Publication accepted for:

J.-P. Fagnart, L. Mevel, B. Valentin and M.-J. Weber (eds.), L'Europe du Nord-Ouest autour de 10 000 BP (9 600 cal BC): quels changements? Conference Proceedings of the XXVIIIe congrès préhistorique de France Amiens, 30th Mai – 4th June 2016, The Final Palaeolithic of Northern Eurasia. Session 3 (2nd – 3rd June 2016). Paris 2017, in prep.

The Late Palaeolithic and Early Mesolithic in (north)eastern Germany

Daniel Groß[1], Clemens Pasda[2], Birgit Gehlen[3]

[1] corresponding author; Centre for Baltic and Scandinavian Archaeology (ZBSA), Foundation Schleswig-Holsteinische Landesmuseen Schloss Gottorf, 24837 Schleswig, Germany; daniel.gross@schloss-gottorf.de

[2] Friedrich-Schiller-Universität Jena, Bereich für Ur- und Frühgeschichtliche Archäologie, Löbdergraben 24a, 07743 Jena, Germany

[3] University of Cologne, CRC 806, Project D4, Bernhard-Feilchenfeld-Str. 11, 50969 Cologne, Germany

Abstract

The late Palaeolithic and early Mesolithic in (north) eastern Germany provides good insights into cultural aspects of hunter-gatherer-communities due to the amount and density of key-sites. Representing different geographical zones like coast, lowlands, or middle range mountains, the areas inhabited by Late Pleistocene and Early Holocene hunter-gatherers show a distinct variety within their ecological constraints. Likewise other regions in Europe, these shifted in the area under investigation as a consequence of the repeated ecological changes.

Regarding the archaeological finds, the presented area has been settled by several archaeological cultures or groups synchronously as well as diachronically. Therefore it serves as a good area for investigating contacts and changes in the archaeological record. Sites with fairly high significance (e.g. Abri Fuchskirche, Golßen, Friesack, Hohen Viecheln, Kleinlieskow, Reichwalde, Wustermark 22) render possible the link of archaeological finds and palaeo-environmental investigations and hence provide much better insights into the life of prehistoric foragers than many other regions. When it comes to regionalism, eastern Germany provides the opportunity to trace the connections or interferences of the "lowland-cultures" with those from higher elevations and serve as a bridging area between eastern, western, and southern traditions in Central Europe, both in the Palaeolithic and Mesolithic.

In this paper we present some summaries of some extraordinary sites and overarching cultural developments. Specific differences between and alterations within Late Pleistocene and Early Holocene communities are discussed. The changes during the Late Palaeolithic

seem to be marked by traditional constraints and perhaps reflecting cultural entities whereas changes during the Mesolithic seem to follow common trends on a supra-regional perspective but with more regional specifications.

Geomorphological context

Eastern Germany is primarily characterized by two geomorphological areas: On the one hand there are large lowland areas which are framed by the Baltic Sea in the North and on the other hand the southern part is characterized by the fringes of the Middle Range Mountains.
While the lowland was formed by the Saalian and Weichselian glaciers and presents today with corresponding geomorphological situations, the southern half of Eastern Germany is a 600-1200m high mountainous area with the Hercynian Mountain, the Thuringian Forest, the Ore Mountains, the Elbe Sandstone Mountains and the Zittau Mountains. The northern foreland of these mountain ranges is crossed by the rivers Ilm, Saale, Weiße Elster or Mulde that flow into the Elbe. Today, this area is part of Thuringia, Saxony and the southwestern half of Saxony-Anhalt. The Elbe riverforms the border to the large North European Plain, part of which is Lower Lusatia in most southern Brandenburg. This is where Saalian glacier melt waters formed the extensive ice margin valleys that characterize large parts of the lowlands in eastern Germany. Due to the more limited extension of the Weichselian glacier, its ice margin valleys are located further north, but follow a similar east-west orientation (fig. 1).
The valleys are connected by several smaller channels and are characterized by fens today. Thus, good preservation conditions are typical for Late Palaeolithic and Early Mesolithic sites from the eastern German lowland – predominantly those from the ice margin valleys. However, less ground water saturated areas and uplands provide less favourable opportunities for finding organic artefacts (fig. 2).

The area presented here is well-known for its Magdalenian and early Holocene sites (Geupel, 1985; 1987; Gramsch, 2010; Küßner, 2009; Küßner and Jäger, 2015). According to a radiocarbon date of 13341–12885 cal. BC (12,685 ± 55 BP (OxA-13849; Grünberg, 2006)) the last Magdalenian occupation may be represented by the site of Wallendorf (Weinberg), formerly Friedensdorf and Kriegsdorf, in the Saale valley of southern Saxony-Anhalt (Küßner, 2009, p. 69-73). Here, only remains of horses have been found. Among the ca 880 lithics 35% represent blades and bladelets, among the ca 70 lithic tools backed bladelets predominate and burins as well as end scrapers are the most common domestic tools.

Final Palaeolithic

At the end of GS-2 (tab. 1) in the mountainous area of eastern Germany, river incision started to change fluvial dynamics from braided to meandering systems (Friedrich et al., 2001; Mol et al., 2000). Soil development started in GI-1e in loess covered areas (Meszner et al., 2013, p. 105) as well as in lower areas covered by aeolian sand (Friedrich et al., 2001). With the onset of the Holocene, the Late Weichselian terrace was covered by 4–6m of loam (Bischoff, 1999; Hiller et al., 1991; 2003; Steinmüller, 2002, p. 292) making the discovery of Final Palaeolithic sites in river valleys a rare exception. Many surface collections with backed

points and short end scrapers are known from Saxonia (Geupel, 1985), Lower Lusatia (Geupel, 1987) as well as Thuringia and Saxonia-Anhalt (Küßner, 2007). Unfortunately, many are mixed with Mesolithic and / or Neolithic artefacts. Only few sites have been excavated and fewer are published. Here, only recently excavated sites as well as re-investigated assemblages are presented.

Rasmussen et al. 2014 (INTIMATE events, years BP)		Litt et al. 2007 (biozones, warve years BP	
Preboreal	11703±4	Preboreal	11590
GS-1	12896±4	Younger Dryas	12680
GI-1a	13099		
GI-1b	13311	Allerød	13350
GI-1c1	13600		
GI-1c2	13660	Older Dryas	13540
GI-1c3	13954		
GI-1d	14075		
GI-1e	14692±4	Bølling	14670

Note: see comments by Rasmussen et al. (2014, p. 25). Radiometric dates are calibrated with IntCal 13 (Reimer et al., 2013) and correlated with the INTIMATE event stratigraphy (Rasmussen et al., 2014).

Some assemblages are very small, for example the Thuringian sites Hartmannsdorf-Caaschwitzer Berg or Ranis and Bärenkeller (Bergmann et al., 2012; Hülle, 1977; Feustel et al., 1972; Feustel and Musil, 1977). At Ranis the longest Palaeolithic stratigraphy in Central Germany was excavated by Werner Hülle (1977) between 1932 and 1938 but his excavation strategy and documentation methods confuse recent re-investigators (Grünberg, 2006, p. 107-109; Weiß, 2013). Therefore, two radiocarbon dates of 12,615 ± 50 (OxA-12052) and 10,145 ± 50 (OxA-12051) uncal. bp (13243–12776 and 10097–9464 cal. BC[1]; Grünberg 2006, Tab. 4) indicate a late Weichselian age but lithic tool types do not indicate whether a Late Magdalenian, a *Federmesser* or Ahrensburgian is present. The cave site Bärenkeller was excavated in different episodes from the 1950s up until 1975 (Feustel, 1963; Feustel and Musil, 1977; Feustel et al., 1972; Küßner, 2009, p. 187). During the Pleistocene the cave was

[1] All calibrated radiocarbon dates for Pleistocene sites in this paper are given with a 2 σ standard deviation (95.4%) and are calibrated with OxCal 4.2 (Bronk Ramsey and Lee 2013; IntCal13 atmospheric curve from Reimer et al. 2013).

mainly used by cave bear. Linear Banded Pottery sherds found inside as well as in the humic soil outside of the cave show that it was also used during the Neolithic. In front of the cave, the loessic horizon below this soil contained only few non-diagnostic artifacts and horse bones. A probable fireplace in the cave was used by Pleistocene humans, fueled with shrub willow, hazel, maple and beech. However, only 43 lithics and 28 organic artefacts indicate activities of Pleistocene humans: an end scraper, some backed bladelets, a few long points made out of ivory and six (up to 40cm) long antler points with a double beveled base may indicate a Magdalenian occupation. Human presence in GS-2.1a/b is supported by a date of 13.7 14C-ka BP on charcoal. Additionally, a handful of curved backed points and 11.2 14C-ka BP old charcoal may be seen as a Final Palaeolithic occupation in GI-1c1 to GI-1a.

In contrast, other excavations contain many lithics but have never been finally published. One example is Taucha, where ca 1400 lithics were excavated in three clusters in a 2000m² large area (Dunkel and Dunkel, 1977). Here, curved and angled backed points, as well as short end scrapers and different borer types, indicate a Final Palaeolithic age. Other sites, like Bergheide and Finsterwalde in southern Lower Lusatia, are mentioned in connection with the Final Palaeolithic but their exact age is difficult to interpret. Bergheide was excavated in 1981 (Wechler and Wetzel, 1987). Among the ca. 4500 lithics, flakes (68%) and chunks (25%) are most common. Cores (1.5%) and blades (2%) occur rarely. Pit-like features are interpreted as evidence of primitive mining for moraine flint but, due to a lack of distinct lithic tool types, the age of this site is difficult to estimate (Gayck, 2000, p. 239; Wechler and Wetzel, 1987, p. 25–27). The other site, Finsterwalde, was excavated in 1983 (Wechler, 1988). Just below the surface, in a bleached, grey sand, ca. 2800 lithics were found in an area of ca 50m². Refitting of breaks as well as of burins and burin spalls was possible. Several shaft smoothers and grindstone fragments were found. 60cm below this layer another archaeological horizon was found in a yellow, aeolian sand. The lower layer contained ca. 2100 lithics and several grindstones. Many refittings were possible here, too. However, like Bergheide, due to a lack of diagnostic lithic tool types the age of this site remains unknown (Cziesla, 2008, p. 35; Wechler, 1988, p. 14).

At Etzdorf in Thuringia, an amateur archaeologist collected several hundred artifacts in the 1930s. Until recently, this assemblage was classified as early Final Palaeolithic (Holzkämper et al., 2013, p. 131). However, a re-investigation of this assemblage (Bergmann et al., 2011) did not reveal the presence of curved backed points and short end scrapers. In contrast, shouldered points and many burins are present. Among the other tools are only end scrapers on blades as well as borers and zinken. The presence of backed bladelets is far from sure. Ca 30% of all blanks are blades / bladelets and the lithic chaîne opératoire is focused on the production of blades. The technological characteristics of the blanks are similar to the local Magdalenian. Thus, Etzdorf may be a ´Late Magdalenian´ site with shouldered points.

Two sites, one in Thuringia the other in Lower Lusatia, indicate that the Final Palaeolithic and mammals associated with forest habitats started in GS-1e/GS-1d. The first site is Abri

Fuchskirche, situated in the Thuringian Slate Mountains, which was excavated in 1962 by Rudolf Feustel (Museum of Prehistory in Thuringia). 50m² was excavated and approximately 490 lithics were found (fig. 3). A revision of the finds was recently done (Benecke et al., 2006). The lithics were found in all layers, from the top soil (layer 1) as well as mixed with Mesolithic microliths in layer 2. 219 lithics were found in layer 3, which has to be seen as an early Final Palaeolithic / early Federmesser assemblage: backed retouched pieces (n=16) are the most common tool type. Among them, there are at least four curved backed points and three trapezoidal backed points, but only one of them resembles a Kent-type point. The amount of blades is low (8%), but blades have been modified into borers (n=3), burins (n=2) and end scrapers (n=2). Layer 3 is further characterized by the presence of horse, moose, aurochs, red deer, roe deer, wild boar, brown bear and red fox, all indicating a forest environment. Three radiocarbon dates on two moose teeth and one bovid bone range between 12.2-12.0 14C-ka BP, corresponding with GI-1d to GI-1c3. However, a fourth radiocarbon dated horse bone dates to12.7 14C-ka BP, which correlates with the periods GS-2.1a / GI-1e. This may indicate that the presence of older elements from a Late Glacial tundra/steppe environment cannot be ruled out.

