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## THE TRANSITION FROM THE MIDDLE TO THE UPPER PALEOLITHIC IN THE SWABIAN JURA, SOUTHWESTERN GERMANY

**ABSTRACT:** *The Swabian Jura in southwestern Germany is a key region for the study of the late Middle Paleolithic and the evolution of the early Upper Paleolithic or Aurignacian in central Europe. Several cave sites in the Ach Valley, such as Hohle Fels, Geißenklösterle, and Sirgenstein, and in the Lone Valley, such as Vogelherd, Hohlenstein-Stadel, and Bockstein-Törle, have yielded considerable stratigraphic sequences with both Middle and Upper Paleolithic deposits. While some of the Middle Paleolithic assemblages can be attributed to the Keilmessergruppe or Micoquian, most of them can only in general be classified as "Swabian Mousterian". The find density in most Middle Paleolithic sites of Swabia is low and indicates that Neandertals visited most caves only sporadically and for short stays. The Aurignacian of Swabia, which started fully developed more than 40,000 years ago, marks a clear break and a radical shift in material culture. A similar shift can be observed with regard to the occupation intensity, which increases strongly with the Aurignacian. New technologies and tool types, made of both lithic and organic raw materials, are characteristic for the Aurignacian assemblages, which are supposed to have been produced by anatomically modern humans. Of particular importance are a broad variety of personal ornaments carved from mammoth ivory, bone and ivory flutes, and, most spectacular, ivory figurines. With ages of down to 40,000 years, the art objects and the musical instruments from the Swabian Jura represent the oldest examples of their kinds known from the archaeological record and prove that the Swabian Jura was one key center of innovations in the early Upper Paleolithic.*

**KEY WORDS:** *Southwestern Germany – Swabian Jura – Middle Paleolithic – Upper Paleolithic – Aurignacian – Figurative art – Musical instruments*

### INTRODUCTION

With several rich cave sites in the Ach and Lone Valleys, the Swabian Jura in southwestern Germany is one

of the key regions for the study of the late Middle Paleolithic and the evolution of the early Upper Paleolithic or Aurignacian in central Europe. It has been a major center of Paleolithic research since the 19<sup>th</sup> century that is

closely connected with excavations of Oscar Fraas, Robert Rudolf Schmidt, Eduard Peters, Gustav Riek, Robert Wetzel, Joachim Hahn, Nicholas Conard, and others (see Conard, Bolus 2006). Particularly renowned among the Swabian cave sites are Geißenklösterle, Hohle Fels, Vogelherd, and Hohlenstein-Stadel for having yielded the oldest universally accepted figurative art and musical instruments belonging to the Aurignacian period (Conard 2009a, b, Conard *et al.* 2004a, 2009, Floss 2007, Hahn 1986, Hahn, Münzel 1995). The long history of research and the abundance of deposits in many of the region's caves provide great potential for conducting detailed studies of how Neandertals and anatomically modern humans organized their subsistence and daily life in the Swabian Jura some 45–30,000 years ago.

### THE SWABIAN JURA AND ITS SITES

Geographically, Swabia corresponds to the eastern half of the modern state of Baden-Württemberg

(Figure 1). It covers the area from Lake Constance north to the border with the state Hessen and includes the westernmost part of the state of Bavaria. The most prominent topographic feature is the low Jurassic-aged limestone mountains and plateaus of the Swabian Jura, referred to in German as the *Schwäbische Alb*. The Swabian Jura ranges in elevation from about 450 to 1000 m and is characterized today by a relatively cool and wet climate. The Upper Danube Valley is located along the southern and eastern edge of the Swabian Jura, and the Neckar Valley helps to define the western border of the region. Most of the key Paleolithic sites are caves. Research in Swabia has typically focused on caves which in most cases provide excellent preservation of faunal remains while, although they are present, little is known about open-air sites (Conard *et al.* 2006).

The most important Swabian sites are represented by the caves in the Ach Valley 15 km west of Ulm between Schelklingen and Blaubeuren and the Lone Valley 25 km north of Ulm (Figure 1). Many of these sites, e.g., Hohle Fels, Geißenklösterle, and Sirgenstein in the Ach Valley

