at Vogelherd (Conard and Malina, in press) confirms our expectations that many of the smaller artifacts and much debris from ivory and bone working and stone knapping were not recovered in the original excavation under Riek's direction in 1931 (Riek, 1934). Nonetheless, the results of the work from earlier generations of researchers point to the overall technological, typological and chronological unity of these assemblages.

Cultural and chronostratigraphy

Bolus (2003) has recently addressed the question of variation in the Swabian Aurignacian assemblages. In keeping with Hahn's (1977, 1981) and Bolus' (2003) results, we argue that the region shows relatively little well-documented chrono-cultural variation. Some forms, such as perforated horse incisors, tend to appear late in the assemblages, as has been demonstrated at Hohle Fels (Conard, 2003a), but most classes of artifacts are not strictly limited to lower, middle or upper horizons within the Aurignacian sequence. Identifying fine-grained cultural-stratigraphic organization within the Aurignacian is further complicated by the variable quality of the data. Only Geißenklösterle and Hohle Fels provide the large and well-documented assemblages needed to approach these questions.

While mixing and poor recovery are particularly problematic for the older excavations, we do not think that major taphonomic mixing has destroyed the integrity of the key assemblages from recent excavations. Contrary to earlier claims by Zilhão and d'Errico (1999, 2003a, 2003b), refitting and micromorphological studies, in combination with arguments based on the composition of the assemblages, indicate that taphonomic mixing is not a central factor shaping the assemblages from the key sites of Geißenklösterle and Hohle Fels (Conard and Bolus, 2003; Conard et al., 2003a). This being said, we must assume that geological, biological and cultural processes do reduce the coherence of the find horizons. As Hahn and we have discussed, excavation error is also a non-trivial factor when assessing the integrity of the assemblages (Hahn, 1988; Conard and Bolus, 2003).

Despite the abundance of radiometric dates from the Swabian sites and especially from the new excavations, major problems in dating the sites still persist (Conard, 2002b; Conard and Bolus, 2003). These problems are primarily related to the highly variable production of atmospheric radionuclids during the Aurignacian (Voelker et al., 2001; Beck et al., 2001; Hughen et al., 2004). These irregularities in radiocarbon production can easily explain the fluctuation of dates from similar stratigraphic positions by several thousand years or more. In some settings, these production spikes can lead to younger dates stratigraphically underlying older dates from secure contexts.

Radiometric dates indicate that the Swabian Aurignacian dates to roughly 30-40 kyr BP. The thermoluminescence dates by Richter et al. (2000) confirm the great antiquity of the Aurignacian

with dates of ca.40 kyr BP for archeological horizon (AH) III and ca.37 kyr BP for AH II at Geißenklösterle. At each site where data are available, a stratigraphic break and an occupational hiatus separates the Aurignacian from the underlying and usually much less intensively occupied Middle Paleolithic strata. Geißenklösterle, Hohle Fels, Sirgenstein, and Vogelherd all provide a consistent picture of this key transition. Contrary to our own expectations, very little data exist to suggest that the makers of the Middle Paleolithic and the Aurignacian encountered each other in Swabia (Conard and Bolus, 2003; Münzel and Conard, 2004; Bolus, 2005; Conard, 2005b). Since the Swabian Aurignacian appears suddenly in a highly developed form containing numerous regionally unique signatures, this material culture must have developed quickly with the makers of the Aurignacian rapidly establishing a sustainable breeding population. The Swabian Aurigna-

TABLE 3

Radiocarbon dates with 1σ uncertainties for the Ach Valley sites. The dates from Bern (B), Heidelberg (H), and Pretoria (Pta) are conventional radiocarbon dates, those from Kiel (KIA), Oxford (OxA), and Zurich (ETH) are AMS dates.

Lab. Number	Arch. Hor.	Material	Modification	Date	Cultural Group	First Publication
ACH VALLEY						
Geißenklösterle						
OxA-5157	Ip	hare pelvis		24 360±380	Gravettian	Housley et al., 1997
OxA-4855	Ir	reindeer phalange		27 000±550	Gravettian	Housley et al., 1997
OxA-4857	Ir	horse rib	cutmarks	27 500±550	Gravettian	Housley et al., 1997
OxA-4856	Ir	horse radius		30 950±800	Gravettian	Housley et al., 1997
OxA-5227	Is	horse femur		28 050±550	Gravettian	Housley et al., 1997
OxA-5226	It	reindeer tibia	impact	26 540±460	Gravettian	Housley et al., 1997
OxA-5229	It	mammoth rib	cutmarks	27 950±550	Gravettian	Housley et al., 1997
OxA-5228	It	mammoth rib		28 500±550	Gravettian	Housley et al., 1997
OxA-4592	It	reindeer phalange		29 200±460	Gravettian	Hahn, 1995
OxA-4593	It	bone		29 200±500	Gravettian	Hahn, 1995
OxA-5706	Ia	red deer antler		29 220±500	Gravettian	Richter et al., 2000
OxA-5161	Ic	reindeer metacarpal	impact	30 300±750	Gravettian	Housley et al., 1997
H 4147-3346	Ila	mixed bone sample		30 625±796	Upper Aurignacian	Hahn, 1983
H 4279-3534	Ila	mixed bone sample		31 525±770	Upper Aurignacian	Hahn, 1983
OxA-5707	Ila	horse scapula	impact + cutmarks	33 200±800	Upper Aurignacian	Richter et al., 2000
OxA-5160	Ila	hare tibia		33 700±1100	Upper Aurignacian	Hahn, 1988
OxA-4594	Ila	reindeer? humerus		36 800±1000	Upper Aurignacian	Hahn, 1995
KIA 8960	Iib	mammoth rib	impact	29 800±240	Upper Aurignacian	Conard and Bolus, 2003
Pta-2361	Iib	charred bone		31 070±750	Upper Aurignacian	Hahn, 1983
KIA 8958	Iib	horse humerus		31 870+260/-250	Upper Aurignacian	Conard and Bolus, 2003
Pta-2270	Iib	charred bone		31 870±1000	Upper Aurignacian	Hahn, 1983
OxA-5708	Iib	mammoth cranium		32 300±700	Upper Aurignacian	Richter et al., 2000
PtA-2116	Iib	charred bone		32 680±470	Upper Aurignacian	Hahn, 1983
OxA-5162	Iib	hare pelvis		33 200±1100	Upper Aurignacian	Housley et al., 1997
H 4751-4404	Iib	mixed bone sample		33 700±825	Upper Aurignacian	Hahn, 1983
OxA-6256	III	reindeer tibia	impact	30 100±550	Lower Aurignacian	Conard and Bolus, 2003
KIA 8963	III	long bone	impact	31 180+270/-260	Lower Aurignacian	Conard and Bolus, 2003
H 5118-4600	III	mixed bone sample		34 140±1000	Lower Aurignacian	Hahn, 1983
H 5316-4909	III	mixed bone sample		36 540±1570	Lower Aurignacian	Hahn, 1983
OxA-5163	III	ibex mandible		37 300±1800	Lower Aurignacian	Housley et al., 1997
OxA-4595	III	horse femur		40 200±1600	Lower Aurignacian	Hahn, 1995
OxA-6629	IIIa	reindeer metatarsal		30 300±550	Lower Aurignacian	Conard and Bolus, 2003
OxA-6628	IIIa	reindeer metatarsal		30 450±550	Lower Aurignacian	Conard and Bolus, 2003
ETH-8268	IIIa	bone		33 100±680	Lower Aurignacian	Hahn, 1995
OxA-5705	IIIa	reindeer metatarsal		33 150±1000	Lower Aurignacian	Conard and Bolus, 2003
ETH-8269	IIIa	bone		33 500±640	Lower Aurignacian	Hahn, 1995
OxA-6255	IIIa	rhino humerus		32 900±850	Lower Aurignacian	Conard and Bolus, 2003
KIA 13075	IIIa	reindeer tibia	impact	34 330+310/-300	Lower Aurignacian	Conard and Bolus, 2003
KIA 13074	IIIa	reindeer tibia	impact	34 800+290/-280	Lower Aurignacian	Conard and Bolus, 2003
ETH-8267	IIIa	bone		37 800±1050	Lower Aurignacian	Hahn, 1995
KIA 8962	IIIb	rib	impact	28 640+380/-360	Lower Aurignacian	Conard and Bolus, 2003
KIA 8961	IIIb	reindeer humerus		33 210+300/-290	Lower Aurignacian	Conard and Bolus, 2003
KIA 13076	IIIb	reindeer tibia	impact + cutmarks	34 080+300/-290	Lower Aurignacian	Conard and Bolus, 2003
KIA 8959	IIIb	femur		34 220+310/-300	Lower Aurignacian	Conard and Bolus, 2003
KIA 16032	IIIb	roe deer metacarpal	impact	36 560+410/-390	Lower Aurignacian	Conard and Bolus, 2003

TABLE 3 [cont.]