The second early Final Palaeolithic site is Reichwalde in southernmost Lower Lusatia. It was excavated by Jürgen Vollbrecht (2005; Friedrich et al., 2001) between 1997 and 2000. Reichwalde consists of two archaeological layers in humic soils. By combining bio-, litho- and chronostratigraphy the older layer is dated to the Bølling climate interval. After the first occupation an aeolian dune accumulated, on which a soil developed that contains the younger layer. Radiocarbon dates of charcoal of a tree-fall indicate that the human occupation of the upper layer took place in the Bølling also. Impressive remains of a forest are preserved on top of the younger soil. This forest consisted of pine, most of them younger than 110 years, with a few birch trees. Organic remains in the soil burnt in forest fires about every ten years, but most trees survived these. Since the growth of the oldest trees started in the Allerød, the forest remains support the Bølling dating of the younger archaeological layer. Radiocarbon dates of both archaeological layers cluster between 12.3-12.1 14C-ka BP, indicating the period of GI-1e to GI-1c3. Among the ca 230 excavated bones, roe deer and red deer are present, again showing the presence of forest mammals during a phase of the early Final Palaeolithic.

The lower layer was excavated only in two small areas. Circa 530 lithics, among them 20% blades but only one oblique truncation, were excavated in 6m²at location 5064. At location 5042, ca 680 lithics, among them short end scrapers, were excavated in 35m². In contrast, the upper layer is a vast Final Palaeolithic occupation surface. It contains ca 22,200 lithics but, due to sieving, three quarters of the 30kg lithics are artifacts <1cm. These finds cluster in a dozen distinct concentrations scattered over ca 2000m² (fig. 4). Numerous refittings indicate that the lithic concentrations are contemporaneous. Flakes dominate by far; blades are only 5% of the assemblage. Up to 200 lithic tools are present. Laterally retouched pieces, short end scrapers, truncations and borers are the most common domestic tools. Only eleven burins are present and backed retouched pieces dominate. Among them are ca 50 large and small, curved and angled backed pieces (fig. 5). Some of these points are named

Taucha points by Cziesla and Masoijć (2007, p. 37) after the site Taucha which was mentioned above.
These halfmoon-shaped points occur at Groitzsch, a site in the Mulde valley, also. At Groitzsch, the largest Late Pleistocene lithic assemblage in Eastern Germany, ca. 180,000 lithics were excavated by Helmut Hanitzsch (1957; 1972) in 1952-1961. Numerous refittings indicate a well-preserved site, but a re-investigation may be necessary to evaluate the distinction of sub-assemblages due to different patinations. Among the lithics, many blades as well as typical tool types of the central German Magdalenian occur but, despite the low amount of short end scrapers (Hanitzsch, 1972, Tab. 4; Taf. 69: 2, 9), a faint presence of early Federmesser groups cannot be ruled out as few Taucha points are present (Hanitzsch, 1972, Taf. 30: 25, 27, 29).

The brown coal open-cast mines of Lower Lusatia are a well-known archive of Late Weichselian landscape history. Together with Reichwalde, the open-cast mine Cottbus-Nord may be the best researched area for the Late Palaeolithic in Eastern Germany, as huge Final Palaeolithic sites have been excavated there (Gautier, 2001; Kayser, 1999). Nonetheless, most of these remain await archaeological analysis, but data from lithological, botanical, radiometric and archaeological investigations are available (Kühner et al., 1999). The period of GI-1e to GI-1c3 is well represented by a distinct band of turf but, in contrast to Abri Fuchskirche and Reichwalde, no archaeological remains have found in that layer. However, only 10–20km to the east in Poland a barbed harpoon was found that is radiocarbon dated to that period (Cziesla and Masojć, 2007). As at Reichwalde, after GI-1c3 aeolian activity resulted in the accumulation of up to 5m high dunes at Cottbus-Nord. A faint humic soil with pine charcoal developed on top of these dunes in GI-1a / GS-1. In this soil, Federmesser sites have been excavated (Gautier, 2001), for example at Groß Lieskow (Pasda, 1999): here ca. 1900 lithics were found in a 10cm thick layer. Straight and curved backed points, as well as burins, indicate a Final Palaeolithic occupation (fig. 6). Refitting and a large number of small lithics represent the well-preserved site that was only destroyed on the highest part of the dune during the Late Bronze / Early Iron Age. This destruction may explain why no short end scrapers are present. More importantly, at the site of Groß Lieskow tanged points, long blades and short end scrapers (fig. 7) were found in the upper most parts of the humic soil as well as in the sand above, indicating that an Ahrensburgian occupation followed the Federmesser occupation but was more or less completely destroyed in the Mid and Late Holocene. At Groß Lieskow, the Late Allerød / early Younger Dryas humic soil extends to the foot of the dune where it is represented by a turf which is a distinct lithological layer in the open-cast mine. At certain spots just some centimeters above the flood plain, this layer was a humic soil.
In this humic soil a huge Final Palaeolithic site was excavated at Kleinlieskow (Neubeck, 2014; Pasda, 2007) only 1.5km south-west of Groß Lieskow. At Kleinlieskow, in an area of 360m², nearly 16,000 lithics were found in three distinct concentrations (fig. 8). Reddish sand with small burnt bone fragments indicate a hearth in between two of these concentrations. Refitting of lithics was successful, but in contrast to Reichwalde, did not

reveal connections between the concentrations. In contrast, refitting of rocks, of which only a few occur in each concentration, indicate that non-flint objects were much more mobile, connecting at least two concentrations. Among the burnt bones, a fragment of a fishhook was found (Pasda, 2001). Besides fishing with a line, multiple skeletal elements from e.g. roe deer, hare, a large dog or wolf, a carnivore and an animal of the size of a fox as well as undetermined fragments of crania, teeth, ribs, long bones and feet indicate hunting of forest mammals not far from the site. Kleinlieskow is a Federmesser site because, among the domestic tools, short end scrapers predominate and burins as well as lateral retouched pieces are rare. Only four truncations, borers and splintered pieces are present. The lithic tool assemblage is characterized by a dominance of backed retouched pieces, among them small and large angle backed as well as curved backed pieces (fig. 9+10). In contrast to Reichwalde, a few Malaurie points are present. This may indicate a Final Federmesser occupation of the late Allerød / early Younger Dryas. At Kleinlieskow, like at Reichwalde, the soil where the Federmesser occupation was deposited was covered some centuries later at the very end of the Younger Dryas by a forest predominantly of pine, with some birch, willow / poplar and alder (Kühner et al., 1999; Gautier, 2001). Despite the presence of 250 year old and more than 10m tall pines, the forest was not dense. It was destroyed by flooding which resulted in perfect preservation.

Fishing with hook and line is present from the final Federmesser period of GI-1a / GI-1b, as shown at Kleinlieskow. This is supported by the 11.4 14C-ka BP radiocarbon dated fishhook collected in 1953 in a brown coal open-cast mine near Braunsbedra in Saxonia-Anhalt (Grünberg, 2006, p. 102). At Wustermark, a ca 300m²site that was excavated in 1998 and 1999, approximately 60 lithics, 25 organic tools and 350 animal bones were discovered in the basal sandy layers of a fluvial stream (Gramsch and Beran, 2010; Gramsch et al., 2013). These layers were accumulated in a shallow depression covered by water. Within the lithic inventory, three endscrapers, three burins and one oblique truncation are recorded. Additionally, nine bone points, four bone awls, one bone dagger, a moose antler manufactured into a smoother-like tool or axe blade with zig-zag ornaments as well as six fishhooks were found, which prove that fishing with hook and line was also present in the last period of the Late Pleistocene. Furthermore, many bones of large pike (n=123), elk (n=67), reindeer (n=49) and red deer (n=23) represent the most common animal species. Wild boar (n=14) and lynx (n=10) occur more rarely. Horse, aurochs, roe deer, bear, wolf, beaver and dog are represented by one to five bones each. Pollen analysis as well as three of six radiocarbon dates (two on wood, one on a bone fishhook) indicate that the main part of the bones and artifacts are connected with the GS-1 / Younger Dryas. The tool made of elk antler, which is dated to 10,050 ± 80 14C-ka BP (Bln-5645) - the Pleistocene / Holocene border, may confirm this. The only known fishhook manufactured from ivory is dated to 15,825 ± 180 14C-ka BP (Ua-24105), which may indicate the use of fossil ivory in the Younger Dryas. However, two bones – one of wild boar that was dated to 11,719 ± 45 14C-ka BP (KIA-32463), the other of horse dated to 9,135 ± 75 14C-ka BP (Ua-24700), indicate both older and Holocene uses of the site (Gramsch et al., 2013, p. 2462). Due to the depositional

context of the organic layers at Wustermark 22 and the wide range of radiocarbon ages, it is clear that the area was occupied during several phases.

Further north, we find an important site in Mecklenburg-Vorpommern at Endingen, where some 40 animal remains, bark fragments, and a tree-fungus were found already in 1899. Though no lithic artefacts were recovered, the spectrum of bones and some rib-knives make this assemblage quite important. Among the finds, nine pieces show cutmarks and can therefore be seen as remains of food procurement or tool production (Street, 1996; Terberger et al., 1996, p. 18–19). Special emphasis is assigned to a horse-rib which was modified to become a rib-knife. Since no other horse remains have been found on the spot, it is assumed that this artefact was brought by humans to the site. Another relevant osseous tool is a shed antler of giant deer that was worked to produce splinters for tool blanks (Street, 1996; Terberger et al., 1996, p. 20–22). Radiocarbon measurements assign the material to a middle Allerød occupation that is suspected to have been located near the finds, since these were deposited at a lakeshore and thus represent refuse layers of the settlement. The site is assigned to the backed point assemblages (Terberger et al., 1996, p. 29)

The site presented here that is closest to the Baltic Sea is Nienhagen, which dates to the late Pleistocene or, more specifically, the Late Ahrensburgian. It was discovered during construction of a gas pipeline in 1993, when during profile analysis a tanged point was found. Following this, a small excavation was started and 120 lithic artefacts were recorded (Kaiser and Terberger, 1995, p. 7–22). Due to probable re-deposition of some of the finds, it was difficult to evaluate if the artifacts represent a single or multiple events at first sight. Nevertheless, re-fitting of artifacts and geomorphological analyses showed that the inventory was, though fragmented, most likely from a single-event. The wide vertical distribution of finds is due to fluvial activity during the deposition of artifacts (Kaiser and Terberger, 1995, p. 22–26). Complementary to the tanged point (Bromme type), several flakes and blades were found. Other tools found are a simple point, one backed point, four micro-burins, two burins, and one fragment of a backed blade or simple point. During the excavation, some small bone and tooth fragments were recovered in the find layers, but due to their small size it was not possible to determine them to species. Only two teeth fragments could be recorded belonging to the group of larger Cervidae (Kaiser and Terberger, 1995, p. 32–38). Due to some lithic production debris and cores recovered on the site, it is regarded as a short-term hunting camp where hafting-and-retooling was done (Kaiser and Terberger, 1995, p. 39–41).
While many more sites with tanged points are known in the lowlands between the rivers Elbe and Oder (Baales, 1996, p. 307-317), the most southern Ahrensburgian sites in Eastern Germany are situated north of the Hercynian Mountain where surface collection from Blankenburg und Westerhausen (Baales, 1996, p. 302-303) prove the presence of humans in GS-1. At Schkeuditz, near the airport Halle-Leipzig, Stefan Ertmer conducted a short excavation on a new Ahrensburgian site in September 2015. As mentioned previously, the

Ahrensburgian is present in southern Lower Lusatia at Groß Lieskow, but three other sites of that time period have been excavated by Bernhard Stapel (2000) nearby, at Weißagk and Grötsch. These are large assemblages, containing up to 100,000 lithics, among them tanged points, burins, short end scrapers and few long blades (fig. 11). The artefacts were found just below the recent soil in distinct concentrations. It must be noted that at one site early and late Neolithic ceramics and lithics were found together with the Pleistocene lithics. This is the case at another site, Golßen, which is the Federmesser type-site of Brandenburg (Gramsch, 1988, p. 512). Bernhard Gramsch excavated Golßen over an area of 66m ² in 1968. According to the recent investigation (Winkler, 2010), ca 3100 lithics occurred within a distinct brown soil. End scrapers, most of them short scrapers, are the most common tool type (26%). Backed implements, among them curved backed points, occur more often (21%) than burins (19%) and truncations (9%). The amount of burnt lithics is high (32%). Additionally, a shaft smoother made of sandstone was found. However, besides the Federmesser lithics, 270 small sherds of Late Bronze / Early Iron Age ceramics have been found within the brown soil which is covered by <50cm aeolian sand. This is strange because preservation, refitting and spatial distribution of the artefacts indicate a well-preserved Final Palaeolithic site (Winkler, 2010). Also, more recent pit-like disturbances reach the brown soil only rarely. However, a small pit-like structure is interpreted as a Final Palaeolithic hearth, although it is situated on the far periphery of the spatial distribution of lithics. Perhaps Late Holocene aeolian processes with deflation and re-covering, which is well-known in Lower Lusatia (Poppschötz et al., 2010; Raab et al., 2016), resulted in the occurrence of both Stone Age lithics and prehistoric ceramics in a single layer (Bartholomé et al., 2002). At other sites catastrophic rainfall in medieval times resulted in erosion of lithic artefacts (Berg-Hobohm, 2000). Consequently, the brown soil at Golßen might not be a Late Glacial soil, but is instead connected with Late Holocene soil development (see references in Pasda 2002, p. 21).