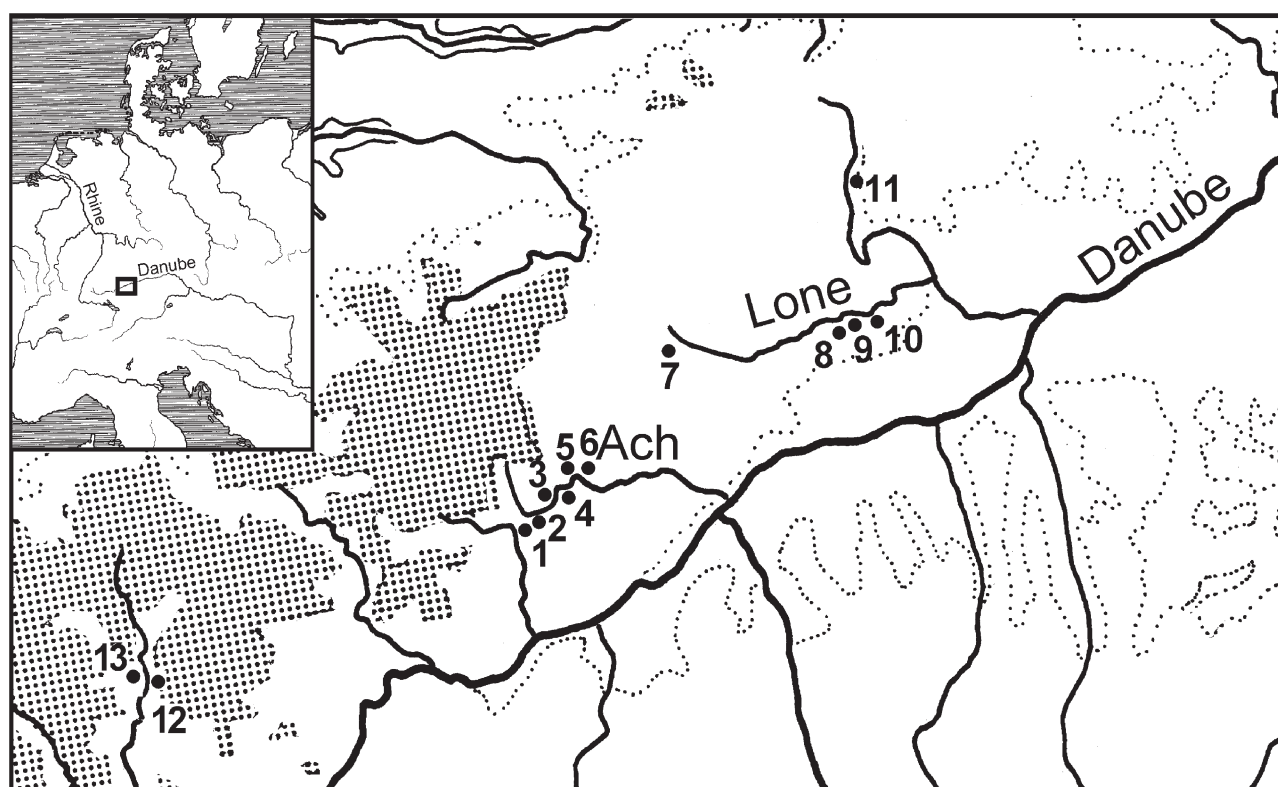


FIGURE 1. Map showing the major Middle and Upper Paleolithic sites in the Swabian Jura. 1, Kogelstein; 2, Hohle Fels; 3, Sirgenstein; 4, Geißenklösterle; 5, Brillenhöhle; 6, Große Grotte; 7, Haldenstein; 8, Bockstein; 9, Hohlenstein-Stadel and Hohlenstein-Bärenhöhle; 10, Vogelherd; 11, Heidenschmiede; 12, Schafstall; 13, Göpfelsteinhöhle. After Conard *et al.* (2012).

and Vogelherd, Hohlenstein-Stadel, and Bockstein-Törle in the Lone Valley have yielded considerable stratigraphic sequences with both Middle and Upper Paleolithic deposits. Other caves with shorter cultural sequences are known for their Middle Paleolithic (Große Grotte and Kogelstein in or next to the Ach Valley; Bocksteinschmiede and Haldenstein in the Lone Valley) or Upper Paleolithic (Brillenhöhle in the Ach Valley) assemblages respectively. Less well-known are the sites of Göpfelsteinhöhle (Göpfelstein Cave) and Schafstall in the Lauchert Valley in the southwestern part of the Swabian Jura which yielded Middle and Upper Paleolithic deposits, and the Middle Paleolithic rockshelter of Heidenschmiede in the municipal area of Heidenheim (Figure 1).

## CHRONOSTRATIGRAPHY

The Swabian cave sites play a crucial role in discussions about the age and the cultural context of the late Middle Paleolithic and early Upper Paleolithic or Aurignacian in central Europe. While for the Aurignacian a solid data framework is available, dates for the Middle Paleolithic are much rarer and are still problematic. Both in Geißenklösterle and in Hohle Fels some dates for the Middle Paleolithic deposits are

younger than those for the Aurignacian assemblages. Moreover, in the case of Geißenklösterle the dates do not show a clear pattern of increasing age with depth (Conard, Bolus 2003, 2008). Of course, one has to keep in mind that the radiocarbon dates for the Middle Paleolithic lie at the limit of the method and should be treated with caution. Much further systematic research will be necessary to clarify the chronology in detail. At least for Geißenklösterle, the situation has improved with new AMS dates measured with ultrafiltration technique and modeled with Bayesian statistics (Higham *et al.* 2012). At present an age of around 45–40,000 calendar years seems plausible for the late Swabian Middle Paleolithic.

The oldest dates for the Swabian Aurignacian fall into the same range. Here, Geißenklösterle, Hohle Fels, and Hohlenstein-Stadel are the most important sites with about 90 radiocarbon dates and independent confirmation of the early  $^{14}\text{C}$  dates, using TL measurements on burnt flint for the Aurignacian deposits (Beutelspacher *et al.* 2011, Conard 2009a, Conard, Bolus 2008, Higham *et al.* 2012, Richter *et al.* 2000). In general, the uncalibrated radiocarbon dates for the Swabian Aurignacian range between 40,000 and 30,000 BP, with ages between 35,000 and 30,000 BP being more common than earlier dates. Calibrated and modeled ages

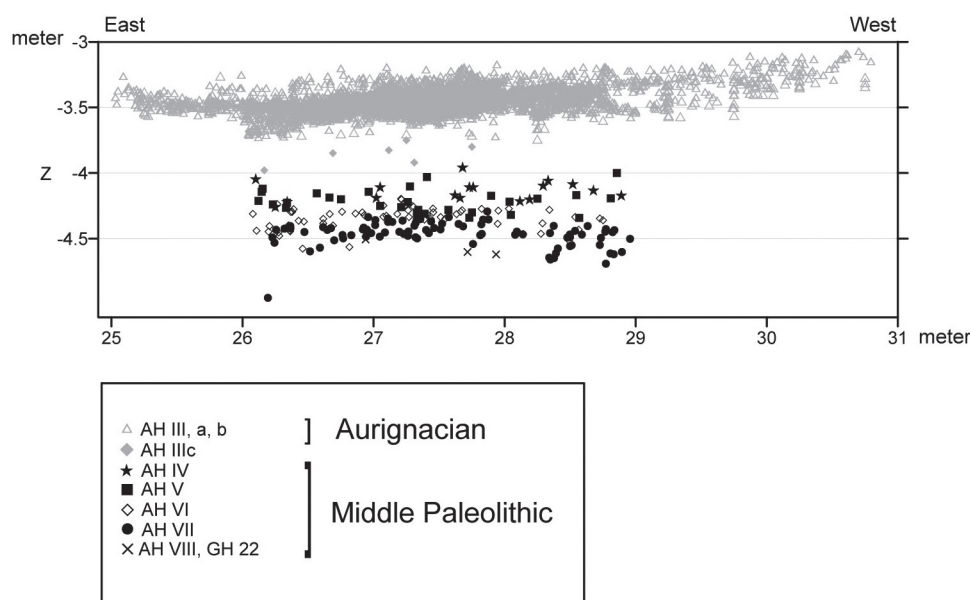


FIGURE 2. Geißenklösterle. Vertical distribution of lithic and organic artifacts from the lower Aurignacian and the Middle Paleolithic deposits. Archaeological Horizon (AH) IIIc marks an archaeologically almost sterile layer separating Middle and Upper Paleolithic. After Conard *et al.* (2006).