Lab. Number	Arch. Hor.	Material	Modification	Date	Cultural Group	First Publication
OxA-6077	GH 17	ibex tibia		32 050±600	sterile	Conard and Bolus, 2003
OxA-6076	IV	red deer tibia		33 600±1900	Middle Paleolithic	Conard and Bolus, 2003
Hohle Fels						
OxA-4599	IIC	reindeer antler	tool (decor. adze)	28 920±400	Gravettian	Hahn, 1995
OxA-5007	IIC	reindeer antler	tool (decor. adze)	29 550±650	Gravettian	Housley et al., 1997
KIA 3503	IICf	bone		27 030+250/-240	Gravettian	Conard 2003b
KIA 17742	IICf	horse tibia	impact + cutmarks	27 690±140	Gravettian	Conard 2003b
KIA 17743	IICf	cave bear vertebra	with flint point	27 830+150/-140	Gravettian	Conard 2003b
KIA 17744	IICf	rib rhino-mammoth	point	27 780±150	Gravettian	Conard 2003b
KIA 17741	IICf	reindeer antler		27 970±140	Gravettian	Conard 2003b
KIA 8964	IId (base)	rib rhino-mammoth		29 560+240/-230	Aurignacian	Conard and Bolus, 2003
KIA 8965	IId (base)	reindeer antler		30 010±220	Aurignacian	Conard and Bolus, 2003
KIA 16040	IIE	horse pelvis	impact + cutmarks	30 640±190	Aurignacian	Conard and Bolus, 2003
OxA-4979	III	<i>Salix</i> charcoal		27 600±800	Aurignacian	Housley et al., 1997
KIA 18878	III	<i>Pinus</i> charcoal		29 780+330/-310	Aurignacian	Conard 2003b
KIA 16038	III	reindeer femur	Impact + cutmarks	29 840±210	Aurignacian	Conard and Bolus, 2003
KIA 18877	III	<i>Pinus</i> charcoal		30 170+250/-240	Aurignacian	Conard 2003b
OxA-4601	III	bone		30 550±550	Aurignacian	Hahn, 1995
KIA 18876	III	<i>Pinus</i> charcoal		31 010+600/-560	Aurignacian	Conard 2003b
KIA 16039	III	ungulate femur	impact	31 140+250/-240	Aurignacian	Conard and Bolus, 2003
OxA-4980	IV	<i>Salix+Betula</i> charc.		28 750±750	Aurignacian	Housley et al., 1997
OxA-4600	IV	reindeer metapodial		31 100±600	Aurignacian	Hahn, 1995
KIA 18879	IV	unidentif. charcoal		31 160+1530/-1280	Aurignacian	Conard 2003b
KIA 16036	IV	horse femur	tool (retoucher)	33 090+260/-250	Aurignacian	Conard and Bolus, 2003
KIA 16035	V	horse bone	impact	33 290±270	Aurignacian	Conard 2003b
KIA 18880	V	<i>Pinus</i> charcoal		34 190+340/-330	Aurignacian	Conard 2003b
KIA 16034	V	ungulate humerus	impact + cutmarks	35 710+360/-340	Aurignacian	Conard 2003b
Sirgenstein						
KIA 13079	II	bone	tool (point)	27 250+180/-170	Gravettian	Conard and Bolus, 2003
KIA 13080	III	bone	tool (burnisher)	30 210±220	Aurig./Grav.	Conard and Bolus, 2003
KIA 13081	IV	mammoth rib	tool (burnisher)	28 400±200	Aurignacian	Conard and Bolus, 2003
KIA 13082	V	bone (antler?)	tool (point)	26 730+170/-160	Aurignacian	Conard and Bolus, 2003
KIA 13083	VI	bone	tool (awl)	30 360+230/-220	Aurignacian	Conard and Bolus, 2003
Brillenhöhle						
B-492	VII	charred bone		>25 000	Gravettian	Riek, 1973
B-491	VIII	charred bone		>29 000	?	Riek, 1973

TABLE 4

Radiocarbon dates with 1σ uncertainties for the Lone Valley sites. The dates from Groningen (GrN) and Heidelberg (H) are conventional radiocarbon dates, those from Kiel (KIA), Oxford (OxA), Purdue (PL), and Zurich (ETH) are AMS dates.

<i>Lab. Number</i>	<i>Arch. Hor.</i>	<i>Material</i>	<i>Modification</i>	<i>Date</i>	<i>Cultural Group</i>	<i>First Publication</i>
LONE VALLEY						
Bockstein-Törle						
H 4058-3355	VI	mixed bone sample		20 400±220	Aurig./Grav.	Hahn, 1977
KIA 8956	VI	bone		20 990 +120/-110	Aurig./Grav.	Conard and Bolus, 2003
H 4058-3526	VI	mixed bone sample		23 440±290	Aurig./Grav.	Hahn, 1983
KIA 8953	VI	reindeer radius-ulna	fresh break	31 530±230	Aurig./Grav.	Conard and Bolus, 2003
H 4049-3356	VII	mixed bone sample		26 133±376	Aurignacian	Hahn, 1977
KIA 8952	VII	reindeer metatarsal	fresh break	30 130 +260/-250	Aurignacian	Conard and Bolus, 2003
H 4059-3527	VII	mixed bone sample		31 965±790	Aurignacian	Hahn, 1983
KIA 8954	VII	reindeer femur?	fresh break	44 390+990/-880	Aurignacian/MP?	Conard and Bolus, 2003
KIA 8955	VII	horse metapodial	fresh break	46 380+1360/-1170	Aurignacian/MP?	Conard and Bolus, 2003
Hohlenstein-Bärenhöhle						
KIA 8967	brown loam	bone	fresh break	26 080+140/-130	Aurignacian?	Conard and Bolus, 2003
Hohlenstein-Stadel						
KIA 8951	19m, spit 6	reindeer humerus	impact	31 440±250	Aurignacian	Conard and Bolus, 2003
H 3800-3025	20m, spit 6	mixed bone sample		31 750+1150/-650	Aurignacian	Hahn, 1977
ETH-2877	20m, spit 6	reind. ulna+wolf		32 000±550	Aurignacian	Schmid, 1989

TABLE 4 [cont.]

Lab. Number	Arch. Hor.	Material	Modification	Date	Cultural Group	First Publication
GrN-6583	IV/V	mixed bone sample		23 860±190	?	Hahn, 1977
GrN-6662	IV/V	charred bone		27 630±830	?	Hahn, 1977
PL0001339A	IV/V	horse tibia	cutmarks	32 180±960	Aurignacian	Conard and Bolus, 2003
PL0001342A	IV/V	bovid-horse rib	cutmarks	34 100±1100	Aurignacian	Conard and Bolus, 2003
KIA 19538	V (base)	human mandible (Stetten 1)		4 715±35	Neolithic	Conard et al. 2004a
KIA 19539	V (base)	human vertebra (Stetten 4)		4 735±30	Neolithic	Conard et al. 2004a
KIA 20967	V (base)	human cranium (Stetten 1)		4 910±25	Neolithic	Conard et al. 2004a
KIA 20969	V (base)	human mandible (Stetten 1; 2nd sample)		4 985±30	Neolithic	Conard et al. 2004a
KIA 19540	V (base)	human humerus (Stetten 3)		4 995±35	Neolithic	Conard et al. 2004a
H 4035-3209	V	mixed bone sample		23 020±400	?	Hahn, 1977
H 8498-8950	V	mixed bone sample		25 900±260	?	Hahn, 1993
H 8497-8930	V	mixed bone sample		27 200±400	?	Hahn, 1993
H 4054-3210	V	mixed bone sample		30 162±1340	Aurignacian	Hahn, 1977
H 8500-8992	V	mixed bone sample		30 600±1700	Aurignacian	Hahn, 1993
GrN-6661	V	charred bone		30 650±560	Aurignacian	Hahn, 1977
H 8499-8991	V	mixed bone sample		31 350±1120	Aurignacian	Hahn, 1993
KIA 8968	V	artiodactyl tibia	impact	31 790±240	Aurignacian	Conard and Bolus, 2003
H 4056-3208	V	mixed bone sample		31 900±1100	Aurignacian	Hahn, 1977
PL0001338A	V	horse tibia	cutmarks	32 400±1700	Aurignacian	Conard and Bolus, 2003
KIA 8969	V	reindeer longbone	impact	32 500±260/-250	Aurignacian	Conard and Bolus, 2003
KIA 8970	V	horse longbone	impact	33 080±320/-310	Aurignacian	Conard and Bolus, 2003
PL0001337A	V	bovid-horse longbone	cutmarks	35 810±710	Aurignacian	Conard and Bolus, 2003

Discussion and conclusions

In this paper we have presented a summary of the Aurignacian assemblages from Swabia. Nowhere in Europe is there clear evidence for earlier manifestations of the Aurignacian. Based on the work of Bon (2002), Teyssandier (2003), and Broglio's team at Fumane (Broglio et al., 2002; Broglio and Gurioli, 2004; Broglio and Dalmeri, 2005), it is becoming increasingly clear, that the many early assemblages that have been described as Proto-Aurignacian are radically different from the early Swabian Aurignacian and the *Aurignacien ancien* of southwestern France. While the technological and typological links between southwestern France and Swabia are clear, the Mediterranean Proto-Aurignacian, which can be seen as far north as Krems-Hundsteig in the central Danube region, represents a distinctive technocomplex (cf. Teyssandier et al., this volume).