Earliest and early Mesolithic

Processes that altered the sedimentological situation were also detected in Burow 3, where a Mesolithic campsite was excavated in 1975 and 1976 (Wechler, 1998). During investigations of a Late Palaeolithic site in its direct vicinity (1972–1974; Gramsch, 1973a), the site was discovered by test pitting. Four concentrations of Early Mesolithic artifacts were found that were associated with fireplaces. In combination with the Late Boreal/Early Atlantic inventory, a few ceramic sherds and burnt animal bones were found, but based on spatial analysis they are not interpreted as being connected to the concentration. Even though partly covered by aeolian sands, the vertical distribution of finds renders possible that some displacement of artifacts took place (Wechler, 1998, p. 29–31).

As usual in Germany, numerous Mesolithic sites are known by surface collections (Feustel, 1957; 1958; 1961; Geupel, 1985; 1987), but only few have been re-investigated recently, e.g. Kranichfeld and Hohenfelden (Bock, 2015).Others, for instance Pöllnitz, where Early and Late Mesolithic microliths have been found, were published by a palaeontologist (Diedrich, 2012). Erwin Cziesla (2009) has made a critical discussion of Mesolithic research in Lower Lusatia.

According to him, at Malitschkendorf and further north at the city Brandenburg, an earliest Mesolithic site may be present (Cziesla, 2009, p. 381). However, it is quite possible that the site represents a palimpsest due to an artifact spectrum that can be assigned to Federmesser, Ahrensburgian/Sviderian and Early Mesolithic techno-complexes (c.f. Geupel, 1987, Taf. 79–84). At Göttern in Thuringia, a doline was excavated by the State Archaeological Office between 2005 and 2008 (Karl et al., 2011). Remains of animal bones, fire-cracked stones and charcoal were found in the lowest layer. Among the animals are wild boar, elk, roe deer, aurochs, wild horse, wolf and brown bear. A radiocarbon date gave an age of 9.5 14C-ka BP. Above the dated layer ca 40 lithics have been found and ca 50 additional lithics were collected without a stratigraphic context. Among the lithics are one end scraper, one truncation, one borer, one splintered piece and the fragment of a microlith with a backed back and a truncation. Aurochs may has been more widespread in the Preboreal as is shown by the more or less complete skeleton of a large aurochs found in 1821 in a bog near Haßleben in Thuringia, which was described by Johann Wolfgang von Goethe in 1822 and recently radiocarbon dated to 9.8 / 9.7 14C-ka BP (Benecke, 2009).
At Urdhöhle and Ranis human bones have been radiocarbon dated, indicating the presence of Mesolithic humans in the Boreal period. The cave site Urdhöhle is situated next to the well-known Magdalenian site Kniegrotte in Thuringia. Urdhöhle was excavated by an amateur archaeologist between 1946 and 1959 and in 1968 by Rudolf Feustel. A recent re-investigation (Terberger et al,. 2003) showed that few Magdalenian lithics are present but that, besides Neolithic, Bronze Age and Medieval human bones, Mesolithic humans were here too, indicated by two radiocarbon samples from human bones dating around 8.4 14C-ka BP. Within the finds from Ranis there are microliths and pierced teeth of wild boar, as well as bones of a human child that has been radiocarbon dated to 8.3 14C-ka BP (Grünberg, 2006, p. 109).
Other human bones have been dated to the Atlantic period, e.g. Bad Dürrenberg and Unseburg (Terberger et al., 2003, p. 10) but also at Abri Fuchskirche: here, layer 2 contains >100 lithics, among them a few microliths as well as a few Palaeolithic ones, a fireplace with charcoal of oak, pine, elm, lime-tree and hazel as well as remains of a human child that was radiocarbon dated to 7.7 14C-ka BP (Küßner and Birkenbeil, 2010).
Radiocarbon dated Mesolithic sites from the Pleistocene/Holocene border are still missing from eastern Germany. Extensive dating programs were applied to the sites of Friesack 4 and Friesack 27a, with the first settlement phases proven to date to the Middle and Late Preboreal (Gramsch, 2002; Groß, 2017; Sørensen et al., submitted). Providing a vast amount of lithic material, animal bones and organic tools, the Friesack sites give a good insight into the material culture of the Early Mesolithic and the surrounding landscape (Gramsch, 1989; 1990; 1993; 2002; 2007; 2011; 2012; 2014; Gramsch et al., 2016; Groß, 2017; Groß, in press).
Friesack 4 is a large Mesolithic-Neolithic site on a sandy hill with associated subaquatic deposits in the Rhinluch, a bog area within the Berlin-Warsaw glacial valley close to the town of Friesack in Brandenburg. It was excavated during the 1970s and 1980s by Bernhard Gramsch (former Landesmuseum für Ur- und Frühgeschichte Potsdam; later Brandenburgisches Landesamt für Denkmalpflege), who has already published ample

information on the site and the organic implements (Gramsch 1990; 1993; 1998; 2000; 2003; 2006; 2011; 2012, 2014; 2016; in press). The excavations by B. Gramsch concentrated mainly on the subaquatic layers. In 2000 and 2001, Stefan Wenzel excavated a larger area on the sandy hill (Wenzel 2002; 2003).

Friesack 4 displays the most complex subaquatic stratigraphy of a Mesolithic bog site in Europe. From the Early Mesolithic (around 10.0 14C-ka BP) to the late Mesolithic (approx. 7.5 14C-ka BP), hunter-gatherers repeatedly visited this former lakeside. Neolithic settlers lived there during the younger Atlantic period. Only during the middle Boreal period between c. 8.7 and 8.1 14C-ka BP does the stratigraphy of the subaquatic deposits show a remarkable hiatus even though an occupation is proven between 8.4 and 8.0 14C-ka BP by radiocarbon dates from three pits from the settlement area (see below; fig. 12).

Approximately 120 archaeological layers from five trenches along the former shoreline contain around 140,000 Mesolithic lithic artifacts and thousands of animal remains and other organic finds. Several erosional and alluvial processes influenced the development of the complex stratigraphic sequence at the site, which are partly caused by the Mesolithic people themselves and partly by changes in water level over time. Nevertheless, the stratigraphy is consistent with regard to the interpretation of the settlement sequence. The site is famous for its numerous bone and antler artifacts, some of them ornamented, and the remains of Mesolithic nets and wooden implements (Gramsch, 1990; 2002; 2012; in press). Until now, 91 radiocarbon dates by the laboratories of Berlin and Cologne has been published (Görsdorf and Gramsch, 2004; Gramsch, 2016).

Three projects funded by the “Deutsche Forschungsgemeinschaft” were conducted over the last 15 years: one excavation in 2000/2001 and analysis of features and finds by S. Wenzel as well as two research-projects on the lithic artefacts by B. Gehlen from 2007-2011.

St. Wenzel excavated larger areas and test trenches on the sandy hill (Wenzel, 2002; 2003). The most intriguing finds from this area are six storage- or garbage pits and three waterholes (fig. 13); the latter were already excavated by B. Gramsch during the 1980s (Gramsch, 2003). Two of them yielded water containers made from birchbark.

During the first part of the project on the Mesolithic lithic artefacts, B. Gehlen worked out the stratigraphy using a Harris-matrix of the documented layers and analyzed c. 3000 microliths and microburins from the site. The merged stratigraphy of undisturbed and dated deposits from three trenches (Z, D and C) contains 114 layers with typologically identifiable microliths (980 microliths in total). Based on a typology depending on the systems introduced by Bernhard Gramsch (1973b), Wolfgang Taute (1971) and Peter Vang Petersen (1993) and additional forms deriving from the Friesack 4 assemblages themselves, the microlithic inventory was typologically analyzed (Gehlen, 2009). A seriation of the microlithic types and their frequency, in combination with the stratigraphic sorting and the radiocarbon dates, led to a grouping of layers which support the former division of the stratigraphy in four Mesolithic complexes (I to IV) by Bernhard Gramsch (2002; 2006; 2016; fig. 14). According to the results of the seriation, the stratigraphic sequence can be subdivided into 17 layer complexes, which correspond to shorter chronological phases. This differentiation into several short chronological periods is an important basis for the general typo-

chronology of the Mesolithic in Central Europe. In the late Preboreal the first narrow lanceolate points occur, which are very variable in early Boreal times. During the early Boreal, the first broader trapezes on irregular bladelets appear. However, there are only single trapeze-shaped microliths of this type, and they are even rarer in the late Mesolithic complex IV. The lanceolate points are especially characteristic of the complexes III and IV in Friesack 4. It is very probable that these slender microliths are typical for Mesolithic groups in the eastern and central parts of Germany. The very small number of microliths characteristic for Mesolithic assemblages in Denmark and Southern Sweden reveals only very loose relationships between the Mesolithic people from Friesack 4 to those in southern Scandinavia from the late Preboreal onwards. Contacts to the sites in the Duvensee bog in Holstein (e.g. Bokelmann, 1980; 1991; Bokelmann et al., 1981; 1985; Holst, 2014; Lübke et al., this volume) were probably sparse from that time on as indicated by a typological comparison of the microliths so far published from the Duvensee.

The results of the second project by Gehlen, which had its foci on attribute analysis and microwear studies of the lithic artifacts, are as follows: From the middle Preboreal to the Early Atlantic period there was a more or less continuous development in terms of typology and style of the microliths and other tools. The measurements of microliths and micro-burins, the mode of blade technology, and the concepts of core processing revealed a similar continuity. Nonetheless, a continuous introduction of new elements and techniques during time is traceable as well. The concepts of core processing seem to be similar during the entire time. A very few specialized cores for bladelets (handle cores) occur only in the late Mesolithic layers at around 7.5 14C-ka BP. The low number of these artifacts shows that this technique was not invented in Friesack 4 or Eastern Germany. There are almost no regular bladelets in the assemblages of Friesack 4 as well, and – except during the Late Preboreal when a hard hammer technique was used – the knapping technique was direct percussion with a soft hammer during the major part of the Mesolithic occupation. We interpret these special cores as clues for sporadic contacts with late Maglemosian groups from Southern Scandinavia.

The microwear studies on 306 lithic artefacts were conducted by Alfred Pawlik (2010). Predominantly the processing of wood, bone or antler for activities such as hafting and retooling could be proven. Tar was identified on many of the studied artefacts. Retouched tools and blanks were used for several purposes. The usage of the tools only partly coincides with the expectations from tool typology. Many objects – especially the burins – were identified as broken arrowheads or inserts in wooden weapons or tools.

Recently, the archaeobotanical and zooarchaeological studies on the material from Friesack 4 were published (Benecke et al., 2016). Not only the new assessment of the pollen samples from the site by S. Jahns (Jahns et al., 2016), originally taken, analyzed and published by K. Kloss (1987a; 1987b), but also the examination of numerous plant macro-remains by S. Wolters (2016) illustrate very well the local ecology as well as use of plants by the Mesolithic settlers. The analysis of the fauna was done by N. Benecke, H. K. Robson, U. Schmölcke, and H. Ullrich (2016). The multiple results of the natural scientists' research cannot be presented here, but they deliver a very rich dataset for the reconstruction of the ecology and economy

during the Mesolithic in North-Eastern Germany and will be discussed in context with the results of lithic analyses in the near future (Gehlen et al., in prep.).
A recent re-investigation of the organic material from Hohen Viecheln has revealed an occupation of the site already in the Late Preboreal, whilst most activity is proven for the Boreal (Groß et al., in prep.). The site is located on the northern shore of Lake Schwerin in Mecklenburg-Vorpommern and ca. 70 km west of the sites at Duvensee (see Lübke et al. this volume). It was excavated in the 1950s and due to a large number of bone points quickly regarded as a reference site for the Early Mesolithic of the Northern European Lowland (Schuldt, 1961). The number of bone points resembles the quantity from Friesack and extends the typo-chronology for this tool type to the end of the Boreal and Early Atlantic. Another relevant site in this context is Rothenklempenow 17 where Preboreal layers at an ancient shore were excavated amongst younger Mesolithic settlements and a Late Mesolithic burial (Schacht, 1993; Bach and Bruchhaus, 1995; Schacht and Bogen, 2001). Unfortunately, so far only preliminary reports are published.
The vast number of organic finds on archaeological sites in the Lowland areas is commonly due to the fact that excavations have taken place in the ancient lakeshore areas, where better preservation conditions were present than on the settlements themselves. Consequently, it is not possible to derive any spatial organizational patterns from these excavations. Nevertheless, a more profound understanding of the material culture and subsistence patterns has developed. Furthermore, research in Eastern Germany is traditionally focused on site-specific studies (Gramsch, 2010, p. 168) and therefore regional studies are rarely done (Faasch, 2017; Schülke, 2011).