reach as far back as about 43,000 (Higham *et al.* 2012). Seen in a European scale, this means that the Aurignacian appeared rather early in the Swabian Jura, suggesting an early migration of anatomically modern humans into Swabia via the Danube Valley.

This is in accordance with two models developed in Tübingen in connection with the sites of the Swabian Jura: the Danube Corridor and *Kulturpumpe* models (Conard 2002, Conard, Bolus 2003, Conard, Floss 2000). According to the former, anatomically modern humans rapidly entered the interior of Europe following the Danube Valley. The latter model presents competing working hypotheses to explain the early advent of fully modern behavior and the cultural innovations of the Aurignacian and Gravettian in the Swabian Jura. Dates from several sites in the region document Gravettian tool kits before 30,000 BP (Conard, Bolus 2008, Higham *et al.* 2012). These rich assemblages predate similar finds in central Europe and correspond to a period when the Aurignacian was still widespread in Western Europe (Conard, Bolus 2003, Delporte 1998, Djindjian *et al.* 1999, Moreau 2009).

Although the dates for the Swabian late Middle Paleolithic and the Aurignacian overlap to a certain degree, there can be no doubt about the cultural and stratigraphic relationship of both complexes. Robert Rudolf Schmidt (1912) following his excavations in Sirgenstein, and Gustav Riek (1934) following his fieldwork in Vogelherd, had already pointed out that archaeologically sterile deposits separated the uppermost Middle Paleolithic from the lowermost Aurignacian. This was confirmed by Joachim Hahn in Geißenklösterle and, more recently, by Nicholas Conard in Hohle Fels (Conard *et al.* 2006, Hahn 1988) (*Figure 2*).

## THE HUMAN FOSSIL RECORD

The human fossil record from the Swabian Jura is very sparse as far as the Middle Paleolithic and the Aurignacian are concerned. Only one single Neandertal femur has been excavated from the Mousterian levels of Hohlenstein-Stadel (Kunter, Wahl 1992). Nevertheless, it seems plausible that Neandertals were responsible for all Middle Paleolithic assemblages in Swabia. Since the Vogelherd fossils, long thought to be of Aurignacian age, proved to be Neolithic (Conard *et al.* 2004b), the Aurignacians of the Swabian Jura themselves are only known from three isolated teeth from Sirgenstein and possibly one tooth from Hohlenstein-Stadel (Conard, Bolus 2003). All belong to anatomically modern humans,

and despite the scarcity of human remains, this suggests that anatomically modern humans are responsible for all assemblages of the Swabian Aurignacian.

## THE SWABIAN MIDDLE PALEOLITHIC

While Middle Paleolithic open-air sites are very rare in the Swabian Jura (e.g., Börslingen: Floss *et al.* 2012, see also Conard *et al.* 2012), several caves in both the Ach and the Lone Valleys have yielded deposits with Middle Paleolithic assemblages. Some of these, especially those from Bocksteinschmiede (Wetzel, Bosinski 1969), can be attributed to the *Keilmessergruppe* (Micoquian/Pradnikian) (*Figure 3:3*) which include backed bifacial knives (*Keilmesser*), handaxes and a broad variety of sidescrapers (see Jöris 2004). Other assemblages or single finds in the Swabian Jura outside the Ach and Lone Valleys that can be grouped into this techno-complex include Heidenschmiede (Peters 1931) (*Figure 3:2, 3:5–6*) and Winterhalde (Conard 2000) (*Figure 3:4*), both in the municipal area of Heidenheim.

A very small assemblage from Haldenstein cave in the Lone valley consists of two bifacial leaf points (*Blattspitzen*) (*Figure 3:1*), a large blade, and associated faunal remains (Riek 1938). This assemblage belongs to the *Blattspitzen* Group, which, although not adequately dated, seems to represent the latest expression of the Middle Paleolithic (Bolus 2004a, Bosinski 1967). Unfortunately, assemblages belonging to the *Blattspitzen* Group are extremely rare in the Swabian Jura and in general only consist of few lithic artifacts.

In contrast to colleagues in other parts of Europe, for instance eastern central Europe, the German research tradition does not view the *Blattspitzen* Group as an initial Upper Paleolithic techno-complex but instead classifies it as belonging to the latest Middle Paleolithic. In this sense, it might also be grouped among the so-called transitional techno-complexes, which have often been described in many parts of Europe but seem to be nearly lacking in Germany (Bolus 2004b).

Most Middle Paleolithic deposits in the Swabian Jura, including those from Große Grotte (but perhaps excluding the layer II assemblage which includes two bifacial leaf points), Sirgenstein, Geißenklösterle, Hohle Fels, Kogelstein, Hohlenstein-Stadel, and Hohlenstein-Bärenhöhle, yielded non-standardized assemblages which may in general be classified as Swabian Mousterian (Beck 1999, Böttcher *et al.* 2000, Conard *et al.* 2012, Riek 1934, Schmidt 1912, Wagner 1983). In