We recommend abandoning the term 'Proto-Aurignacian' to avoid unnecessary confusion. A term such as 'Fumanian' would be a more appropriate name for assemblages of the Fumane and Krems-Hundssteig type, while another term could perhaps be used to refer to assemblages of the Riparo Mochi type (Kuhn and Stiner, 1998), which are characterized by few backed and pointed forms and less diverse organic artifact assemblages than the 'Fumanian'. The detailed data from Fumane provide a clear and highly contrasting signal to the Swabian Aurignacian and *Aurignacien ancien* in southwestern France. The long, narrow laminar debitage and finely retouched and backed tools from the 'Fumanian' are entirely absent in the Swa-

bian Aurignacian. Similarly, abundant evidence contrasts the art, ornaments and organic tools of the two regions. Given the strong similarities between the Swabian and southwestern French assemblages from the early Aurignacian, this term should be used for assemblages with similarities to those from these well-researched areas, while, of course, allowing room for the presence of local signatures, as are well-documented, especially in the ornaments and art of these regions (Hahn, 1986, 1988; Leroi-Gourhan, 1995; White, 1993, 2001; Conard 2003a, 2005a). Vanhaeren and d'Errico's (in press) work on personal ornaments from the Aurignacian also points to links between the Swabian and southwestern French Aurignacian, as well as to the Belgian Aurignacian. Based on a number of technological and stylistic characteristics, these groups of sites are more closely related than those of other regions.

Recent fieldwork and dating programs in Swabia have done much to clarify the place of the region's Aurignacian within the early Upper Paleolithic of Europe. The early dates from Swabia and the many innovations that characterize the Aurignacian of the region point to the Upper Danube Valley as a key center of cultural development during the early Upper Paleolithic. The Danube Corridor hypothesis argues that modern humans migrated into central Europe via the Danube Valley (Conard and Bolus, 2003, but see also Conard et al., 2004a). This would help to explain the early dates for the Swabian Aurignacian. Excavations in the caves of Swabia have yet to provide any indications of contact between the makers of the Aurignacian and late Middle Paleolithic assemblages. Thus we argue, in keeping with the Population Vacuum Model (Conard et al., 2003b; Conard, 2003b), that modern humans arrived in a depopulated region during or immediately following an unfavorable climatic phase, most likely during continental European equivalent of Heinrich Event 4 or the following interstadial 8, roughly 40 000 years ago. The Aurignacian represents a radical break in the cultural sequence of the region, and the *Kulturpumpe* hypothesis points to inter-taxa competition, climatic stress and largely internal social-cultural and demographic factors as probable causes of the local innovations of the Swabian Aurignacian. Based on our most recent data and the lack of evidence demonstrating interaction between modern humans and Neanderthals in Swabia, the local innovations of the Aurignacian more likely reflect a combination of climatic and social-culturally embedded phenomena.

Placing the Swabian data in a broader context, we argue that Eurasia showed great behavioral variation in the middle of the Late Pleistocene. A dynamic equilibrium existed between regions and populations at various scales (Conard, 2005c). About 40 kyr BP, anatomically modern humans entered Europe via the Danube Corridor and the Mediterranean coast (Bar-Yosef, 1998; Conard and Bolus, 2003; Bolus, 2005). There was give and take between populations as is documented in distinctive regional records. In Swabia, contact between archaic and modern populations was minimal. In most regions modern humans reproduced at higher rates and relied on new technologies, more intensive caloric extraction and higher impact behavioral strategies, compared to the low impact strategies followed over tens of millennia by Neanderthals (Münzel and Conard, 2004; Conard, 2005b). Many lines of evidence from Swabia point to higher human population densities during the Aurignacian than during the preceding Middle Paleolithic. In the context of Darwinian competition and in the face of radical climatic change, modern humans produced innovations of the Aurignacian that archeologists view as hallmarks of what is often referred to as behavioral or cultural modernity (Mellars, 1996, 2004; d'Errico, 2003).

While competition and climate are key variables, the causes of the innovations of the Swabian Aurignacian lie in social-cultural and demographic spheres. We are currently working to develop more explicitly formulated and testable variants of the *Kulturpumpe* hypothesis. We need testable hypotheses reflecting multiple scales of analysis and more data, if we are successfully to reconstruct the prehistory of the cultural dynamics of the early Upper Paleolithic.

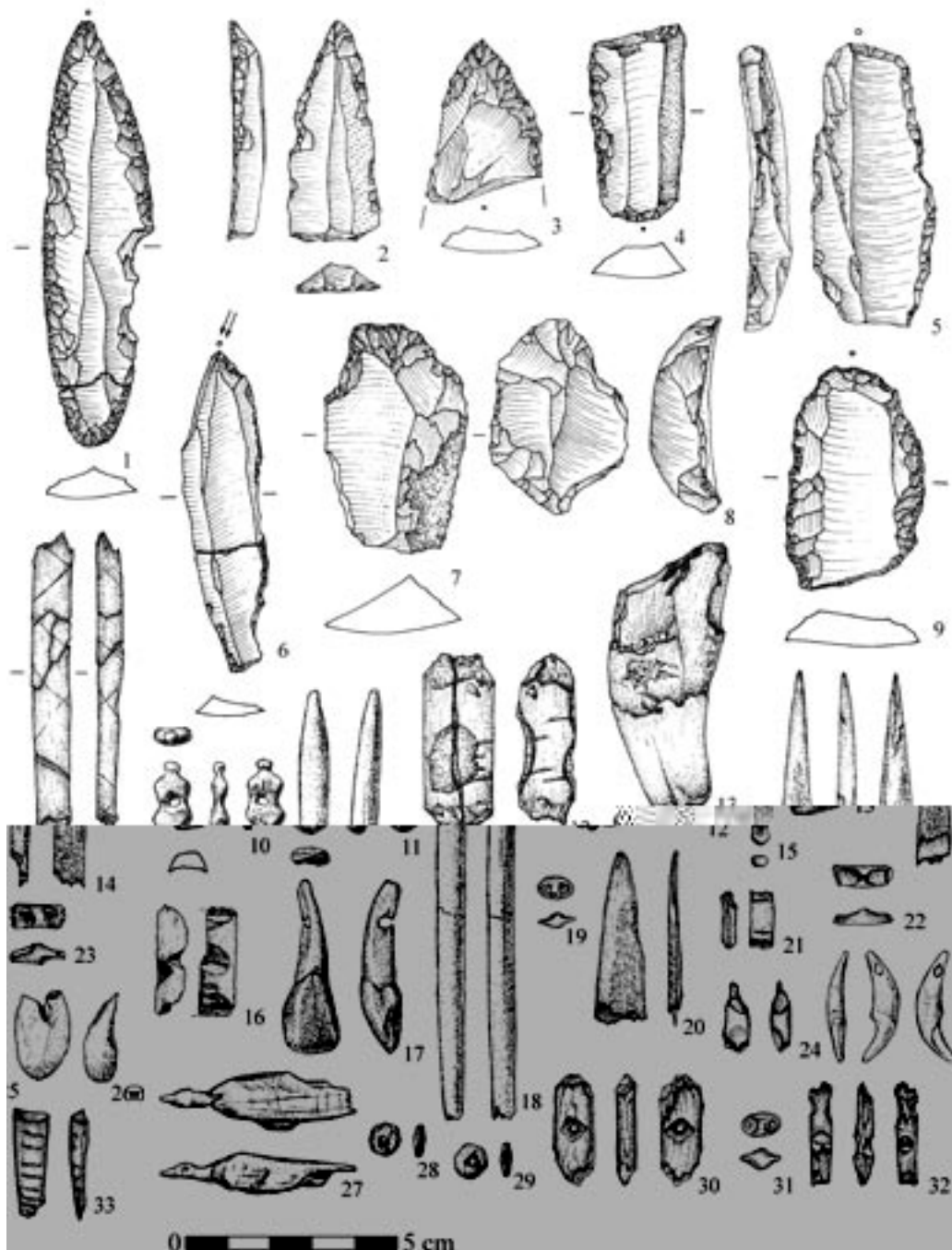


FIG. 5 – Aurignacian of Hohle Fels, Archeological Horizon IV: 1-3. pointed blades (Spitzklingen); 4. blade with double truncation; 5-6. burins on truncation; 7-8. nosed endscrapers; 9. laterally retouched end scraper; 10. decorated ivory rod; 11. violin shaped ivory bead; 12. roughout for a perforated ivory object; 13. bear canine retoucher; 14, 20. antler points; 15. ivory bead; 16, 21-22. roughouts for double perforated ivory beads; 17. perforated tooth; 18. ivory point; 19, 23, 31. double perforated ivory beads; 24. ivory ornament; 25. perforated fox canine; 26. perforated upper canine from red deer; 27. ivory figurine; 28-29. disc shaped ivory beads; 30. perforated ivory object; 32. roughout for an ivory object; 33. double beveled antler point. After Conard et al., 2002 (2, 8, 16, 26, 28-29), Conard and Bolus, 2003 (3), Conard, 2003a (15, 25) and Conard et al., 2004b (1, 14, 20, 22-23, 30).