What changes?

The transition from the Pleistocene to the Holocene brought vast environmental changes (cf. Boettger et al., 2008; Coope et al., 1998; Fahlke, 2009; Steffensen et al., 2008; Usinger, 2004; van Asch et al., 2012) but also the archaeological preservation conditions change. This is best exemplified by the finds from the lowlands where extensive wetlands formed in the Preboreal. The reforestation and silting up of lakes and oxbows provided different habitats and probably changed settlement patterns as well. From the Early Holocene, some of Germany's most extensive collections of organic artifacts are known (e.g. Friesack; Hohen Viecheln) while spatial analyses of site structures are predominantly connected to Late Pleistocene sites (e.g. Burow, Golßen, Reichwalde). As a consequence, the understanding of both eras differs significantly: Since most (scientific) focus for the younger epochs is laid on the lakeshore excavations, analysis of spatial patterns are regarded less often. In contrast, examples have shown that the distribution of finds gives a good understanding of the differences in settlement organization: During the Alleröd the sites of the FMG are usually characterized by small and very distinct lithic patterns which probably indicate only short-term stays (Bartholomé et al., 2002; Pasda, 2002), while some authors interpret bigger artifact scatters as latent evidence of huts (Gelhausen et al., 2015). The different appearance of the sites comprises the representativeness for processes that happened. The small and distinct concentrations represent short-term occupations and thus can be used to reconstruct internal settlement organization and processes like hafting and retooling. The other type of excavations usually only show the refuse zone of settlements and are therefore of less use for analyzing internal processes. However, they do give

further information on long-term developments and, as for instance at Friesack, provide the opportunity to analyze micro-regional developments over time.

Apart from the source critical aspects, there are further significant changes in the archaeological evidence around the Pleistocene/Holocene border that need to be addressed here. From a typological perspective, the Late Pleistocene techno-complexes of Ahrensburgian and Sviderian character are replaced by simple microliths and geometrical forms. Even though there are different interpretations of this archaeological-cultural change, it remains as yet unclear exactly why and when this change occurred. While some researchers find arguments that the ecological change caused a re-organization of settlement systems (e.g. Gramsch, 1980; 1992, 72; Groß, 2017, p. 166–167) and argue for the Mesolithic techno-complexes of Eastern Germany being rooted in the Arch-backed/Federmesser industries, others find arguments for cultural continuity (cf. Cziesla and Pettit, 2003; Cziesla, 2004, p. 178–179; 2009, 380–381; Jöris and Thiessen, 1997; Terberger, 2006, p. 127–132). Until further evidence is provided (c.f. Terberger et al., 2004, p. 163) all explanations have to be seen as hypotheses. Relevant in this respect is the lack of stratified sites that show a cultural continuity like Ahrenshöft (cf. Lübke et al. this volume), and the fact that radiometric dating is faced with imprecision at the Pleistocene/Holocene transition due to a radiocarbon plateau. Nevertheless, there are still no sites known from Eastern Germany with Early Mesolithic assemblages that are radiometrically dated to the Earliest Holocene, which is therefore different from Western Germany (cf. Heinen, 2014; Street et al., 2001; Street this volume).

Though there are significant changes in the lithic typology and technology around the Pleistocene/Holocene transition, it seems increasingly unlikely that the same is true for the organic artifact spectrum as well. Antler mattocks or axe blades are only known from Holocene assemblages (e.g. Wustermark 22 (Gramsch et al., 2010); Hohen Viecheln (Schuldt, 1961); Friesack 4 (Pratsch, 2011)). However, it cannot be excluded that this picture might change if more osseous artefacts are directly dated in the future. As is exemplified by bone points, which were subject to some direct dating programs that provided absolute ages for them (Cziesla, 1999; Cziesla and Pettit, 2003; Groß et al., in prep.) In this respect, the analysis done by Cziesla and Pettit (2003) highlights that the type-fossil approach has proven unreliable with respect to bone points. Their results show that the common assignment of bi-serially harpoons to the Pleistocene and finely barbed points to the Holocene is not unambiguously possible. Nevertheless, it also needs to be considered, especially when dealing with old excavations or legacy material, that the radiocarbon age of such artifacts may be influenced by external factors (e.g. preservatives; e.g. Meadows et al., in print).

Another relevant tool type when discussing chronological aspects are hooks made from osseous material. They are usually seen as fishhooks with partly very extensive dimensions (>20 cm length; Cziesla, 2004, p. 177; cf. Gramsch et al., 2013) and have been recorded in large numbers in Brandenburg (Cziesla, 2004, p. 169–178). Interestingly, it can be noted that the earliest fishhooks that are reliably dated from the area under investigation are found on Late Palaeolithic sites connected to the Arch-backed/Federmesser industries and the Ahrensburgian (e.g. Kleinlieskow (Pasda, 2001); Wustermark 22 (Gramsch et al., 2013). Further insights to their chronology can be expected from the Havelland area where the vast majority of these tools are found, but usually without context (Cziesla, 2004, p. 169–178). Surprisingly, no fishhooks have been found on the Early Holocene sites of Friesack or Hohen Viecheln (c.f. Cziesla, 2001, p. 484). Since the excavations have mainly investigated the ancient shoreline where hundreds of bone points were found on each site, it would be expected that fishhooks are present in the assemblages as well. However, merely two

artifacts from Friesack 4 might be double-pointed gorges (Gramsch, 2012, p. 17–20). The reason for this may be that fishhooks were not used in the direct vicinity of the camps (Cziesla, 2001, p. 484), but it seems equally likely, especially with respect to the dated specimen, that this tool type was not part of the Early Mesolithic toolkit in our area of focus. Consequently, most of the hooks found might be from younger or Late Palaeolithic contexts. In contrast, the first remains of nets found at Friesack 4 and Rothenklempenow 17 (Kernchen and Gramsch, 1989; Schacht and Bogen, 2001, pp. 7) are so far the oldest artifacts of this type. Despite the uncertainty if they were used as fishing nets at all (Kernchen and Gramsch, 1989).

Acknowledgements

We would like to thank the organizers, Jean-Pierre Fagnart, Ludovic Mevel, Boris Valentin and Mara-Julia Weber, of the session “Northwest Europe around 10000 BP (9600 cal.BC). What changes?” 3 at the 28th Congrès préhistorique de France in Amiens for inviting us and giving the possibility to present our research. Parts of the presented results are funded by the German Science Foundation (DFG) under the project numbers: GR 4651/1-1 (D.G.); Zi 276/13-1, Zi 276/13-2 (B.G.). We thank Kenneth Ritchie for English proof-reading of the manuscript.

References:

BAALES M. (1996) – *Umwelt und Jagdökonomie der Ahrensburger Rentierjäger im Mittelgebirge*, Bonn, Éd. Verlag des Römisch-Germanischen Zentralmuseums (Monographien des Römisch-Germanischen Zentralmuseums).

BACH A., BRUCHHAUS H. (1994) – Das Skelett aus dem Schachtgrab von Rothenklempenow, Kreis Uecker-Randow, *Bodendenkmalpflege in Mecklenburg-Vorpommern*, 42, p. 27-54.

BARTHOLOMÉ G., LIEBERMANN C., PASDA C., SCHÖLCH S., TÜRK B. (2002) – Das Mesolithikum von Kleinlieskow in der Niederlausitz: Anmerkungen zur Entstehung steinzeitlicher Fundstellen in Flugsanddecken, *Archäologisches Korrespondenzblatt*, 32, 3, p. 327-344.

BENECKE N. (2009) – Das Ur-Skelett von Haßleben (Lkr. Sömmerda, Thüringen), *Beiträge zur Archäozoologie und Prähistorischen Anthropologie*, 7, p. 9-13.

BENECKE N. (2016) – Die Tierreste aus den spätmesolithischen und neolithischen Besiedlungsphasen von Friesack 4, in N. Benecke, B. Gramsch et S. Jahns dir., Subsistenz und Umwelt der Feuchtbodenstation Friesack 4 im Havelland. Ergebnisse der naturwissenschaftlichen Untersuchungen, Arbeitsberichte zur Bodendenkmalpflege in Brandenburg, 29, Wünsdorf, Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum, p. 117-159.

BENECKE N., BOLLONGINO R., KÜßNER M., WEBER R. (2006) – Zur Datierung und Fauna des spätglazialen Schichtkomplexes am Abri Fuchskirche I bei Allendorf, Lkr. Saalfeld-Rudolstadt, *Alt-Thüringen*, 39, p. 121-130.

BENECKE N., GRAMSCH B., JAHNS S. dir. (2016) – Subsistenz und Umwelt der Feuchtbodenstation Friesack 4 im Havelland. Ergebnisse der naturwissenschaftlichen Untersuchungen, coll. «

Arbeitsberichte zur Bodendenkmalpflege in Brandenburg », 29, Wünsdorf, Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum.

BERG-HOBOHM S. (2000) – Mesolithische Funde im Tagebauvorfeld Cottbus-Nord, *Arbeitsberichte zur Bodendenkmalpflege in Brandenburg*, 6, p. 29-32.

BERGMANN I., BOCK C., EBERT J., ENDERS S., MÜLLER S., OTTO G., PASDA C., WEIß J., ZEIß D. (2012) – Jung-und spätpaläolithische Freilandfundstellen im Tal der Weißen Elster (Mitteldeutschland), *Archäologisches Korrespondenzblatt*, 42, 4, p. 439-451.

BERGMANN I., DAHLMANN A., PASDA C., WEISS J. (2011) – Etzdorf» Am Nassen Wald «: Steinartefakte aus Thüringen und ihre Diskussion im Rahmen des späten Jungpaläolithikums, *Archäologisches Korrespondenzblatt*, 41, 3, p. 319-337.

BISCHOFF R. (1999) – Untersuchungen an spätglazialen und holozänen Auensedimenten des Unstruttales im Bereich des zentralen Thüringer Beckens, *Geowissenschaftliche Mitteilungen von Thüringen*, 7, p. 439-451.

BOCK C. (2015) – *Die mesolithischen Lesefundkomplexe von Kranichfeld und Hohenfelden (lkr. Weimarer Land*), Masterarbeit Universität Jena.

BOETTGER T., HILLER A., JUNGE F.W., MANIA D., KREMENETSKI K. (2009) – Late Glacial/Early Holocene environmental changes in Thuringia, Germany: Stable isotope record and vegetation history, *Quaternary International*, 203, 1–2, p. 105-112. En ligne: <http://www.sciencedirect.com/science/article/pii/S104061820800092X>.

BOKELMANN K. (1980) – Duvensee, Wohnplatz 6 - Neue Befunde zur mesolithischen Sammelwirtschaft im 7. vorchristlichen Jahrtausend, Die Heimat, 87, p. 320-330.

BOKELMANN K. (1991) – Duvensee, Wohnplatz 9: Ein präborealzeitlicher Lagerplatz in Schleswig-Holstein, Offa, 48, p. 75-114.

BOKELMANN K., AVERDIECK F.-R., WILLKOMM H. (1985) – Duvensee, Wohnplatz 13, Offa, 42, p. 13-33.

BRONK RAMSEY C., LEE S. (2013) – Recent and planned developments of the program OxCal, Radiocarbon, 55, 2–3, p. 720-730.

COOPE G.R., LEMDAHL G., LOWE J.J., WALKLING A. (1998) – Temperature gradients in northern Europe during the last glacial–Holocene transition (14-9 ^{14}C kyr BP) interpreted from coleopteran assemblages, *Journal of Quaternary Science*, 13, 5, p. 419-433. En ligne: <http://dx.doi.org/10.1002/(SICI)1099-1417(1998090)13:5<419::AID-JQS410>3.0.CO;2-D>.

CZIESLA E. (1999) – The Site Bützsee-Altfriesack, Northwest of Berlin. A Dating Program, *Préhistoire Européenne*, 14, p. 135-142.

CZIESLA E. (2001) – Neue Altfunde aus Pritzerbe (Brandenburg). Zugleich ein Beitrag zum Fischfang und zum steinzeitlichen Angelhaken, *Ethnographisch-Archäologische Zeitschrift*, 42, p. 473-504.

CZIESLA E. (2004) – Late Upper Palaeolithic and Mesolithic cultural continuity - or: bone and anlter objects from the Havelland, *in* T. Terberger et B.V. Eriksen dir., *Workshop of the U.I.S.P.P.-Commission XXXII at GReifswald in September 2002*, Hunters in a changing world. Environment and Archaeology of the Pleistocene-Holocene Transition (ca. 11000-9000 B.C.) in Northern Central Europe. Internationale Archäologie - Arbeitsgemeinschaft, Tagung, Symposium, Kongress 5, Rahden (Westf.), Éd., p. 165-182.