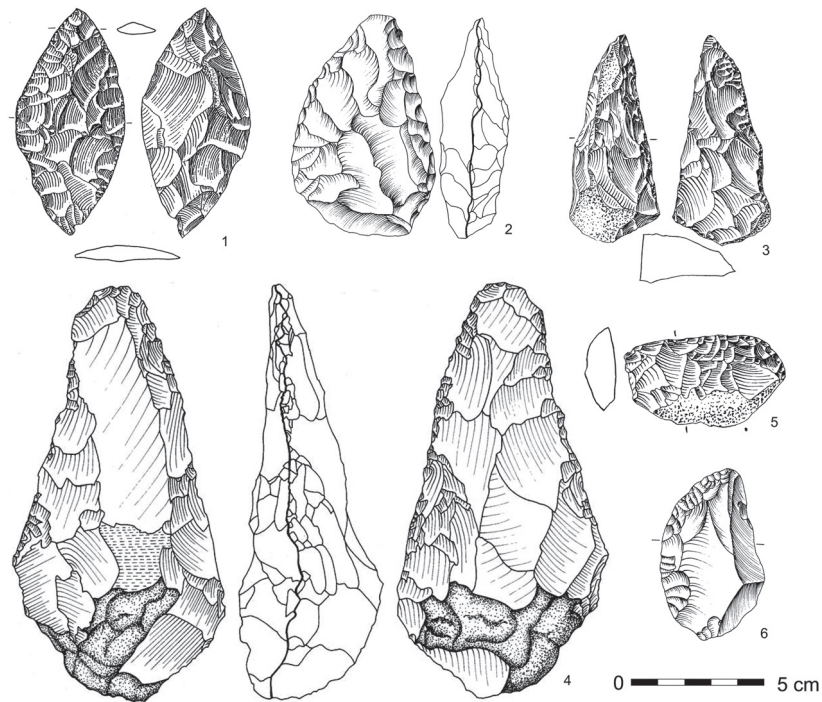


FIGURE 3. Middle Paleolithic stone tools from the Swabian Jura. 1, Haldenstein; 2, 5–6, Heidenschmiede; 3, Bocksteinschmiede; 4, Winterhalde. 1, *Blattspitze* (bifacial leaf point); 2, small handaxe (*Fäustel*); 3, *Keilmesser* (backed bifacial knife); 4, handaxe; 5–6, sidescrapers. After Conard *et al.* (2012).

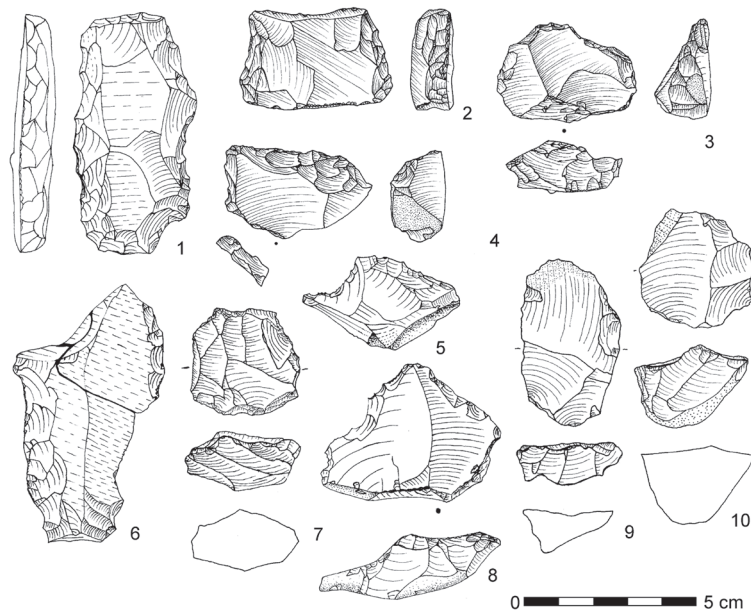


FIGURE 4. Late Middle Paleolithic stone artifacts from Geißenklösterle (1–4) and Hohle Fels (5–10). 1–2, 4–6, sidescrapers; 3, retouched flake with faceted platform remnant; 7–10, Levallois cores. After Conard *et al.* (2012).

most cases, these assemblages are not very rich, and are characterized by small irregular Levallois cores and a limited set of formal tools, mostly sidescrapers and, much rarer, points (*Figure 4*).

Organic tools are very rare in the Swabian Middle Paleolithic; they are only represented by bone points from Vogelherd and Große Grotte, a pointed rib from Vogelherd, and some bone retouchers from Vogelherd and Sirgenstein (*Figure 5*). Secure evidence of personal ornaments is completely lacking (Bolus, Conard 2006,

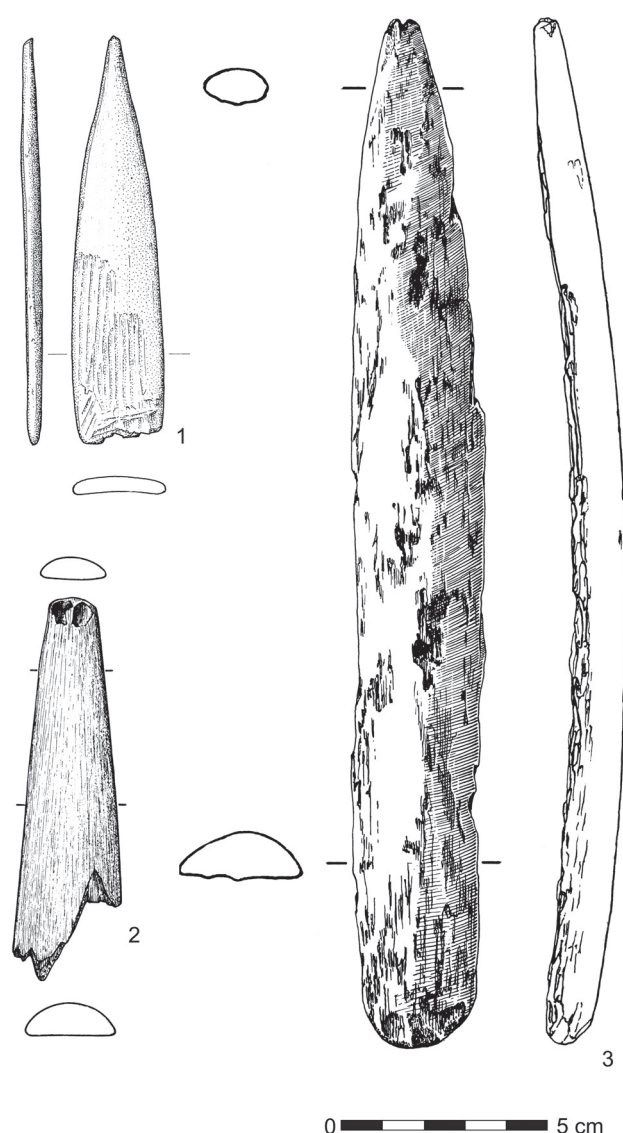


FIGURE 5. Organic artifacts from the late Middle Paleolithic of the Swabian Jura. 1, 3, Vogelherd; 2, Große Grotte. 1–2, bone points; 3, pointed rib. After Conard *et al.* (2006).