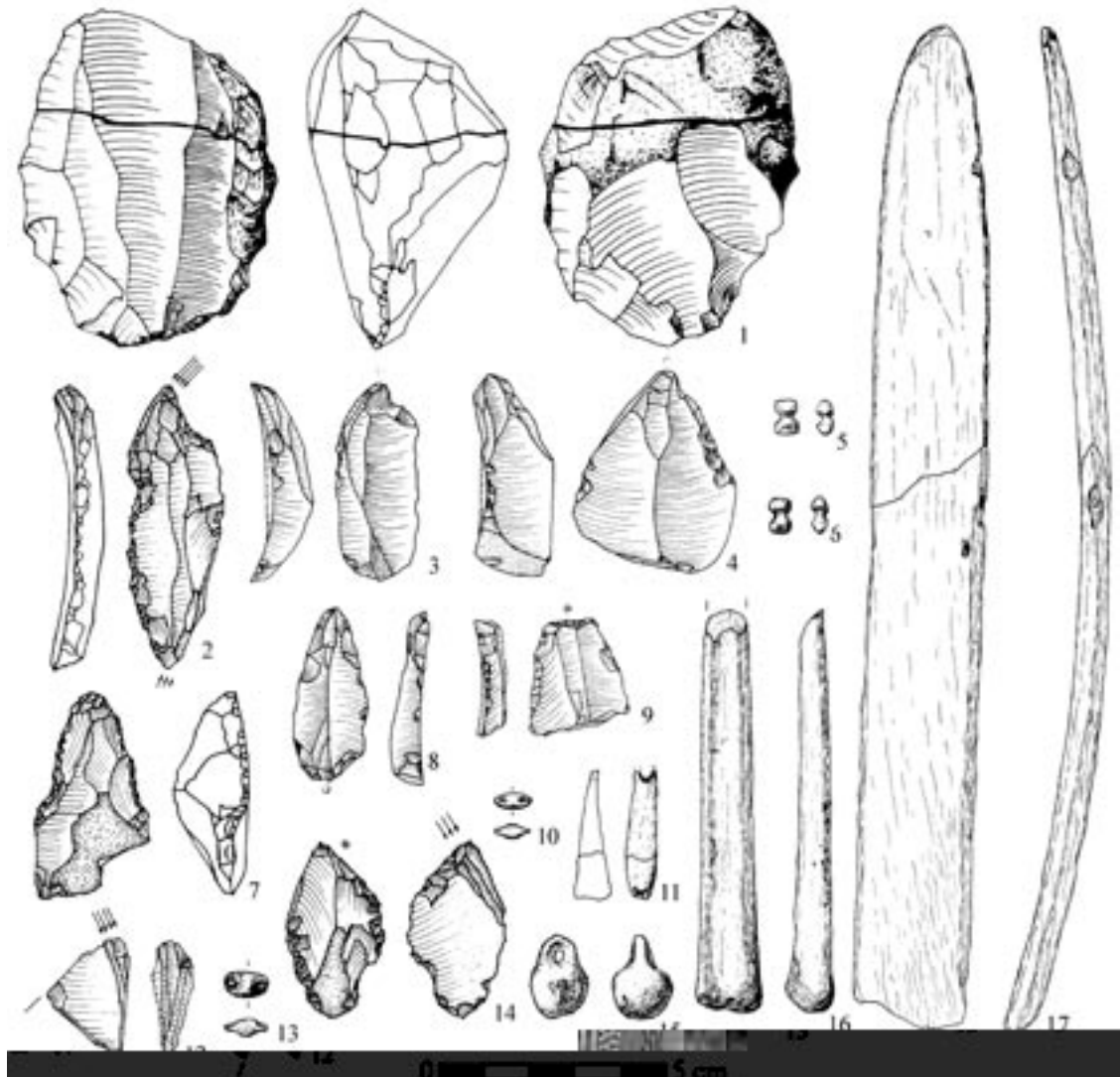


FIG. 6 – Aurignacian of Hohle Fels, Archeological Horizon III: 1. unidirectional blade core; 2-3. busked burins; 4. carinated burin; 5-6. toggle shaped ivory objects; 7. nosed endscraper; 8. pointed blade combined with endscraper; 9. truncated blade; 10, 13. double perforated ivory beads; 11. perforated bear incisor; 12, 14. carinated burins; 15. basket shaped ivory bead; 16. bone awl with intense polishing; 17. burnisher made of a mammoth rib. After Conard et al., 2002 (11), Conard, 2003a (10, 13), Conard and Bolus, 2003 (4, 9, 16-17) and Conard et al., 2004b (12).

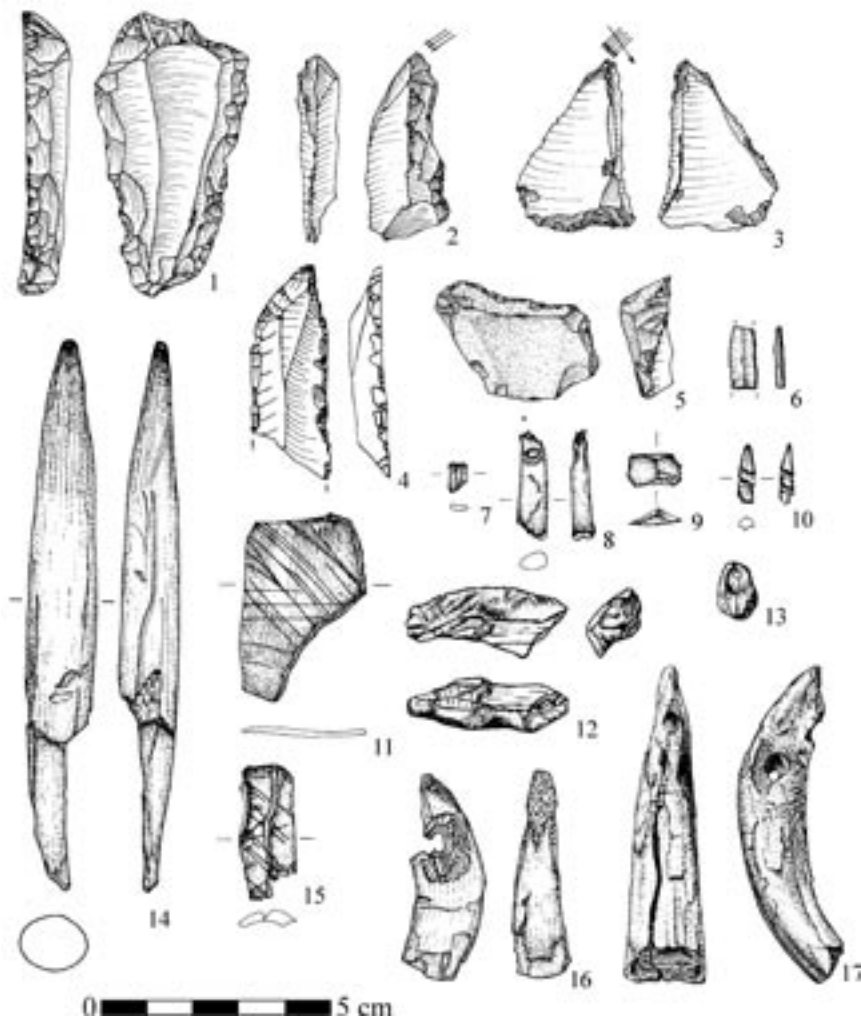


FIG. 7 – Aurignacian of Hohle Fels, Archeological Horizon IIId/e: 1. nosed endscraper; 2-3. carinated burins; 4. point; 5. retouched flake; 6. bladelet with slight lateral retouch; 7. ivory object of unknown function; 8. perforated tooth; 9. roughout for a double perforated ivory bead; 10. notched ivory object; 11, 15. decorated bones; 12. ivory figurine; 13. basket shaped ivory bead; 14. ivory point; 16-17. perforated horse incisors. After Conard, 2003a (13, 17), Conard et al., 2004b (2, 8-11, 15) and Conard and Malina, 2005 (16).

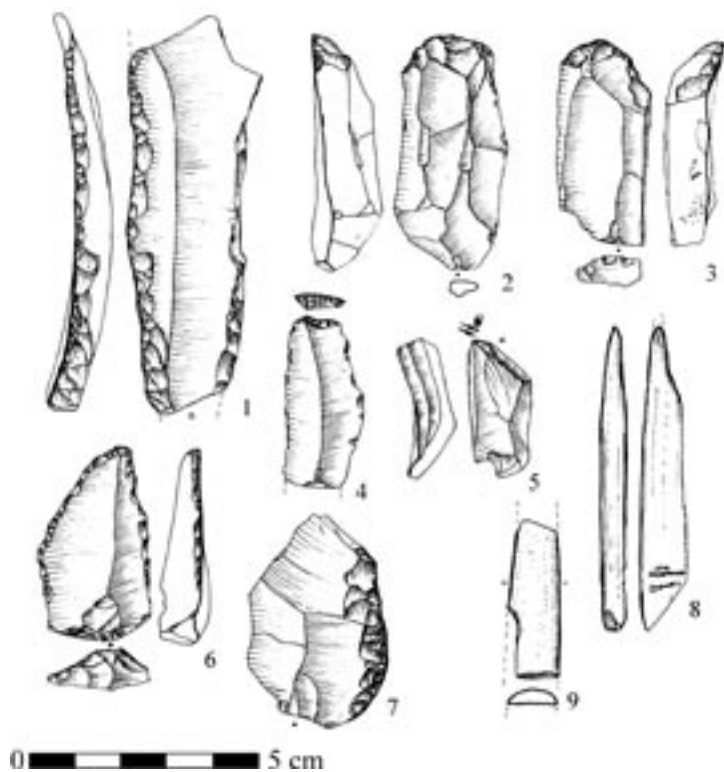


FIG. 8 – Aurignacian of Sirgenstein, Archeological Horizon VI: 1. laterally retouched blade; 2-3. endscrapers; 4. truncated blade; 5. dihedral burin; 6. point; 7. sidescraper; 8. bone awl; 9. fragment of an ivory rod (projectile point?). After Hahn, 1977.