CZIESLA E. (2008) – Als man über das Wetter zu reden begann. Die Altsteinzeit in der Niederlausitz, *Arbeitsberichte zur Bodendenkmalpflege in Brandenburg*, 20, p. 29-54.

CZIESLA E. (2009) – Das Mesolithikum der Niederlausitz, Brandenburg. Einsichten und Aussichten, *Ethnographisch-Archäologische Zeitschrift*, 50, p. 361-407.

CZIESLA E., MASOJĆ M. (2007) – The uniserially barbed harpoon from Węgliny (Wodra Valley, Lower Lusatia, Poland) and some cultural implications, *in* M. Masojć, T. Płonka, B. Ginter et S.K. Kozłowski dir., *Contributions to the Central European Stone Age. Papers dedicated to the Late Professor Zbigniew Bagniewski,* , Wrocław, Éd. Uniwersytet Wrocławski, Instytut Archeologii, p. 33-41.

CZIESLA E., PETTITT P. (2003) – AMS-^{14}C-Datierungen von spätpaläolithischen und mesolithischen Funden aus dem Bützsee (Brandenburg), *Archäologisches Korrespondenzblatt*, 33, p. 21-38.

DIEDRICH C.G. (2012) – Der spätmesolithische Fundplatz Pöllnitz bei Saalfeld (Thüringen, Mitteldeutschland), *in* H.-J. Beier, S. Ostritz, M. Küßner, D. Schäfer, V. Schimpff, K. Wagner et A. Zimmermann dir., *Finden und Verstehen. Festschrift für Thomas Weber zum sechzigsten Geburtstag,* Beiträge zur Ur- und Frühgeschichte Mitteleuropas, 66, Langenweißbach, Éd. Beier & Beran, p. 111-120. En ligne. <http://www.gbv.de/dms/tlda/PPN_690139756.pdf

DUNKEL R., DUNKEL E. (1977) – Ein spätpaläolithischer Rastplatz bei Taucha, Kr. Leipzig, *Ausgrabungen und Funde Berlin*, 22, 1, p. 6-10.

FAASCH F. (2017). – Regionale Siedlungssysteme im Mesolithikum Mecklenburg,Vorpommerns. Hamburg En ligne. <https://www.fbkultur.uni-hamburg.de/vfg/studium/abschlussarbeiten/dissertationen/proj-dok-pdf/faasch-meso-2.pdf>.

FAHLKE J.M. (2009) – *Der Austausch der terrestrischen Säugetierfauna an der Pleistozän/Holozän-Grenze in Mitteleuropa*, Dissertation Mathematisch-Naturwissenschaftliche Fakultät, Rheinische Friedrich-Wilhelms-Universität Bonn, Bonn.

FEUSTEL R. (1957) – Zum Problem des Überganges Mesolithikum-Neolithikum, *Alt-Thüringen*, 2, 1955/57, p. 27-46.

FEUSTEL R. (1958) – Thüringen, *Ausgrabungen und Funde – Archäologische Berichte und Informationen*, 3, p. 170-171.

FEUSTEL R. (1961) – Das Mesolithikum in Thüringen, *Alt-Thüringen*, 5, p. 18-75.

FEUSTEL R. (1963) – Höhlengrabungen in Thüringen, *Ausgrabungen und Funde. Nachrichtenblatt für Vor- und Frühgeschichte*, 8, p. 236-240.

FEUSTEL R., KERKMANN K., SCHMID E., MUSIL R., JACOB H. (1972) – Der Bärenkeller bei Königsee-Garsitz, eine jungpaläolithische Kulthöhle (I), *Alt-Thüiringen*, 11, 1970-71, p. 81-130.

FEUSTEL R., MUSIL R. (1977) – Der Bärenkeller bei Königsee-Garsitz, eine jungpaläolithische Kulthöhle (II), *Alt-Thüringen*, 14, p. 60-81.

FRANKE D. (2015). – Regionale Geologie von Ostdeutschland - Ein Wörterbuch. Glienicke/Nordbahn En ligne. <http://www.regionalgeologie-ost.de/>.

FRIEDRICH M., KNIPPING M., VAN DER KROFT P., RENNO A., SCHMIDT S., ULLRICH O., VOLLBRECHT J. (2001a) – Ein Wald am Ende der letzten Eiszeit. Untersuchungen zur Besiedlungs-, Landschafts-und Vegetationsentwicklung an einem verlandeten See im Tagebau Reichwalde, Niederschlesischer Oberlausitzkreis, *Arbeits-und Forschungsberichte zur sächsischen Bodendenkmalpflege*, 43, 2001, p. 21-94.

FRIEDRICH M., KROMER B., KAISER K.F., SPURK M., HUGHEN K.A., JOHNSEN S.J. (2001b) – High-resolution climate signals in the Bølling–Allerød Interstadial (Greenland Interstadial 1) as reflected in European tree-ring chronologies compared to marine varves and ice-core records, *Quaternary science reviews*, 20, 11, p. 1223-1232.

GAUTIER Y. (2001) – Bausteine einer spätglazialen Landschaft im Baruther Urstromtal (Ldkr. Spree-Neisse), *Die Kunde N. F.*, 32, p. 229-237.

GAYCK S. (1999) – *Urgeschichtlicher Silexbergbau in Europa. Eine kritische Analyse zum gegenwärtigen Forschungsstand*, Langenweißbach, Éd. Beier & Beran (Beiträge zur Ur- und Frühgeschichte Mitteleuropas 15), 326, 310 S p.

GEHLEN B. (2009) – A Microlith Sequence from Friesack 4, Brandenburg, and the Mesolithic in Germany, in P. Crombé, M. van Strydonk, J. Sergant, M. Boudin et B. Marchfeld dir., Chronology and Evolution within the Mesolithic of North-West Europe: Proceedings of an International Meeting, Brussels, May 30th-June 1st 2007, Newcastle upon Tyne, Éd. Cambridge Scholars Publishing, p. 363-393.

GEHLEN B., PAWLIK A., RULAND J., WENZEL S. (in prep.) – Die Siedlungsbefunde und die Feuersteinartefakte der mesolithischen Moorfundstelle Friesack 4, Lkr. Havelland (Land Brandenburg), Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum).

GELHAUSEN F., KEGLER J., WENZEL S. (2015) – Hütten oder Himmel? Latente Behausungsstrukturen im Spätpaläolithikum Mitteleuropas, *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, 51, 1, p. 1-24.

GEUPEL V. (1985) – *Spätpaläolithikum und Mesolithikum im Süden der DDR: Katalog Teil 1. Bezirke Dresden, Karl-Marx-Stadt und Leipzig*, 2 vol., Berlin, Éd. Deutscher Verlag der Wissenschaften).

GEUPEL V. (1987) – *Spätpaläolithikum und Mesolithikum im Süden der DDR: Katalog Teil 2. Bezirk Cottbus*, 2 vol., Berlin, Éd. Deutscher Verlag der Wissenschaften).

GÖRSDORF J., GRAMSCH B. (2004) – Interpretation of 14C Dates of the Mesolithic Site of Friesack, Germany, in T. Higham, C. Bronk Ramsey et C. Owen dir., Radiocarbon and Archaeology - Fourth International Symposium, St Catherine's College, Oxford, Éd. Oxford University school of Archaeology, p. 303-311.

GRAMSCH B. (1973a) – Ein neuer Fundplatz der Ahrensburger Kultur im nördlichen Brandenburg, *Ausgrabungen und Funde. Nachrichtenblatt für Vor- und Frühgeschichte*, 18, p. 109-117.

GRAMSCH B. (1973b) – Das Mesolithikum im Flachland zwischen Elbe und Oder, Berlin, Éd. Deutscher Verlag der Wissenschaften (Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam 7).

GRAMSCH B. (1980) – Spätpaläolithikum und Frühmesolithikum im nordlichen Mitteleuropa, *Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam*, 14/15, p. 63-66.

GRAMSCH B. (1988) – Le Paléolithique final dans la région entre l'Oder et l'Elbe, *in* M. Otte dir., *De la Loire à l´Oder,* British Archaeological Reports International Series, 444, Oxford, Éd.*,* p. 511-522.

GRAMSCH B. (1990) – Die frühmesolithischen Knochenspitzen von Friesack, Kr. Nauen, *Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam*, 24, p. 7-26.

GRAMSCH B. (1992) – Friesack Mesolithic Wetlands, *in* B. Coles dir., *The Wetland Revolution in Prehistory*, Exeter, Éd. The Prehistoric Society*,* p. 65-72.

GRAMSCH B. (1993) – Ein mesolithischer Birkenrindenbehälter von Friesack, *Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam*, 27, p. 7-15.

GRAMSCH B. (1998) – Mesolithische Wasserlöcher in Brandenburg, in B. Beyer dir., Brunnen der Jungsteinzeit : internationales Symposium in Erkelenz, 27. bis 29. Oktober 1997 Materialien zur Bodendenkmalpflege im Rheinland, Erkelenz, Éd. Rheinland-Verlag, p. 17-23.

GRAMSCH B. (2002) – Friesack: Letzte Jäger und Sammler in Brandenburg, *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, 47, 2000, p. 51-96.

GRAMSCH B. (2006) – Site Continuity and Discontinuity of Occupations during Three Millenia of Mesolithic Settlements in Friesack, Northern Germany, *in* C.-J. Kind dir., *After the Ice Age. Settlements, subsistence and social development in the Mesolithic of Central Europe. Proceedings of the International Conference 9th to 12th of September 2003, Rottenburg/Neckar, Baden-Württemberg, Germany = Nach der Eiszeit = Après la période glaciaire* Materialhefte zur Archäologie in Baden-Württemberg, 78, Stuttgart, Éd. Theiss, p. 245-250.

GRAMSCH B. (2007) – Mesolithische Knochenanhänger und gelochte Haselnussschale von Friesack, Land Brandenburg, *in* A.G.i.T. e.V. dir., *Terra praehistorica. Festschrift für Klaus-Dieter Jäger zum 70. Geburtstag*, Langenweißbach, Éd. Beier & Beran, p. 233-240.

GRAMSCH B. (2010) – Paläolithforschung in der ehemaligen DDR, *Mitteilungen der Gesellschaft für Urgeschichte*, 19, p. 157-172.

GRAMSCH B. (2011) – Die mesolithischen Knochenspitzen von Friesack, Fundplatz 4, Lkr. Havelland: Teil 2: Die Knochenspitzen des späten Prä-, des Früh- und Spätboreals sowie des älteren Atlantikums, *Veröffentlichungen zur brandenburgischen Landesarchäologie*, 43/44, p. 7-84.

GRAMSCH B. (2012) – Mesolithische Knochenartefakte von Friesack, Fundplatz 4, Lkr. Havelland, *Veröffentlichungen zur brandenburgischen Landesarchäologie*, 45, p. 7-59.

GRAMSCH B. (2014) – Die Schmuckfunde von Friesack, Fundplatz 4, Lkr. Havelland, *Veröffentlichungen zur brandenburgischen Landesarchäologie*, 46, 2012, p. 7-26.

GRAMSCH B. (2016) – Friesack 4 - eine Feuchtbodenstation des Mesolithikums in Norddeutschland, *in* N. Benecke, B. Gramsch et S. Jahns dir., *Subsistenz und Umwelt der Feuchtbodenstation Friesack 4 im Havelland. Ergebnisse der naturwissenschaftlichen Untersuchungen,* Arbeitsberichte zur Bodendenkmalpflege in Brandenburg, 29, Wünsdorf, Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum, p. 9-24.

GRAMSCH B. (in press) – Die Artefakte aus Holz und Baumrinde vom mesolithischen Moorfundplatz Friesack 4, Lkr. Havelland, *Veröffentlichungen des Brandenburgischen Landesmuseums für Ur- und Frühgeschichte*, 47, 2013.

GRAMSCH B., BERAN J., HANIK S., SOMMER R.S. (2013) – A Palaeolithic fishhook made of ivory and the earliest fishhook tradition in Europe, *Journal of Archaeological Science*, 40, 5, p. 2458-2463.

GRAMSCH B., BERAN J., HEUßNER K.-U., BROSE F., THIEKE H.U., HANIK S., JAHNS S. (2010) – Spätaltsteinzeitliche Funde von Wustermark, Fundplatz 22, Lkr. Havelland, *Veröffentlichungen zur brandenburgischen Landesarchäologie*, 41/42, p. 95-141.

GRAMSCH B., ULLRICH H. (2014) – Menschliche Skelettreste und Schmuckzähne vom mesolithischen Moorfundplatz Friesack 4, Lkr. Havelland, *Veröffentlichungen zur brandenburgischen Landesarchäologie*, 46, 2012, p. 27-36.

GROß D. (2017) – *Welt und Umwelt frühmesolithischer Jäger und Sammler. Mensch-Umwelt-Interaktion im Frühholozän in der nordmitteleuropäischen Tiefebene*, Kiel, Éd. Ludwig (Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum 8).