Conard *et al.* 2006, 2012, Münzel, Conard 2004, Riek 1934, Schmidt 1912, Wagner 1983).

The best evidence for anthropogenic features comes in the form of a fireplace at Sirgenstein (Schmidt 1912) and concentrations of burnt bone at sites including Große Grotte (Wagner 1983), Bocksteinschmiede (Wetzel 1958), and perhaps Hohlenstein-Stadel (see Beck 1999). The use of bone as fuel suggests that wood and other plant fuels were not always available in sufficient quantities to supply the lighting, cooking and heating needs of the Neandertal populations (Conard *et al.* 2012).

Horse and reindeer were the most frequently hunted animal species. Woolly rhino is much less frequent but reaches higher percentages than in the Swabian Aurignacian. Cave bear is abundant in all Middle Paleolithic sites but although some cave bear bones show slight traces of anthropogenic modification, there is no clear indication that Neandertals hunted this animal (Conard, Münzel 2004, Conard *et al.* 2012, Kitagawa 2014, Krönneck 2012, Krönneck *et al.* 2004).

The low find density in most Middle Paleolithic sites of Swabia indicates that Neandertals visited most caves only sporadically and for short stays. In contrast, the large number of cave bear bones shows that bears used the caves much more intensively than humans during the Middle Paleolithic (Conard *et al.* 2012).

## THE SWABIAN AURIGNACIAN

The Swabian Jura is particularly well-known for its Aurignacian deposits, especially those from Geißenklösterle and Hohle Fels. Starting with the lowermost Aurignacian assemblages – Geißenklösterle AH III, Hohle Fels AH Vb, and Hohlenstein-Stadel AH A/1 – some 43–40,000 years ago, the material culture in Swabia changes dramatically. Abundant data from the Swabian sites show a wide spectrum of new artifact types, both lithic and organic, and a variety of personal ornaments as well as figurative art and musical instruments which are totally lacking in the local Middle Paleolithic assemblages (Conard, Bolus 2006) (see *Figure 10*). Evidence from the basal Aurignacian of AH Vb at Hohle Fels demonstrates that the Swabian Aurignacian was fully developed from the beginning and contained the whole "package" of early Upper Paleolithic innovations including symbolic artifacts.

The lithic technology of the Swabian Aurignacian is based on unidirectional blade and bladelet production; moreover, there is also some evidence of systematic flake production (Bolus 2012). Blades, and to a much lower

degree, bladelets were produced from platform cores while in most cases carinates served for the production of bladelets. This leads to the conclusion that the production of blades and bladelets followed frequently, but not exclusively, separate reduction sequences.

Retouched forms include a wide variety of tools such as carinated and nosed endscrapers (which might, as

mentioned, also be seen as bladelet cores), simple endscrapers, burins of various types including busked and carinated burins, *Spitzklingen* (pointed blades), splintered pieces, truncated pieces and blades with lateral Aurignacian retouch (Conard, Bolus 2006) (*Figure 6*). All of these forms are completely lacking in the preceding Middle Paleolithic of the region.