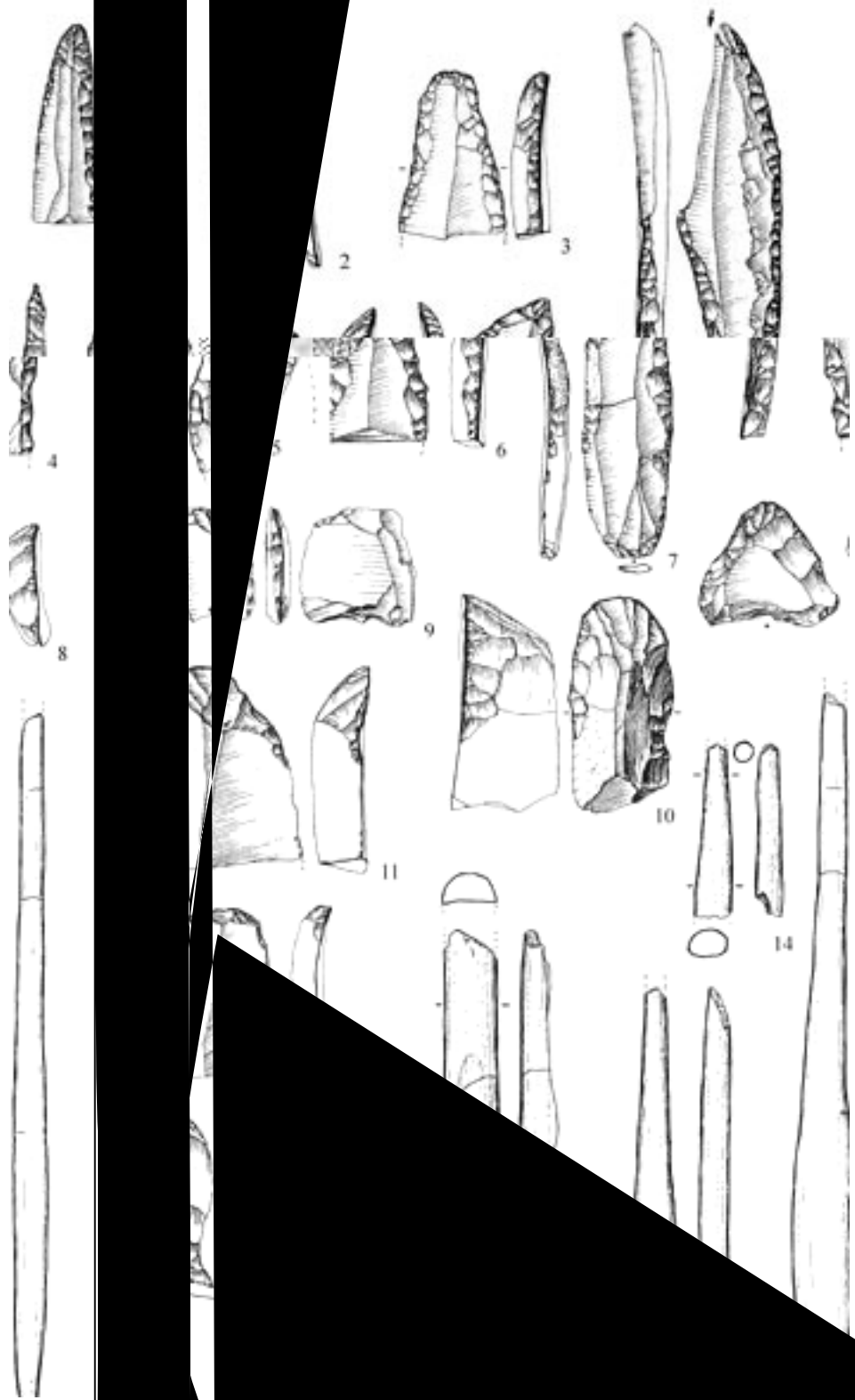


FIG. 9 - Aurignacian of Stein

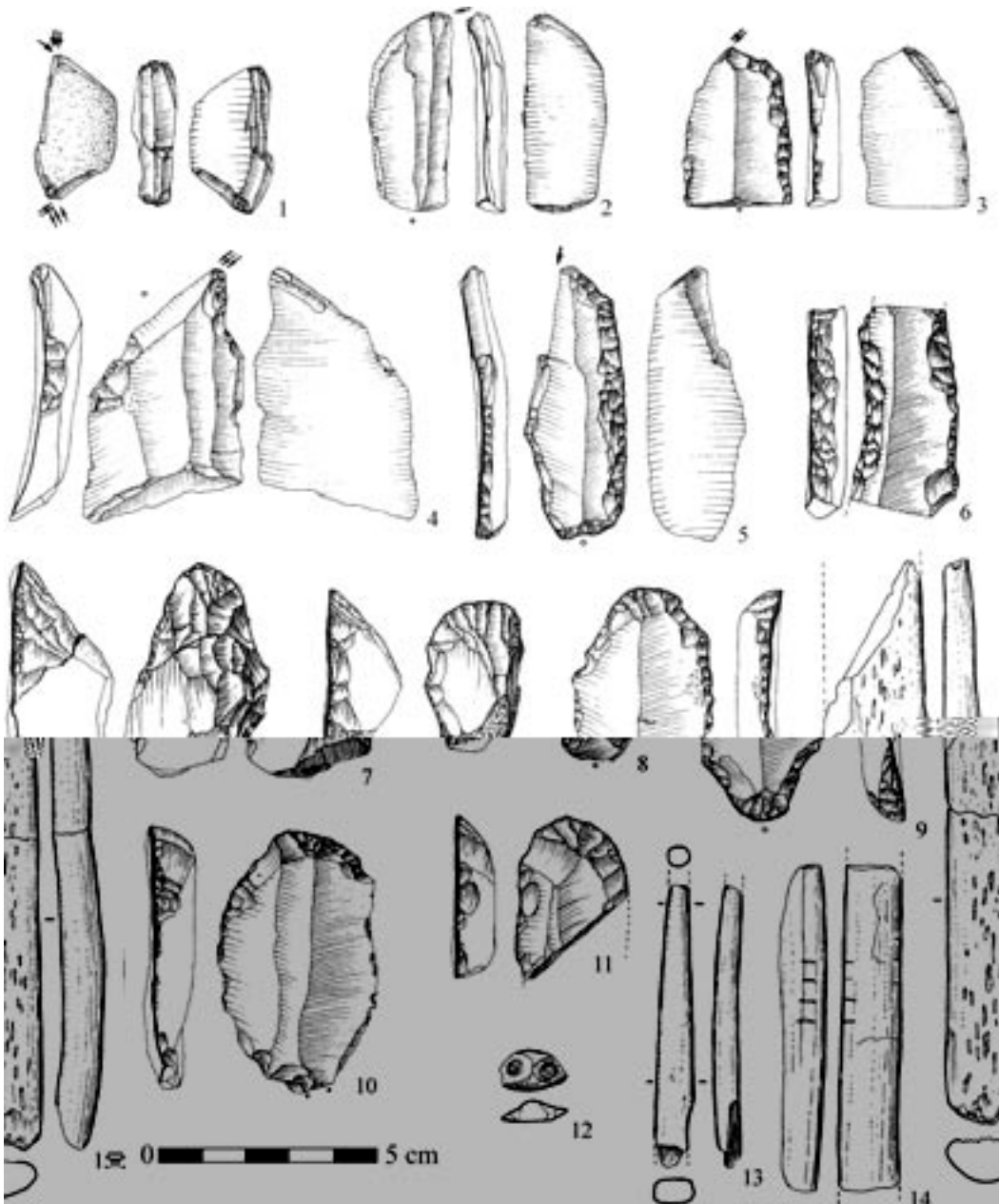


FIG. 10 – Aurignacian of Sirgenstein, Archeological Horizon IV: 1. dihedral burin; 2. transverse burin; 3. burin on truncation; 4. carinated burin; 5. burin on truncation combined with endscrapper; 6. laterally retouched blade; 7-8. carinated endscrapers; 9. double nosed endscrapper; 10-11; endscrapers; 12. double perforated ivory bead; 13. bone point; 14. ivory rod with incisions (projectile point?); 15. burnisher. After Hahn, 1977.