GROß D. (in press) – Islands in the Swamp. Lakescape-reconstructions of Mesolithic sites in the Rhinluch area (Germany), *RGZM Conference Series*.

GROß D., LÜBKE H., MEADOWS J., DREIBRODT S., JANTZEN D. (in prep.) – Re-evaluation of the site Hohen Viecheln, *in* D. Groß, H. Lübke, J. Meadows et D. Jantzen dir., *Working at the sharp end: from bone and antler to Early Mesolithic life in Northern Europe,* Untersuchungen und Materialien zur Steinzeit in Schleswig-Holstein und im Ostseeraum, 10, tba.

GRÜNBERG J.M. 2006. *Proceedings of the Prehistoric Society*. Cambridge Univ Press, 95-112 p.

HANITZSCH H. (1957) – Die Spätmagdalénien-Station Groitzsch bei Eilenburg (Fundplatz A), *Varia Praehistoria. Forschungen zur Vor- und Frühgeschichte*, 2, p. 5-40.

HANITZSCH H. (1972) – *Groitzsch bei Eilenburg: Schlag-und Siedlungsplätze der späten Altsteinzeit*, Berlin, Éd. Deutscher Verlag der Wissenschaften (Veröffentlichungen des Landesmuseums für Vorgeschichte Dresden 12).

HEINEN M. (2014) – Waldjäger - das Mesolithikum im Rheinland, *in* L.-L. Bonn dir., *Eiszeitjäger. Leben im Paradies - Europa vor 15.000 Jahren*, Mainz, Éd. Nünnerich-Asmus Verlag, p. 289-311.

HILLER A., LITT T., EISSMANN L. (1991) – Zur Entwicklung der jungquartären Tieflandstäler im Saale-Elbe-Raum unter besonderer Berücksichtigung von 14C-Daten.

HILLER A., TINAPP C., GROOTES M., NADEAU P.M.-J. (2003) – Ungewöhnliche Probleme bei der 14C-Datierung organischer Komponenten und Fraktionen fluviatiler Sedimente aus der Aue der Weißen Elster bei Leipzig, *Eiszeitalter und Gegenwart*, 52, p. 4-12.

HOLST D. (2014) – *Subsistenz und Landschaftsnutzung im Frühmesolithikum. Nussröstplätze am Duvensee*, Mainz, Éd. Verl. des Römisch-Germanischen Zentralmuseums (Monographien des Römisch-Germanischen Zentralmuseums 120), X, 272 S., 233 Taf. p.

HOLZKÄMPER J., MAIER A., RICHTER J. (2013) – „Dark ages“ illuminated – Rietberg and related assemblages possibly reducing the hiatus between the Upper and Late Palaeolithic in Westphalia, *Quartär*, 60, p. 115-136.

HÜLLE W. (1977) – *Die Ilsenhohle unter Burg Ranis/Thuringen: Eine palaolithische Jagerstation*, Stuttgart, Éd. Gustav Fischer Verlag).

JAHNS S., GRAMSCH B., KLOSS K. (2016) – Pollenanalytische Untersuchungen am mesolithischen Fundplatz Friesack 4, Lkr. Havelland, nach Unterlagen aus dem Nachlass von Klaus Kloss, *in* N. Benecke, B. Gramsch et S. Jahns dir., *Subsistenz und Umwelt der Feuchtbodenstation Friesack 4 im Havelland. Ergebnisse der naturwissenschaftlichen Untersuchungen,* Arbeitsberichte zur Bodendenkmalpflege in Brandenburg, 29, Wünsdorf, Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum*,* p. 25-44.

JÖRIS O., THISSEN J. (1997) – Microlithic tool assemblages associated with Long Blade technology. Übach-Palenberg (Lower Rhine area)–a case study on a late Palaeolithic site at the boundary Younger Dryas/Pre-Boreal*, in* J.-P. Fagnart et A. Thévenin dir., *Le Tardiglaciaire en Europe du Nord-Ouest,* Actes du 119e Congrès national des sociétés historiques et scientifiques (Amiens, 1994), Paris, CTHS, Paris, Éd. Editions du CTHS*,* p. 611-621.

KAISER K., TERBERGER T. (1995) – Archäologisch-geowissenschaftliche Untersuchungen am spätpaläolithischen Fundplatz Nienhagen, Lkr. Nordvorpommern, *Bodendenkmalpflege in Mecklenburg-Vorpommern*, 43, p. 7-48.

KARL H.-V., KÜßNER M., PAUST E., SCHÜLER T., JELITZKI F. (2011) – A doline with Mesolithic finds near Göttern (Thuringia, Middle Germany), *Mesolithic Miscellany*, 21, 2, p. 14-19.

KAYSER H. (1999) – Spätglaziale Dünenlandschaft mit steinzeitlichen Rastplätzen im Tagebau Cottbus-Nord, *Arbeitsberichte zur Bodendenkmalpflege in Brandenburg*, 2, p. 17-22.

KERNCHEN I., GRAMSCH B. (1989) – Mesolithische Netz- und Seilreste von Friesack, Bezirk Potsdam, und ihre Konservierung, *Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam*, 23, p. 23-27.

KLOSS K. (1987a) – Pollenanalysen zur Vegetationsgeschichte, Moorentwicklung und mesolithisch-neolithischen Besiedlung im Unteren Rhinluch bei Friesack, Bezirk Potsdam, *Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam*, 21, p. 101-120.

KLOSS K. (1987b) – Zur Umwelt mesolithischer Jäger und Sammler im Unteren Rhinluch bei Friesack – Versuch einer Rekonstruktion mit Hilfe von Moorstratigraphie und Pollenanalyse, Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam, 21, p. 121-130.

KÜHNER R., HILLER A., JUNGE F.W., NEUBAUER-SAURER D., GAUTIER Y., SPURK M., KROMER B., PESCHKE P., BITTMANN F., PASDA C. (1999) – Naturwissenschaftliche Untersuchungen zum Weichselspätglazial in der Niederlausitz bei Cottbus (Land Brandenburg), *Quartär*, 49/50, p. 7-54.

KÜßNER M. (1994) – Jüngeres Mesolithikum – Ältestes Neolithikum, *in* H.-J. Beier dir., *Das Neolithikum im Mittelelbe-Saale-Gebiet und in der Altmark. Eine Übersicht und ein Abriß zum Stand der Forschung,* Beiträge zur Ur- und Frühgeschichte Mitteleuropas, 4, Wilkau-Hasslau, Éd. Beier & Beran*,* p. 363 S. En ligne.

KÜßNER M. (2007) – Mitteldeutsche Fundstellen der Zeit zwischen dem Weichsel-Pleniglazial und dem Ende des Allerød im Kartenbild, *in* A.G.i.T. e.V. dir., *Terra praehistorica. Festschrift für Klaus-Dieter Jäger zum 70. Geburtstag*, Langenweißbach, Éd. Beier & Beran, p. 211-223.

KÜßNER M. (2009) – *Die späte Altsteinzeit im Einzugsgebiet der Saale. Untersuchungen an ausgewählten Fundstellen*, Langenweissbach, Éd. Beier & Beran (Weimarer Monographien zur Ur- und Frühgeschichte 42), 327 S. p. En ligne.

KÜßNER M., BIRKENBEIL S. (2011) – Neue Untersuchungen an Menschenresten vom Abri Fuchskirche I bei Allendorf (Lkr. Saalfeld-Rudolstadt)–eine mesolithische Bestattung, *Alt-Thüiringen*, 41, p. 242-246.

KÜßNER M., JÄGER K.-D. (2015) – Die Besiedlungsgeschichte Thuringens im spaten Jungpalaolithikum in ihrem naturlichen Umfeld, *Anthropologie*, 53, 1-2, p. 295.

LITT T., BEHRE K.-E., MEYER K.-D., STEPHAN H.-J., WANSA S. (2007) – Stratigraphische Begriffe für das Quartär des norddeutschen Vereisungsgebietes, *Eiszeitalter und Gegenwart*, 56, 1-2, p. 7-65.

Lübke et al. this volume

MEADOWS J., BOUDIN M., GROß D., JANTZEN D., LÜBKE H., WILD M. (in review) – Radiocarbon dating consolidated bone and antler artefacts from Mesolithic Hohen Viecheln (Mecklenburg-Vorpommern, Germany), *Radiocarbon*.

MESZNER S., KREUTZER S., FUCHS M., FAUST D. (2013) – Late Pleistocene landscape dynamics in Saxony, Germany: Paleoenvironmental reconstruction using loess-paleosol sequences, *Quaternary International*, 296, p. 94-107.

MOL J., VANDENBERGHE J., KASSE C. (2000) – River response to variations of periglacial climate in mid-latitude Europe, *Geomorphology*, 33, 3, p. 131-148.

NEUBECK V. (2014) – *Kleinlieskow 120 – Ein Federmesser-Fundplatz in der Niederlausitz*, Dissertation, Universität Jena, Jena.

PASDA C. (2001) – Das Knochengrät vom spätpaläolithischen Fundplatz Kleinlieskow in der Niederlausitz. Ein Essay zum steinzeitlichen Angelhaken, *in* B. Gehlen, M. Heinen et A. Tillmann dir., *Zeit-Räume - Gedenkschrift für Wolfgang Taute,* Archäologische Berichte, 14, Bonn, Éd. Habelt, p. 397-408.

PASDA C. (2002) – Archäologie einer Düne im Baruther Urstromtal bei Groß Lieskow, Stadt Cottbus, *Veröffentlichungen des Brandenburgischen Landesmuseums für Ur- und Frühgeschichte*, 33, 1999, p. 7-49.

PASDA C. (2007) – Living culturally in ice-age forests, dunes and swamps. Preliminary results of a study of backed retouched pieces of the Late Palaeolithic site Kleinlieskow 120 in Lower Lusatia (Brandenburg, FRG), *in* M. Masojć, T. Płonka, B. Ginter et S.K. Kozłowski dir., *Contributions to the Central European Stone Age. Papers dedicated to the Late Professor Zbigniew Bagniewski*, Wrocław, Éd. Uniwersytet Wrocławski, Instytut Archeologii, p. 43-51.

PAWLIK A. (2010). – Mikroskopische Gebrauchsspurenuntersuchungen an mesolithischen Artefakten aus Friesack 4 – Zusammenfassung der Ergebnisse: 13 p

VANG PETERSEN P. (1993) – Flint fra Danmarks oldtid, København, Éd. Høst), 154 S. zahlr. Ill p. En ligne.

POPPSCHÖTZ R., BUSSEMER S., KOWALKOWSKI A., MACHALETT B. (2010) – Das mehrphasige spätpleistozän/frühholozäne Bodenprofil Dühringsheide-NW im Braunkohlentagebau Jänschwalde (Niederlausitz), *Brandenburg. Geowiss. Beitr*, 17, 1/2, p. 55-62.

PRATSCH S. (2011) – Mesolithic antler artefacts in the North European Plain, *in* J. Baron et B. Kufel-Diakowska dir., *Written in Bones. Studies on technological and social contexts of past faunal skeletal remains.*, Wrocław, Éd. Uniwersytet Wrocławski, Instytut Archeologii p. 79-92.

RAAB T., RAAB A., NICOLAY A., TAKLA M., HIRSCH F., RÖSLER H., BAURIEGEL A. (2016) – Opencast mines in South Brandenburg (Germany)—archives of Late Quaternary landscape development and human-induced land use changes, *Archaeological and Anthropological Sciences*, 8, 3, p. 453-466. En ligne: <http://dx.doi.org/10.1007/s12520-015-0227-6>.

RASMUSSEN S.O., BIGLER M., BLOCKLEY S.P., BLUNIER T., BUCHARDT S.L., CLAUSEN H.B., CVIJANOVIC I., DAHL-JENSEN D., JOHNSEN S.J., FISCHER H., GKINIS V., GUILLEVIC M., HOEK W.Z., LOWE J.J., PEDRO J.B., POPP T., SEIERSTAD I.K., STEFFENSEN J.P., SVENSSON A.M., VALLELONGA P., VINTHER B.M., WALKER M.J.C., WHEATLEY J.J., WINSTRUP M. (2014) – A stratigraphic framework for abrupt climatic changes during the Last Glacial period based on three synchronized Greenland ice-core records: refining and extending the INTIMATE event stratigraphy, *Quaternary science reviews*, 106, p. 14-28.

REIMER P.J., BARD E., BAYLISS A., BECK J.W., BLACKWELL P.G., BRONK RAMSEY C., BUCK C.E., CHENG H., EDWARDS R.L., FRIEDRICH M. (2013) – IntCal13 and Marine13 radiocarbon age calibration curves 0-50,000 years cal BP, *Radiocarbon*, 55, 4, p. 1869-1887.