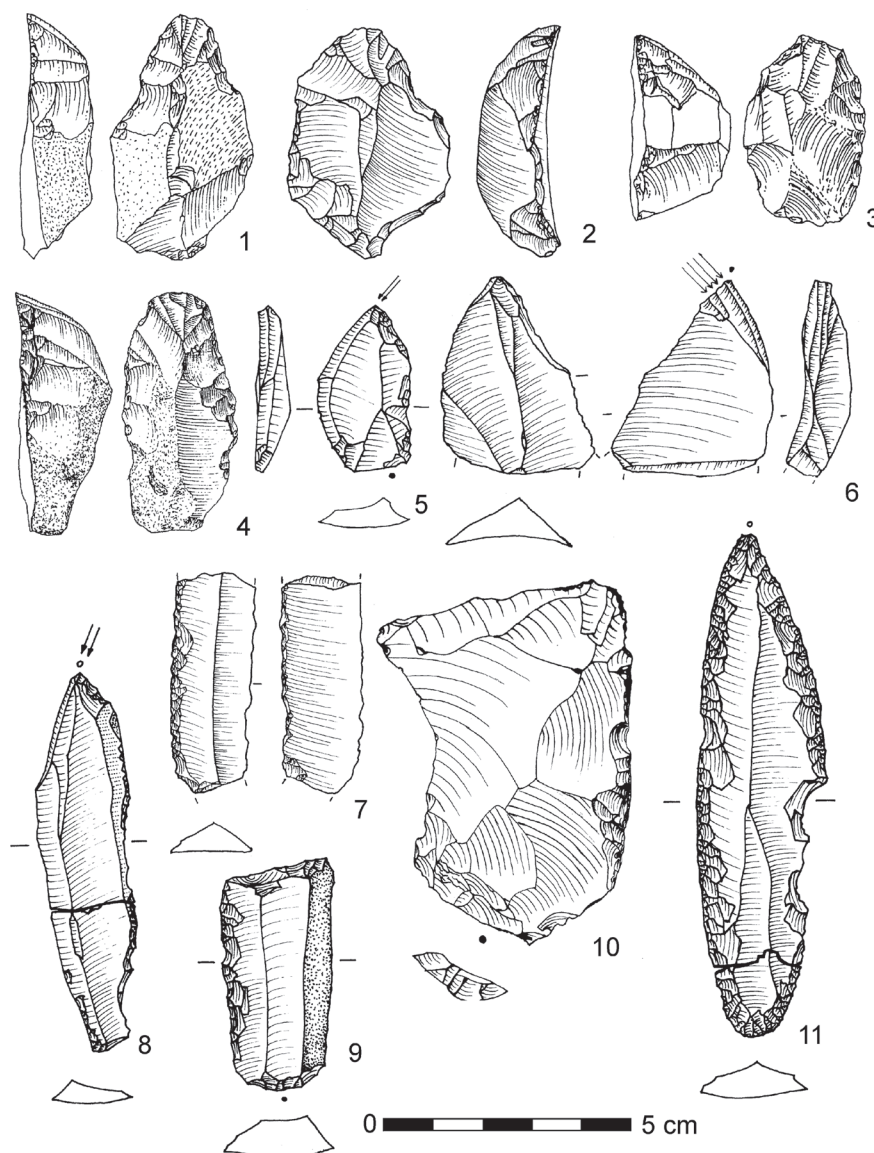


FIGURE 6. Lithic artifacts from the early Swabian Aurignacian. 1, 3–4, Geißenklösterle, Archaeological Horizon (AH) III; 10, Hohle Fels AH V; 2, 5–9, 11, Hohle Fels AH IV. 1–2, nosed endscrapers; 3–4, carinated endscrapers; 5, 8, burins on truncation; 6, busked burin; 7, laterally retouched blade; 9, blade with double truncation; 10, sidescraper; 11, *Spitzklinge* (pointed blade). After Conard *et al.* (2006).



Organic tools are present with a remarkable variety of types (Conard, Bolus 2006). First and foremost, projectile points have to be mentioned here. Pencil-shaped ivory points are known from the lowermost Aurignacian deposits of Geißenklösterle and Hohle Fels (Bolus, Conard 2006) (Figure 7:6, 7:9). Split-based bone

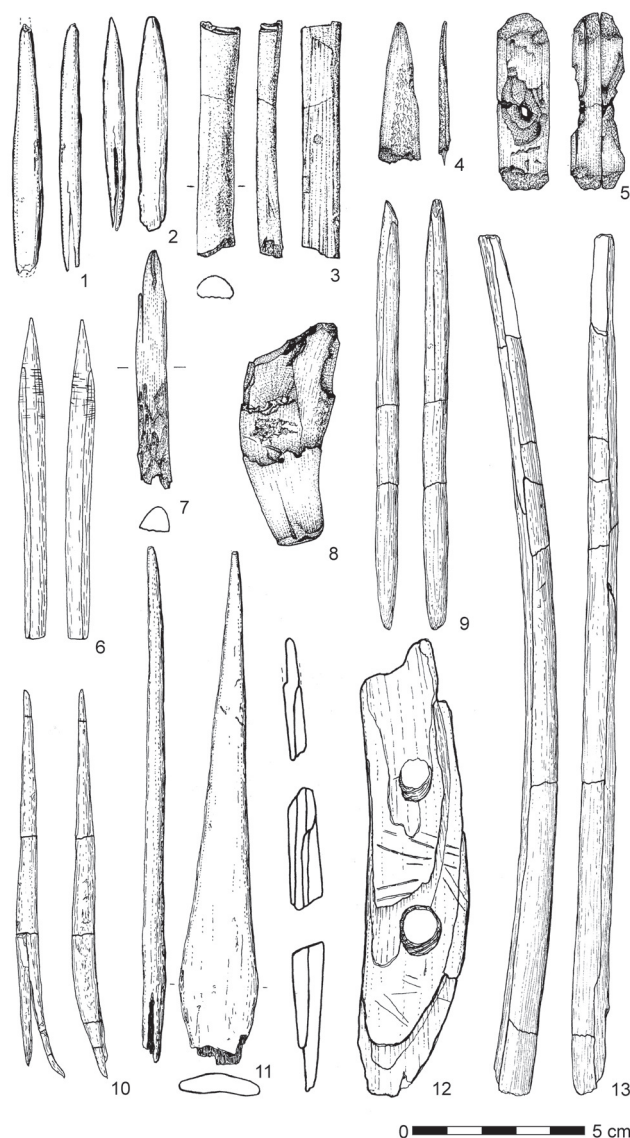


FIGURE 7. Organic artifacts from the Swabian Aurignacian. 1–2, 12, Vogelherd V; 5–7, Hohle Fels AH V; 3–4, 8, Hohle Fels AH IV; 9, Geißenklösterle AH III; 10, 13, Geißenklösterle AH II; 11, Bocksteinhöhle. 1–2, 10–11, bone points with split base; 3, ivory rod; 4, bone point fragment; 5, perforated ivory object of unknown function; 6–7, 9, 13, ivory points; 8, retoucher made of a cave bear canine; 12, *bâton percé* of ivory. After Conard *et al.* (2006).

points, type fossil of the early Aurignacian, are known from several sites including Bocksteinhöhle, Vogelherd, and Geißenklösterle (Figure 7:1–2, 7:10–11). At Hohle Fels split-based points with an age of down to 40,000 years are already present in the lowermost Aurignacian layer AH Vb (Conard, Malina 2009). Given the age of about 32,000 years for one specimen from Brillenhöhle (Bolus, Conard 2006), split-based points appear almost throughout the whole "lifespan" of the Swabian Aurignacian. Other types of organic tools include burnishers, awls, ivory rods (Figure 7:3), perforated ivory objects of unknown function (Figure 7:5), retouchers (Figure 7:8), and *bâtons percés* made of ivory (Figure 7:12). In general, the marked presence of ivory objects, including much debris from their fabrication, is a striking trait of the Swabian Aurignacian (Wolf 2014).