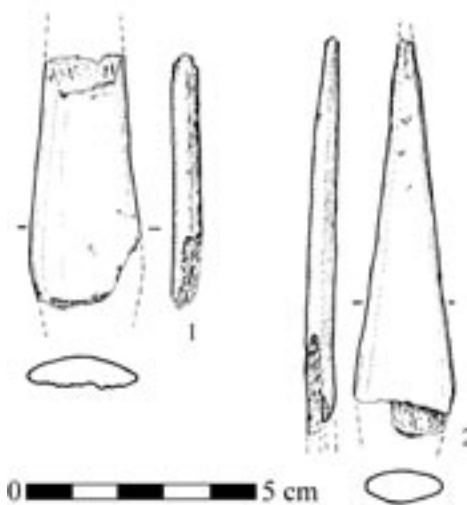


FIG. 11 – Aurignacian of Brillenhöhle, layer XIV: 1. bone point; 2. bone point with split base. After Hahn, 1977.

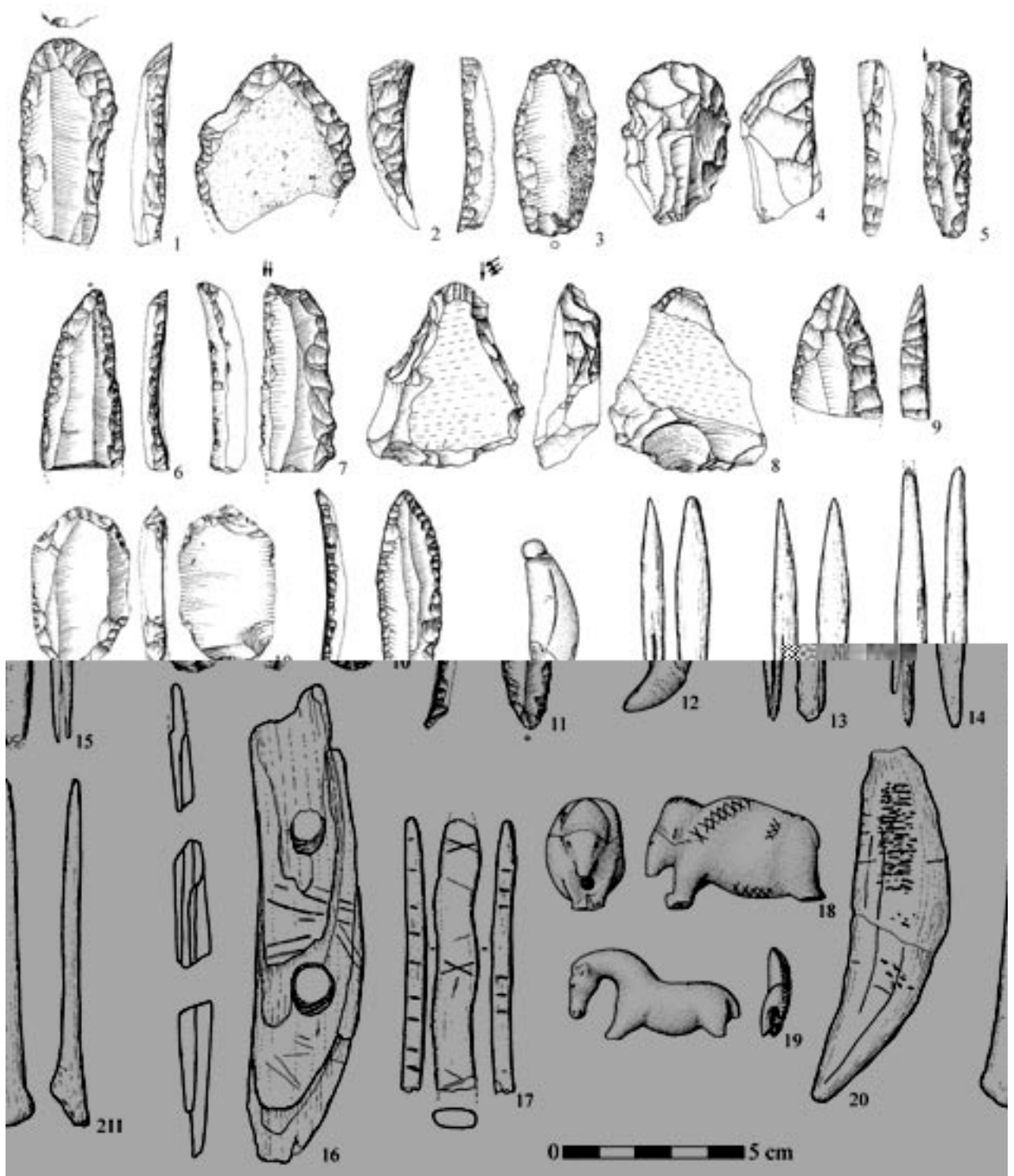
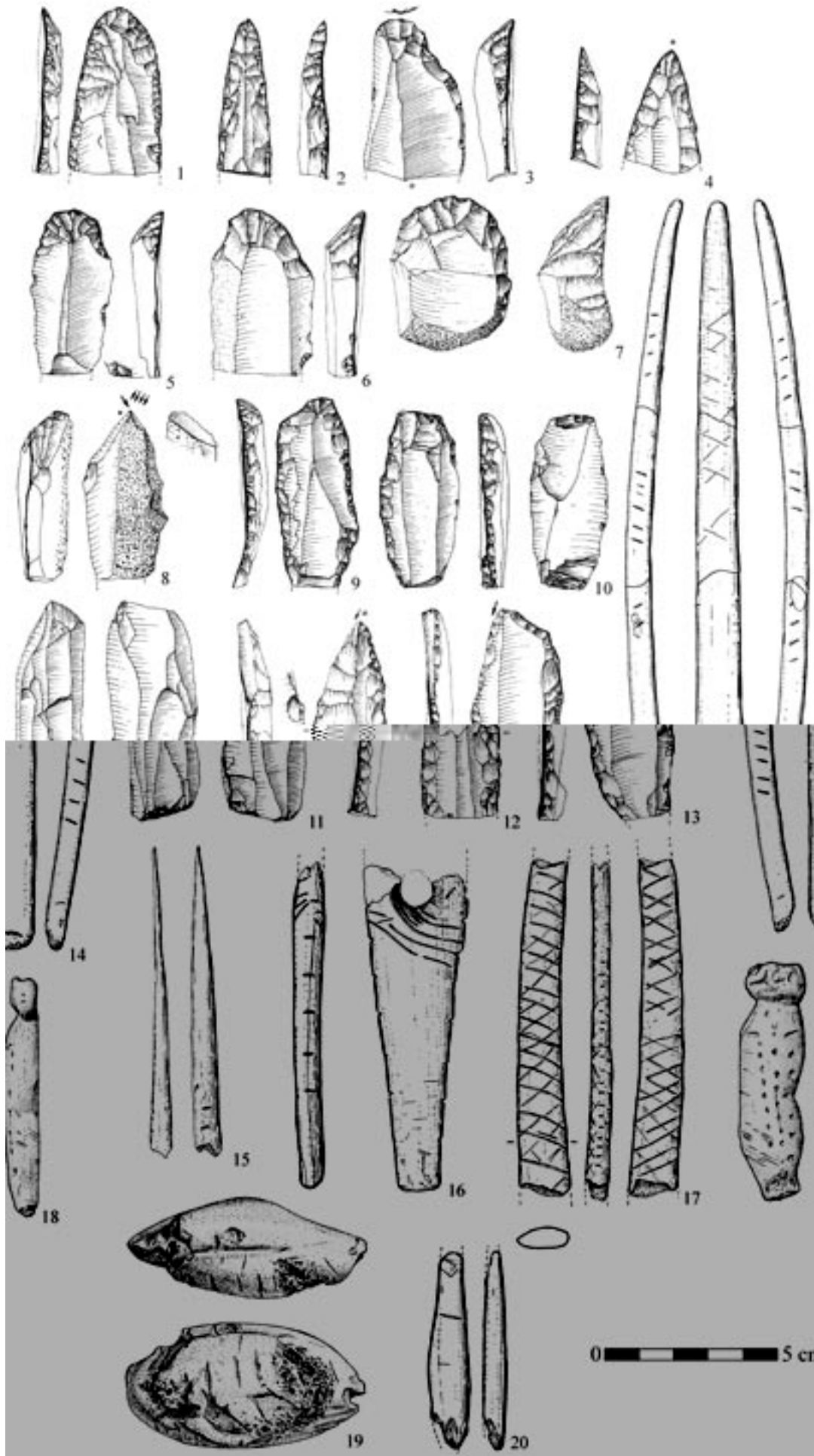


FIG. 12 – Aurignacian of Vogelherd, Archeological Horizon V: 1, 3, endscrapers; 2. nosed endscraper; 4. carinated endscraper; 5, 7. burins on truncation; 6, 9, 11. pointed blades (Spitzklingen); 8. busked burin; 10. splintered piece; 12. canine with a groove at the tip of the root; 13-15. bone points with split bases; 16. *bâton percé* made of ivory; 17. decorated antler rod; 18-19. ivory figurines; 20. retoucher made of a cave bear canine; 21. bone awl. After Hahn, 1977 (1-11, 13-17, 20-21), Conard 2003a, (12) and Conard and Bolus, 2003 (18-19).