ROBSON H.K. (2016) – New ichtyoarchaeological data from the Mesolithic lakeshore settlement site of Friesack 4, *in* N. Benecke, B. Gramsch et S. Jahns dir., *Subsistenz und Umwelt der Feuchtbodenstation Friesack 4 im Havelland. Ergebnisse der naturwissenschaftlichen Untersuchungen,* Arbeitsberichte zur Bodendenkmalpflege in Brandenburg, 29, Wünsdorf, Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum, p. 160-177.

SCHACHT S. (1993) – Ausgrabungen auf einem Moorfundplatz und zwei Siedlungsplätzen aus dem Mesolithikum/Neolithikum im nördlichen Randowbruch bei Rothenklempenow, Kr. Pasewalk, *Ausgrabungen und Funde – Archäologische Berichte und Informationen*, 38, 3, p. 111-119.

SCHACHT S., BOGEN C. (2001) – Neue Ausgrabungen auf dem mesolithisch-neolithischen Fundplatz 17 am Latzig-See bei Rothenklempenow, Lkr. Uecker-Randow, *Archäologische Berichte aus Mecklenburg-Vorpommern*, 8, p. 5-21.

SCHMÖLCKE U. (2016) – Die Säugetierfunde vom präboreal- und borealzeitlichen Fundplatz Friesack 4 in Brandenburg, *in* N. Benecke, B. Gramsch et S. Jahns dir., *Subsistenz und Umwelt der Feuchtbodenstation Friesack 4 im Havelland. Ergebnisse der naturwissenschaftlichen Untersuchungen,* Arbeitsberichte zur Bodendenkmalpflege in Brandenburg, 29, Wünsdorf, Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum, p. 45-116.

SCHULDT E. (1961a) – Der mittelsteinzeitliche Wohnplatz Hohen Viecheln, *in* E. Schuldt dir., *Hohen Viecheln: Ein mittelsteinzeitlicher Wohnplatz in Mecklenburg,* Schriften der Sektion für Vor- und Frühgeschichte, 10, Berlin, Éd. Akademie-Verlag, p. 75-156.

SCHULDT E. (1961b) – *Hohen Viecheln: Ein mittelsteinzeitlicher Wohnplatz in Mecklenburg*, Berlin, Éd. Akademie-Verlag (Schriften der Sektion für Vor- und Frühgeschichte 10).

SCHÜLKE A. (2011) – *Landschaften - eine archäologische Untersuchung der Region zwischen Schweriner See und Stepenitz*, Darmstadt [u.a.], Éd. von Zabern (Römisch-Germanische Forschungen 68), VII, 359 S. p. En ligne. <http://www.gbv.de/dms/tlda/PPN_675811325.pdf

SØRENSEN M., LÜBKE H., GROß D. (submitted) – The Early Mesolithic in Southern Scandinavia and Northern Germany, *in* N. Milner dir., *Star Carr [working title]*, York, Éd.

STAPEL B. (2000) – Als die Rentiere von Weißagk nach Horno zogen. Überblick zu den Untersuchungen auf spätpaläolithischen Plätzen an der Malxe zwischen Grötsch und Heinersbrück, *Arbeitsberichte zur Bodendenkmalpflege in Brandenburg*, 6, p. 9-16.

STEFFENSEN J.P., ANDERSEN K.K., BIGLER M., CLAUSEN H.B., DAHL-JENSEN D., FISCHER H., GOTO-AZUMA K., HANSSON M., JOHNSEN S.J., JOUZEL J., MASSON-DELMOTTE V., POPP T., RASMUSSEN S.O., ROTHLISBERGER R., RUTH U., STAUFFER B., SIGGAARD-ANDERSEN M.L., SVEINBJORNSDOTTIR A.E., SVENSSON A., WHITE J.W. (2008) – High-resolution Greenland ice core data show abrupt climate change happens in few years, *Science*, 321, 5889, p. 680-684. En ligne: <http://www.ncbi.nlm.nih.gov/pubmed/18566247>.

STEINMÜLLER A. (2002) – Stratigraphische Gliederung weichselzeitlicher fluviatiler Sedimente und periglazialer Deckschichten im unteren Ilmtal und in einem Abschnitt des nördlichen mitteleren Saaletals, *Beiträge zur Geologie in Thüringen N.F.*, 9, p. 273-299.

STREET M. (1996) – The late glacial faunal assemblage from Endingen, Lkr. Nordvorpommern, *Archäologisches Korrespondenzblatt*, 26, p. 33–42.

STREET M., BAALES M., CZIESLA E., HARTZ S., HEINEN M., JÖRIS O., KOCH I., PASDA C., TERBERGER T., VOLLBRECHT J. (2001) – Final Paleolithic and Mesolithic research in reunified Germany, *Journal of World Prehistory*, 15, 4, p. 365-453.

STREET M., BAALES M., GEHLEN B., HEINEN M., ZANDER A. (this volume) – Human responses to rapid environmental change: Archaeology across the Pleistocene-Holocene boundary in western Germany

TAUTE W. (1971) – Untersuchungen zum Spätpaläolithikum und Mesolithikum im südlichen Mitteleuropa, Habilitationsschrift, Tübingen

TERBERGER T. (2006) – The mesolithic hunter-fisher-gatherers on the Northern German Plain, *in* Keld Møller Hansen et K.B. Pedersen dir., *Across the western Baltic*, Vordingborg, Éd. Sydsjællands Museum, p. 111-184.

TERBERGER T., DE KLERK P., HELBIG H., KAISER K., KÜHN P. (2004) – Late Weichselian landscape development and human settlement in Mecklenburg-Vorpommern (NE Germany), *Eiszeitalter und Gegenwart*, 54, 1, p. 138-175.

TERBERGER T., KLOSS K., KREISEL H. (1996) – Die >>Riesenhirschfundstelle<< von Endingen, Lkr. Nordvorpommern. Spätglaziale Besiedlungsspuren in Nordostdeutschland, *Archäologisches Korrespondenzblatt*, 26, p. 13–42.

TERBERGER T., KÜßNER M., SCHÜLER T., STREET M. (2003) – Mesolithische Menschenreste aus der Urdhöhle bei Döbritz, Saale-Orla-Kreis, *Alt-Thüringen*, 36, p. 4-20.

ULLRICH H. (2016) – Sumpfschildkrötenreste aus der mesolithischen Siedlung Friesack, *in* N. Benecke, B. Gramsch et S. Jahns dir., *Subsistenz und Umwelt der Feuchtbodenstation Friesack 4 im Havelland. Ergebnisse der naturwissenschaftlichen Untersuchungen,* Arbeitsberichte zur Bodendenkmalpflege in Brandenburg, 29, Wünsdorf, Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum, p. 178-188.

USINGER H. (2004) – Vegetation and climate of the lowlands of northern Central Europe and adjacent areas around the Younger Dryas–Preboreal transition–with special emphasis on the Preboreal oscillation, *in* T. Terberger et B.V. Eriksen dir., *Hunters in a changing world - Environment and Archaeology of the Pleistocene - Holocene Transition (ca. 11000 – 9000 B.C.) in Northern Central Europe,* Internationale Archäologie – Arbeitsgemeinschaft, Symposium, Tagung, Kongress, 5, Rahden/Westfalen, Éd., p. 1-26.

VAN ASCH N., KLOOS M.E., HEIRI O., DE KLERK P., HOEK W.Z. (2012) – The Younger Dryas cooling in northeast Germany: summer temperature and environmental changes in the Friedländer Groβe Wiese region, *Journal of Quaternary Science*, 27, 5, p. 531-543. En ligne: <http://dx.doi.org/10.1002/jqs.2547>.

VOLLBRECHT J. (2005) – Spätpaläolithische Besiedlungsspuren aus Reichwalde, Dresden, Éd. Landesamt für Archäologie mit Landesmuseum für Vorgeschichte (Veröffentlichungen des Landesamtes für Archäologie mit Landesmuseum für Vorgeschichte 46), 459 S p.

WECHLER K.-P. (1988) – Zwei spätpaläolithische Feuersteinschlagplätze aus dem Altmoränengebiet der südwestlichen Niederlausitz, *Veröffentlichungen des Museums für Ur-und Frühgeschichte Potsdam*, 22, p. 7-15.

WECHLER K.-P. (1998) – Burow 3, Lkr. Oberhavel, ein mesolithischer Siedlungsplatz im nördlichen Brandenburg, *Veröffentlichungen des Brandenburgischen Landesmuseums für Ur- und Frühgeschichte*, 32, p. 7-39.

WECHLER K.-P., WETZEL G. (1987) – Eine Fundstelle mit steinzeitlichem Bergbau auf Moränenfeuerstein von Bergheide, Kr. Finsterwalde, *Veröffentlichungen des Museums für Ur-und Frühgeschichte Potsdam*, 21, p. 7-30.

WEIß M. (2013) – Unsere Spuren sind ROT!, *in* H. Meller, C.-H. Wunderlich et F. Knoll dir., *Rot - Die Archäologie bekennt Farbe. 5. Mitteldeutscher Archäologentag vom 04. bis 06. Oktober 2012 in Halle (Saale),* Tagungen des Landesmuseums für Vorgeschichte Halle, 10, Halle (Saale), Éd. Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte*,* p. 113-120.

WENZEL S. (2002) – Mesolithische Lagerplatzstrukturen am Moorfundplatz Friesack 4 Lkr. Havelland, *Greifswalder Geographische Arbeiten*, 26, p. 207-210.

WENZEL S. (2003) – Mittelsteinzeitliche Gruben vom Moorfundplatz Friesack 4, Lkr. Havelland, *in* J.M. Burdukiewicz, L. Fiedler, W.-D. Heinrich, A. Justus et E. Brühl dir., *Erkenntnisjäger - Kultur und Umwelt des frühen Menschen. Festschrift für Dietrich Mania,* Veröffentlichungen des Landesamtes für Archäologie Sachsen-Anhalt - Landesmuseum für Vorgeschichte, 57, Halle (Saale), Éd*.,* p. 659-671.

WINKLER K. (2010) – Der spatpaläolithische Fundplatz Golßen, Lkr. Dahme-Spreewald. Analyse der Steinartefakte und Befunde der Grabung von 1968, *Veröffentlichungen zur brandenburgischen Landesarchäologie*, 41/42, 2007/2008, p. 7-93.

WOLTERS S. (2016) – Die pflanzlichen Makroreste der Mesolithstation Friesack, *in* N. Benecke, B. Gramsch et S. Jahns dir., *Subsistenz und Umwelt der Feuchtbodenstation Friesack 4 im Havelland. Ergebnisse der naturwissenschaftlichen Untersuchungen,* Arbeitsberichte zur Bodendenkmalpflege in Brandenburg, 29, Wünsdorf, Éd. Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum*,* p. 189-203.

ZANDER A. (2016) – Heek-Nienborg and Werl-Büderich: The transition from Palaeolithic to Mesolithic in Westphalia, *Archäologische Informationen*, 39.

Figure and Table captions

Fig. 1 Geomorphology of Eastern Germany (after Franke, 2015, Fig. 24).

Fig. 2 Mentioned and other relevant sites in this study: 1 Wallendorf, 2 Hartmannsdorf, 3 Ranis, 4 Bärenkeller, 5 Taucha, 6 Bergheide, 7 Finsterwalde, 8 Etzdorf, 9 Abri Fuchskirche, 10 Reichwalde, 11 Groitzsch, 12 Groß Lieskow, 13 Kleinlieskow, 14 Braunsbedra, 15 Blankenburg, 16 Westerhausen, 17 Schkeuditz, 18 Weißagk/Grötsch, 19 Golßen, 20 Kranichfeld, 21 Hohenfelden, 22 Pöllnitz, 23 Malitschkendorf, 24 Göttern, 25 Haßleben, 26 Urdhöhle, 27 Potsdam Schlaatz , 28 Wustermark 22, 29 Friesack, 30 Rothenklempenow, 31 Hohen Viecheln, 32 Nienhagen, 33 Endingen.

Fig. 3 Artefacts from Abri Fuchskirche.

Fig. 4 Site plan of the upper layer of Reichwalde (above) and relations between the different concentrations (below).

Fig. 5 Artefacts from Reichwalde (upper layer).

Fig. 6 *Federmesser* artefacts from Groß Lieskow.

Fig. 7 Ahrensburgian artefacts from Groß Lieskow.

Fig. 8 Site plan with find concentrations of Kleinlieskow.

Fig. 9 Artefacts from Kleinlieskow.

Fig. 10 Artefacts from Kleinlieskow.

Fig. 11 Artefacts from Weißagk/Grötsch.

Fig. 12 Calibrated radiocarbon dates for the Mesolithic settlement in Friesack 4, Brandenburg. The dates for the merged stratigraphy from trenches Z, D and C show a nearly continuous sequence from 9000 to 6400 cal. BC onwards. The dates from three pits on the sand hill fill in the hiatus during the middle to late Boreal period between 7500 and 7000 cal. BC.

Fig. 13 Microliths from the pits on the sand hill, dated to the middle to late Boreal period (drawings from Wenzel 2003).