Personal ornaments include a wide array of perforated and grooved teeth from carnivores and herbivores (Figure 8:6–7, 8:14, 8:16–17). Moreover, the

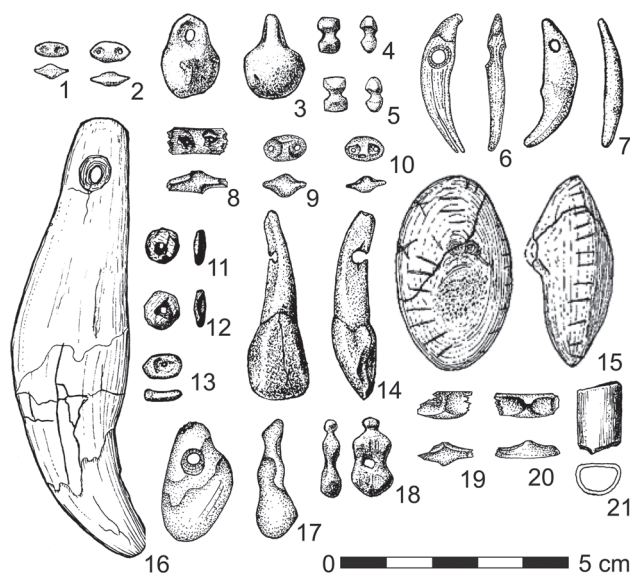


FIGURE 8. Personal ornaments from the Swabian Aurignacian. 1–2, Hohle Fels, Archaeological Horizon (AH) V; 6–14, 17–20, Hohle Fels AH IV; 3–5, Hohle Fels AH III; 21, Geißenklösterle AH III; 15, Geißenklösterle AH II; 16, Bocksteinhöhle. 1–2, 9–10, double perforated ivory beads; 3, basket-shaped ivory bead; 4–5, toggle shaped ivory objects; 6–7, perforated fox canines; 8, 19–20, half-finished ivory beads; 11–12, disc-shaped ivory beads; 13, ivory bead; 14, perforated tooth; 15, retoucher of antler used as pendant; 16, perforated cave bear canine; 17, perforated upper eyetooth from red deer; 18, violin-shaped ivory pendant; 21, bone bead. After Conard *et al.* (2006).



Aurignacian sites have produced a variety of fully carved beads and pendants from mammoth ivory. Most characteristic are finely carved double perforated beads which have been found both in Ach and Lone Valley sites (Figures 8:1–2, 8:9–10, 10b). They are not known from Aurignacian contexts elsewhere. All stages of production of the beads can be documented at Hohle Fels, Geißenklösterle and Vogelherd (Figure 8:8, 8:19–20). Double perforated ivory beads appear throughout the whole lifespan of the Swabian Aurignacian, the oldest specimens – with an age of down to 40,000 years – coming from AH Vb of Hohle Fels and from AH III of Geißenklösterle, while the youngest ones, with an age of 30–29,000 years, are from AH IIe of Hohle Fels and AH IV of Sirgenstein. Other forms include, among many others, basket shaped ivory pendants, small ivory discs, toggle- and violin-shaped ivory beads (Figures 8:3–5, 8:11–13, 8:18; 10c–d) (Conard 2003a, Wolf *et al.* 2013). A singular object is a retoucher of antler, used as pendant (Figure 8:15).

Integral traits of the Swabian Aurignacian are the presence of figurative art represented primarily by small figurines carved from mammoth ivory, and of musical instruments. To date, four caves – Hohle Fels, Geißenklösterle, Vogelherd, and Hohlenstein-Stadel – have yielded about 50 art objects which, while often fragmentary, represent the most impressive examples for symbolic artifacts within the Swabian Aurignacian and which have ages between 40,000 and 30,000 years (Floss 2007, Hahn 1986, Riek 1934). In most cases, animals are depicted: mammoths (Figures 9:5, 10a), felines, horses (Figure 9:3), bison (Figure 9:4) and other, less frequently depicted species including a bear, a waterbird (Figure 9:1), and a fish (Conard 2003b, 2009b). Regularly, the figurines bear symbolic signs, the meaning of which is unknown (see, e.g., Figure 9:2–5). A special group is represented by therianthrope figurines which combine human with animal features. Two of them, one from Hohlenstein-Stadel with a length of about 30 cm and one from Hohle Fels with a length of less than 3 cm, are referred to as *Löwenmenschen* (Lion men), since they show a combination of characteristics of lions and humans (Conard 2003b, Ebinger-Rist *et al.* 2013, Schebesch 2013). A third object, a small ivory plate from Geißenklösterle (Figure 9:2), bears the half-relief of a figure with uplifted arms which might also represent a Lion man (Hahn 1986, Schebesch 2013).

A singular piece of art is a Venus figurine carved from mammoth ivory which was discovered in the basal Aurignacian of AH Vb in Hohle Fels (Conard 2009, Schebesch 2013). The Venus is 6 cm high and lacks

a head. Instead, an off-center, but carefully carved ring is located above the broad shoulders of the figurine (Figure 10e). Beneath the shoulders, large breasts project forwards. The figurine has two short arms with carefully carved hands resting below the breasts. An oversized vulva is visible between the legs. A radiocarbon age of down to 40,000 years makes this Venus the oldest of all figurines recovered from the Swabian caves, and perhaps the earliest example of figurative art worldwide. With this discovery, the idea that three-dimensional female depictions of the Willendorf type developed not earlier than in the Gravettian some 10,000 years later can be rejected (Conard 2009).