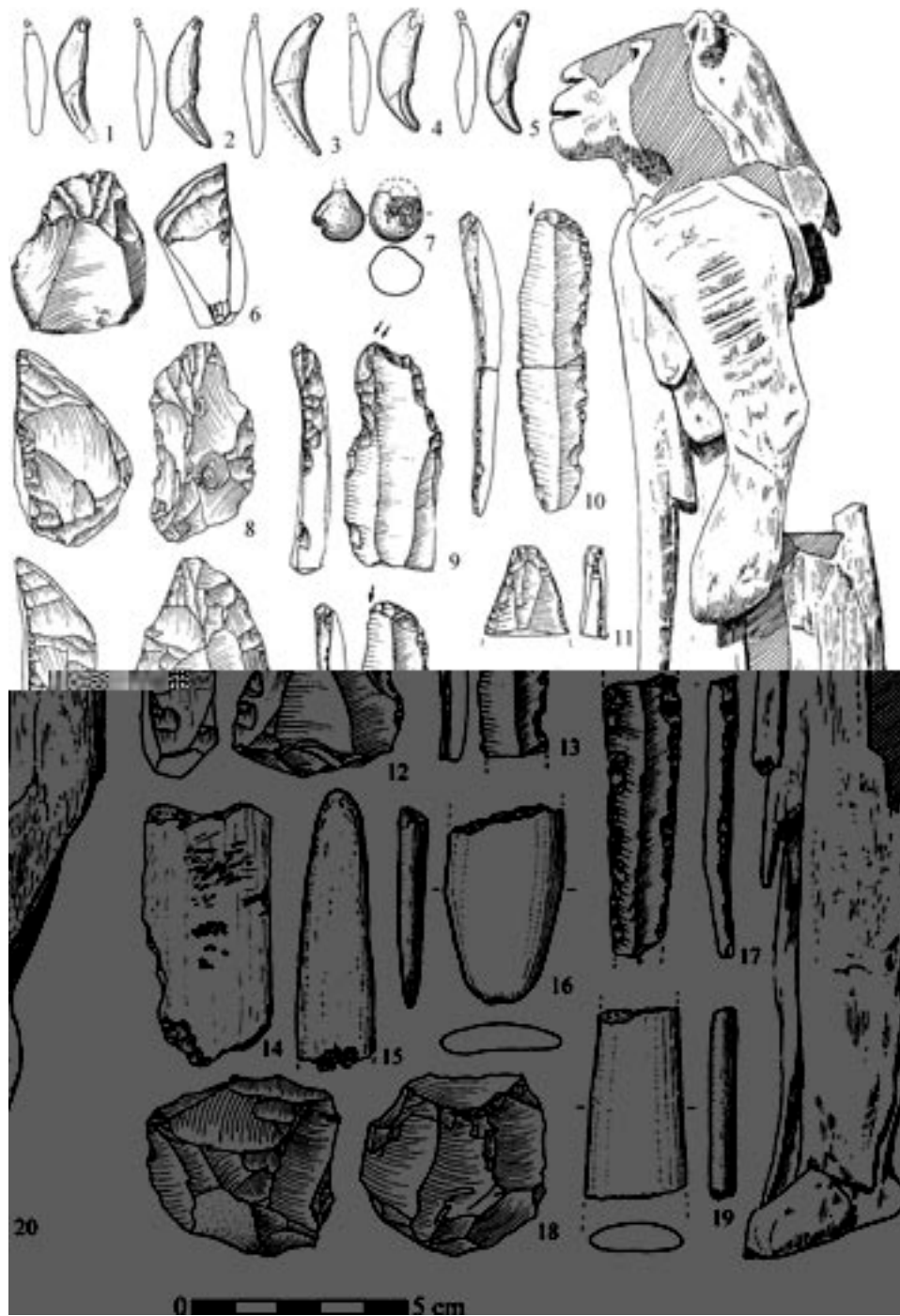


FIG. 14 – Aurignacian of Hohlenstein-Stadel (1-17, 19-20, maximum depth 120 cm; 18, depth 160-180 cm): 1-5. perforated fox canines; 6, 8, 12. carinated endscrapers; 7. ivory bead; 9-10, 13. burins on truncation; 11, 17. laterally retouched blades; 14. bone retoucher; 15. burnisher; 16, 19. bone points; 18. blade core; 20. ivory figurine. After Hahn, 1977 (1-7, 9, 13-17, 19), Hahn in Schmid, 1989 (8, 10-12), Conard and Bolus, 2003 (18) and Schmid, 1989 (20).

FIG. 13 – Aurignacian of Vogelherd, Archeological Horizon IV: 1. endscraper; 2, 4. pointed blades (Spitzklingen); 3, 5-6, 9. nosed endscrapers; 7. carinated endscraper; 8. carinated burin; 10. splintered piece; 11. prismatic blade core; 12-13. burins on truncation; 14. decorated antler point; 15. bone awl; 16. decorated *bâton percé* made of ivory; 17. bone decorated on both sides; 18. ivory figurine; 19. retoucher-pendant made of bone with half relief of a mammoth; 20. bone point. After Hahn, 1977 (1-17, 20).

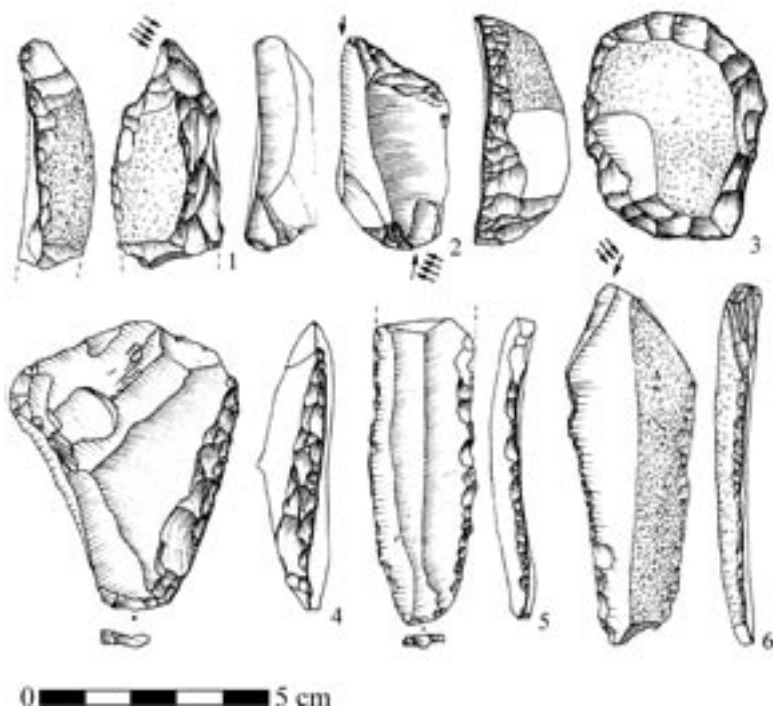


FIG. 15 – Aurignacian of Hohlenstein-Bärenhöhle: 1, 6. carinated burins; 2. burin on truncation combined with a dihedral burin; 3. double endscraper; 4. sidescraper; 5. retouched blade. After Hahn, 1977.

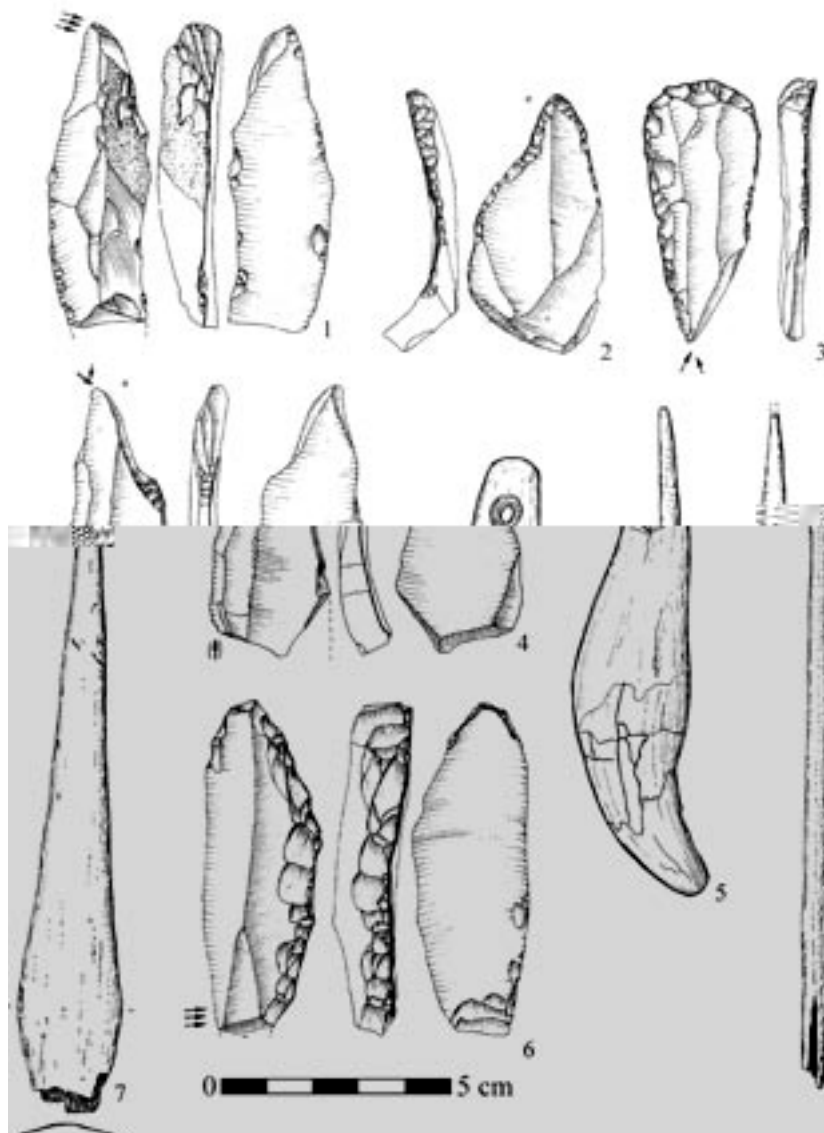


FIG. 16 – Aurignacian of Bocksteinhöhle: 1, 4. busked burins; 2. point; 3, 6. endscrapers combined with burins; 5. perforated cave bear canine; 7. bone point with split base. After Hahn, 1977.