Only 70 cm away from the Venus, the same find layer produced a flute made from a vulture bone (Conard *et al.* 2009). The fact that with this instrument eight Aurignacian flutes are known from three Swabian caves – Geißenklösterle, Hohle Fels, and Vogelherd – shows that a musical tradition existed in the Swabian Jura as early as 40,000 years ago. Four of the flutes are made from bird bones (Figure 9:6), the other four are made from mammoth ivory (Conard 2007, Conard *et al.* 2009, Hahn, Münzel 1995) (Figure 10f). While considerable skill is required to make a flute from a bird

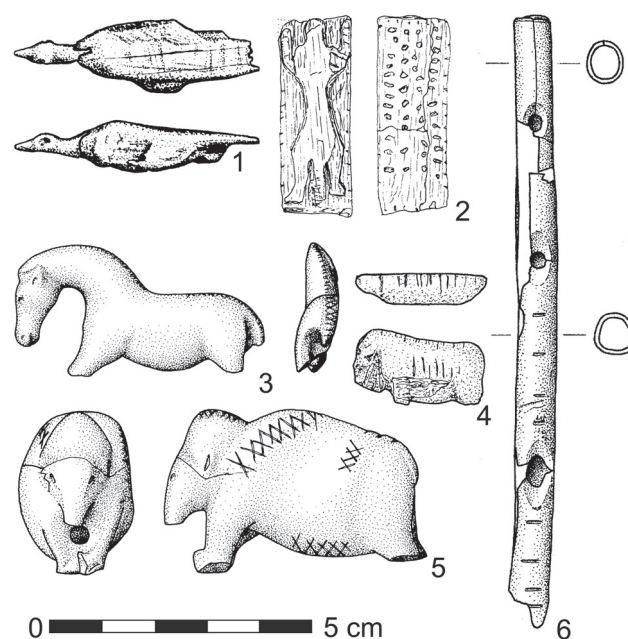


FIGURE 9. Art objects and musical instruments from the Swabian Aurignacian. 1, Hohle Fels, Archaeological Horizon (AH) IV; 2, 4, 6, Geißenklösterle AH II; 3, 5, Vogelherd V. After Conard *et al.* (2006).

bone which is naturally hollow, it is a demonstration of technical mastery to carve a flute from a massive piece of ivory (Conard *et al.* 2004a). One of the most surprising observations is that with these Aurignacian flutes it is possible to play complex melodies, just as with modern flutes.

The Aurignacian deposits in Hohle Fels yielded a number of anthropogenic features which are fire-related but represent dumping areas rather than real fireplaces (Conard, Bolus 2008). At least one fireplace was excavated in the lower Aurignacian (AH III) in Geißenklösterle (Conard, Malina 2002, Hahn 1988,

1989), while the upper Aurignacian (AH II) yielded a large concentration of burnt bones (Hahn 1988). For the Aurignacian deposits of both Sirgenstein and Vogelherd, several fireplaces are documented by the excavators (Riek 1934, Schmidt 1912).

Subsistence in the Swabian Aurignacian was based primarily on horse and reindeer just as in the Swabian Middle Paleolithic, although moreover, there is a small percentage of mammoth, which was very sparsely exploited by Neandertals (Conard *et al.* 2012, Kitagawa 2014, Krönneck 2012, Krönneck *et al.* 2004, Münzel, Conard 2004).



FIGURE 10. Ivory objects from the Swabian Aurignacian. a, Mammoth figurine from Vogelherd; b–d, personal ornaments from Hohle Fels; e, Venus figurine from Hohle Fels; f, flute from Geißenklösterle. © University of Tübingen: a, f, Photo by J. Lipták; b–e, by H. Jensen; compilation by M. Malina.

The find density in the Swabian Aurignacian is much higher than for the preceding Middle Paleolithic. This seems to indicate that Aurignacians used the caves much more intensively than the Neandertals (Conard *et al.* 2012). This is underlined by the fact that cave bear bones, though still numerous, are much less abundant than in the Middle Paleolithic when human presence in the caves had only been sporadic.

## DISCUSSION AND CONCLUSIONS

The archaeological record of southwestern Germany shows a clear break between the late Middle Paleolithic and the earliest Upper Paleolithic or Aurignacian. Although human fossils are sparse in Swabia, so far Neandertal remains have been found only in association with Middle Paleolithic artifacts and modern humans exclusively with Upper Paleolithic assemblages. Thus, the fact that in most cases the late Middle Paleolithic and the Aurignacian are separated from each other by sterile or nearly sterile layers indicates that no Neandertals lived in the Swabian Jura when anatomically modern humans arrived there more than 40,000 years ago. The Swabian Aurignacian appears suddenly in a highly developed form containing numerous regionally unique signatures (*Figure 10*) and differs strongly from the local Middle Paleolithic. Real transitional assemblages are lacking with the exception of a few small assemblages belonging to the *Blattspitzen* Group.

An analysis of the find densities in Swabian Middle Paleolithic and Aurignacian deposits demonstrates a shift in occupation intensity. Though the mere numbers of lithic artifacts, burnt bone, charcoal, and anthropogenically modified faunal remains do not automatically reflect the time and intensity of occupation, most of these data reveal a factor of 10 or even 100 times more cultural debris per unit sediment volume during the Aurignacian compared with the Middle Paleolithic (Conard 2011, Conard *et al.* 2004a, 2012). Even if these figures are viewed as rough approximations, the intensity of occupation at carefully excavated and documented sites such as Hohle Fels and Geißenklösterle was far lower in the Middle Paleolithic than in the Aurignacian. This seems to reflect an increase in population densities in the Aurignacian relative to the Middle Paleolithic.

While most assemblages of the late Swabian Middle Paleolithic do not allow a classification other than "Swabian Mousterian", the Swabian Aurignacian yielded spectacular objects. It started more than 40,000 years ago

in this region, and right from the start, this techno-complex is characterized by a full "package" of Upper Paleolithic innovations such as new technologies, new tool-types, both lithic and organic, a variety of personal ornaments, and, perhaps most impressively, figurative art and fully developed musical instruments, both representing the oldest examples known worldwide: nowhere else can these singular early Upper Paleolithic features be traced to such an early date.

Given that many artifact forms, most notably certain personal ornaments, figurative mobile art and musical instruments (*Figure 10*), are exclusively limited to the Aurignacian of the Swabian Jura, this region can be viewed, within a polycentric framework, as one key center of cultural innovation during the early Upper Paleolithic (Conard 2011). Other potential centers of innovation are located, for instance, in northern Italy and in southwestern France. The data from the Swabian Jura is consistent with a model of modern humans using the Danube Corridor as one main route for early Upper Paleolithic migration into central Europe (Conard, Bolus 2003).

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