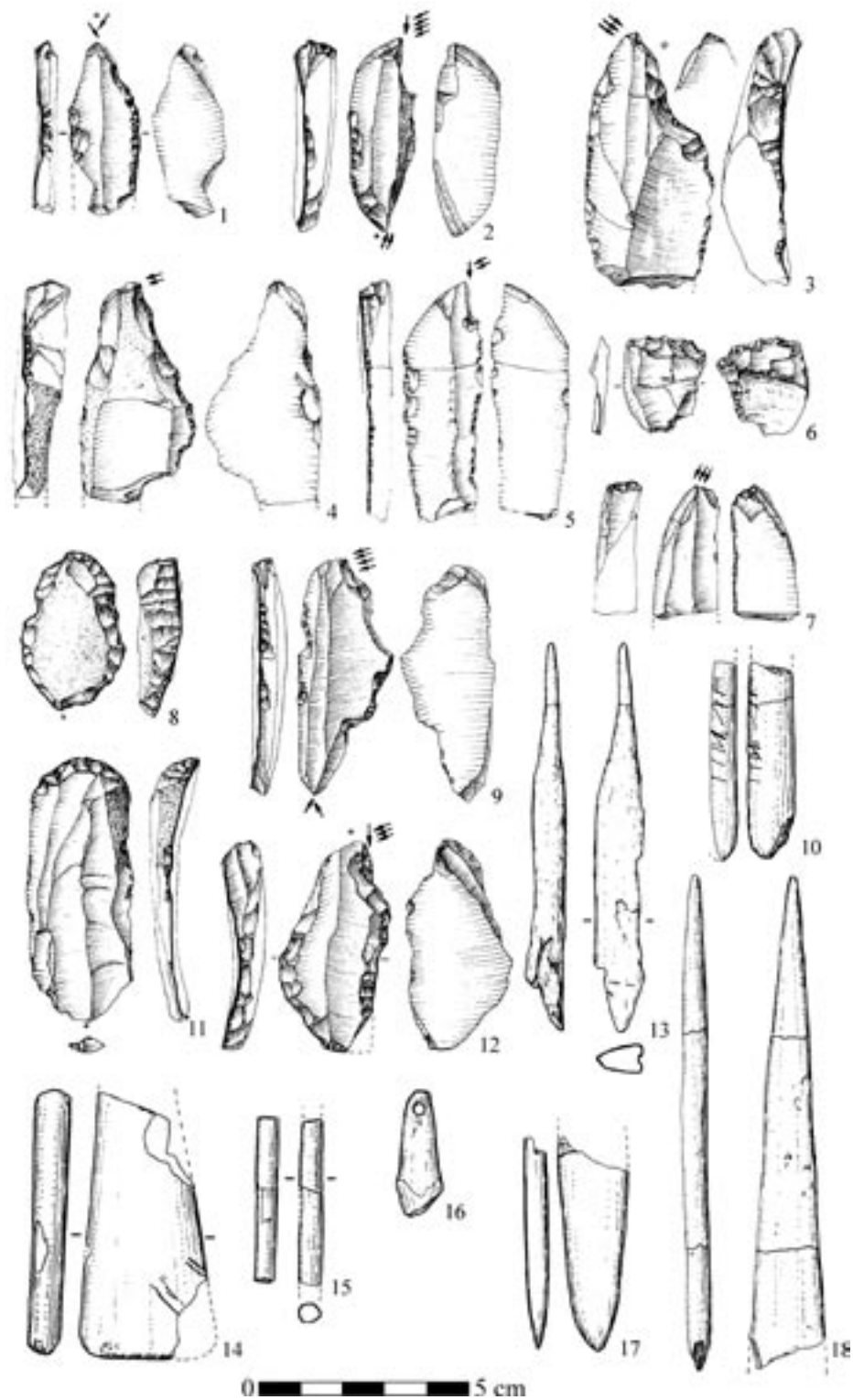


FIG. 17 – Aurignacian of Bockstein-Törle, layer VII: 1. dihedral burin; 2. double carinated burin; 3-4, 12. busked burins; 5, 7. carinated burins; 6. splintered piece; 8. double endscraper; 9. busked burin combined with a dihedral burin; 10. After Hahn, 1977.

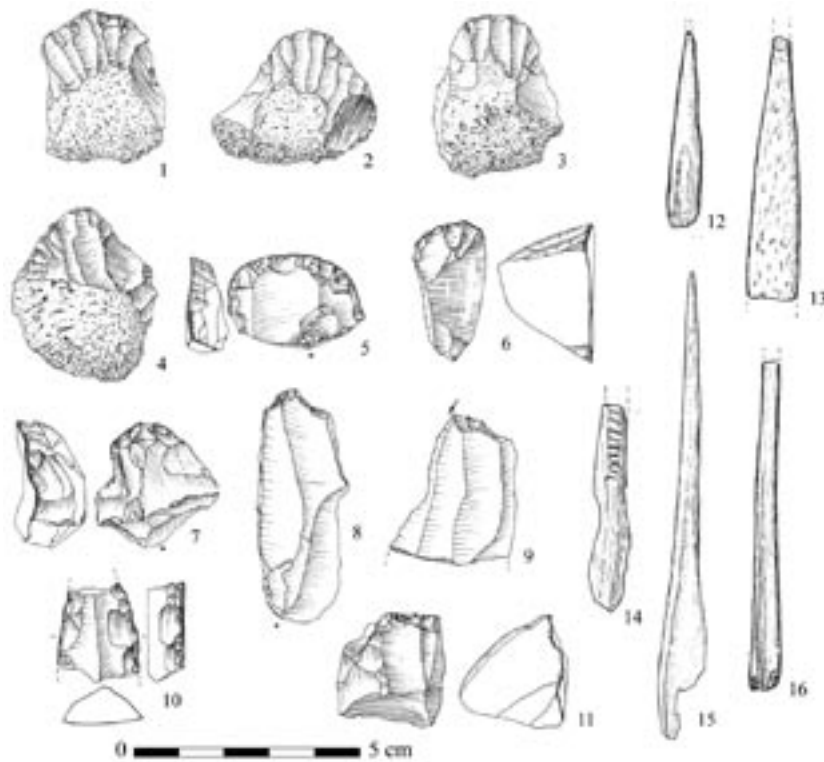


FIG. 18 – Aurignacian of Göpfelsteinhöhle: 1-4, 6. carinated endscrapers; 5. endscraper; 7. nosed endscraper; 8. borer (?); 9. burin on truncation; 10. laterally retouched blade (fragment of a pointed blade?); 11. bladelet core; 12, 15-16. bone awls; 13. antler point; 14. decorated bone fragment. After Hahn, 1977.

Acknowledgments

Many thanks are due our collaborators in the research in Swabia including Martina Barth, Susanne Feine, Harald Floss, Paul Goldberg, Piet Grootes, Michael Hofreiter, Petra Kieselbach, Luc Moreau, Susanne Münzel, Fred Smith, Solveig Schiegl, Nicolas Teyssandier, and Hans-Peter Uerpmann. Many students and the staff of the Department of Early Prehistory and Quaternary Ecology, especially Kurt Langguth and Maria Malina, have made major contributions to the excavations at Hohle Fels and Geißenklösterle. This work has been funded through the generous support of the Deutsche Forschungsgemeinschaft, the Landesdenkmalamt Baden-Württemberg, the Gesellschaft für Urgeschichte, the Museumsgesellschaft Schelklingen, and the Heidelberger Cement Company. Thanks are due to Maria Malina and Susanne Feine for producing many of the figures and illustrations. We are indebted to many colleagues including Alberto Broglio, Francesco d'Errico, James O'Connell, and Teresa Steele for helpful discussions. Finally, we thank João Zilhão and Ofer Bar-Yosef for the opportunity to participate in the Aurignacian meeting in Lisbon in June 2002 and for their generous hospitality.

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