Fig. 14 Typical microliths for the dated sequence of the subaquatic stratigraphy from trenches Z, C layers 23x and D, Younger Mesolithic (drawings B. Gehlen / A. Rüschmann).

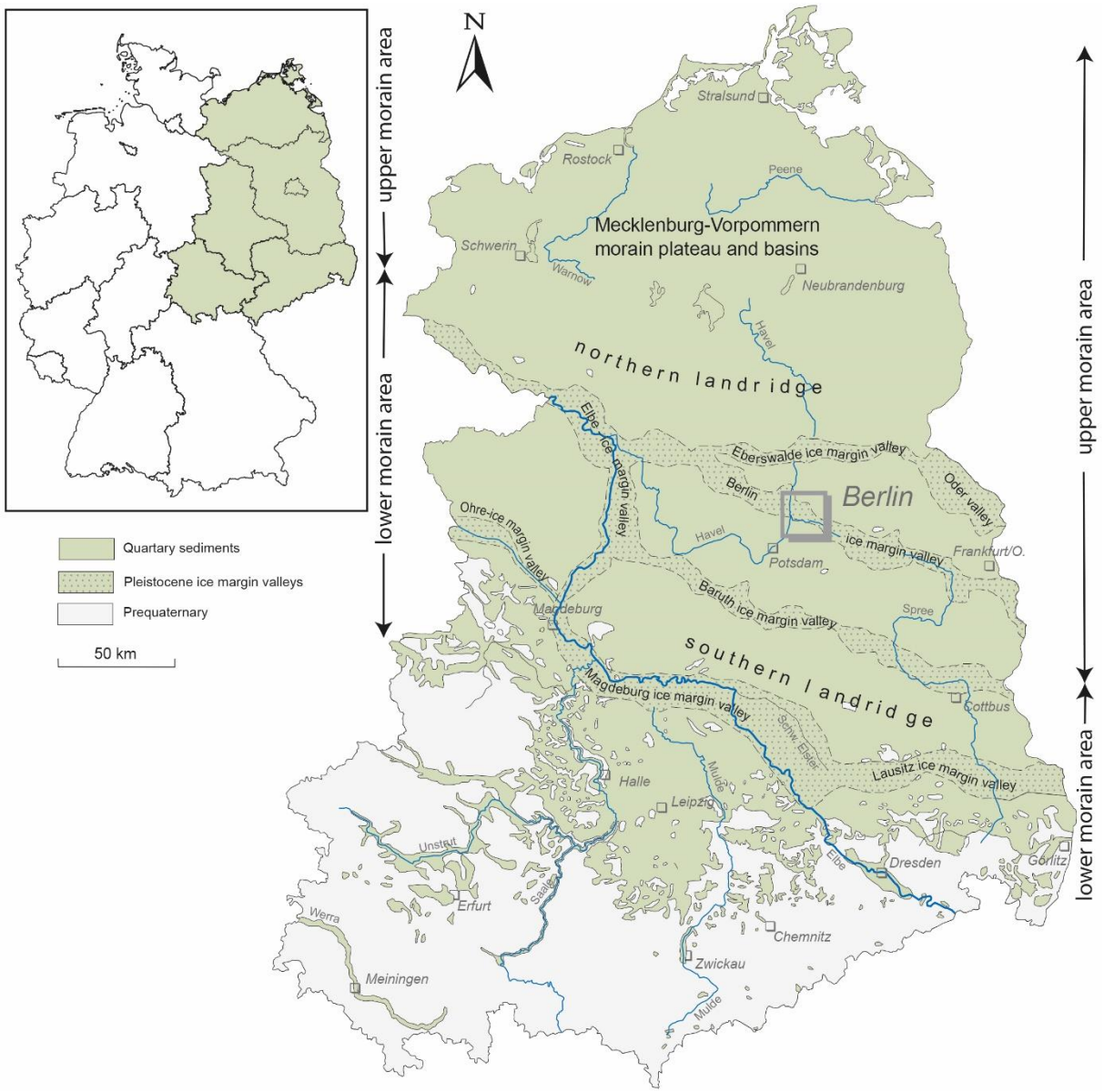

Fig. 1 Geomorphology of Eastern Germany (after Franke, 2015, Fig. 24).

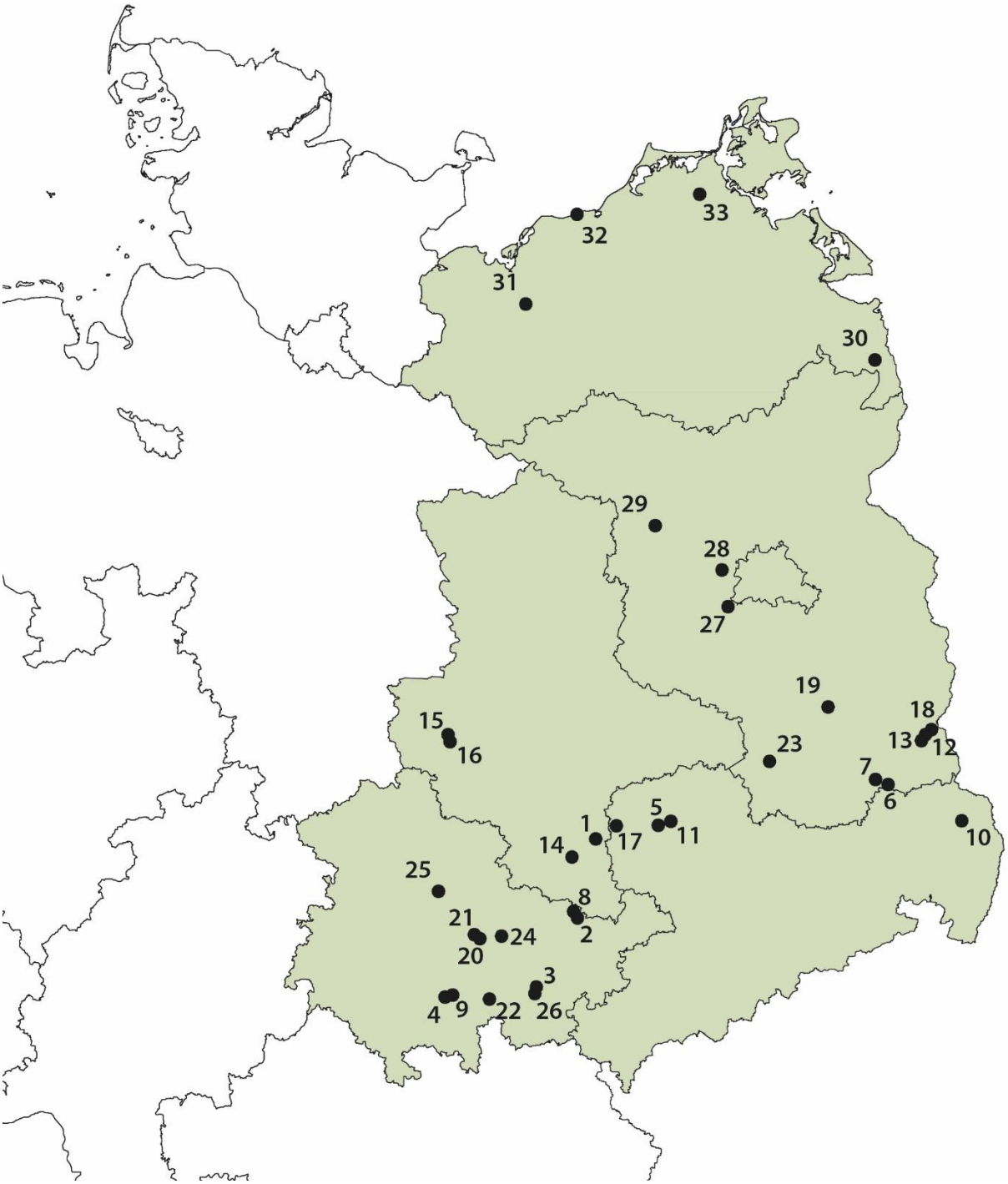

Fig. 2 Mentioned and other relevant sites in this study: 1 Wallendorf, 2 Hartmannsdorf, 3 Ranis, 4 Bärenkeller, 5 Taucha, 6 Bergheide, 7 Finsterwalde, 8 Etzdorf, 9 Abri Fuchskirche, 10 Reichwalde, 11 Groitzsch, 12 Groß Lieskow, 13 Kleinlieskow, 14 Braunsbedra, 15 Blankenburg, 16 Westerhausen, 17 Schkeuditz, 18 Weißagk/Grötsch, 19 Golßen, 20 Kranichfeld, 21 Hohenfelden, 22 Pöllnitz, 23 Malitschkendorf, 24 Göttern, 25 Haßleben, 26 Urdhöhle, 27 Potsdam Schlaatz , 28 Wustermark 22, 29 Friesack 4 + 27, 30 Rothenklempenow, 31 Hohen Viecheln, 32 Nienhagen, 33 Endingen.

Fig. 3 Artefacts from Abri Fuchskirche.

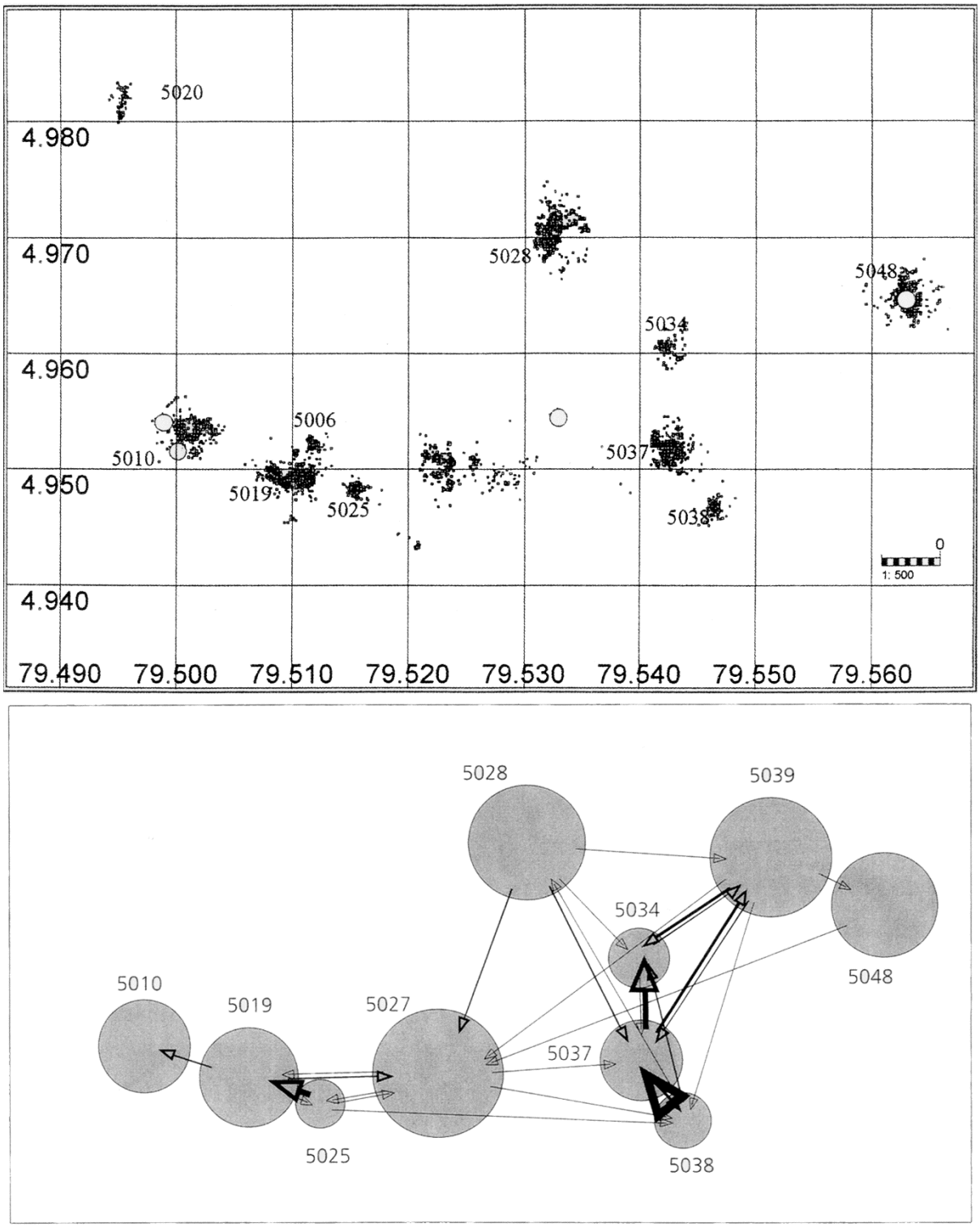

Fig. 4 Site plan of the upper layer of Reichwalde (above) and relations between the different concentrations (below).

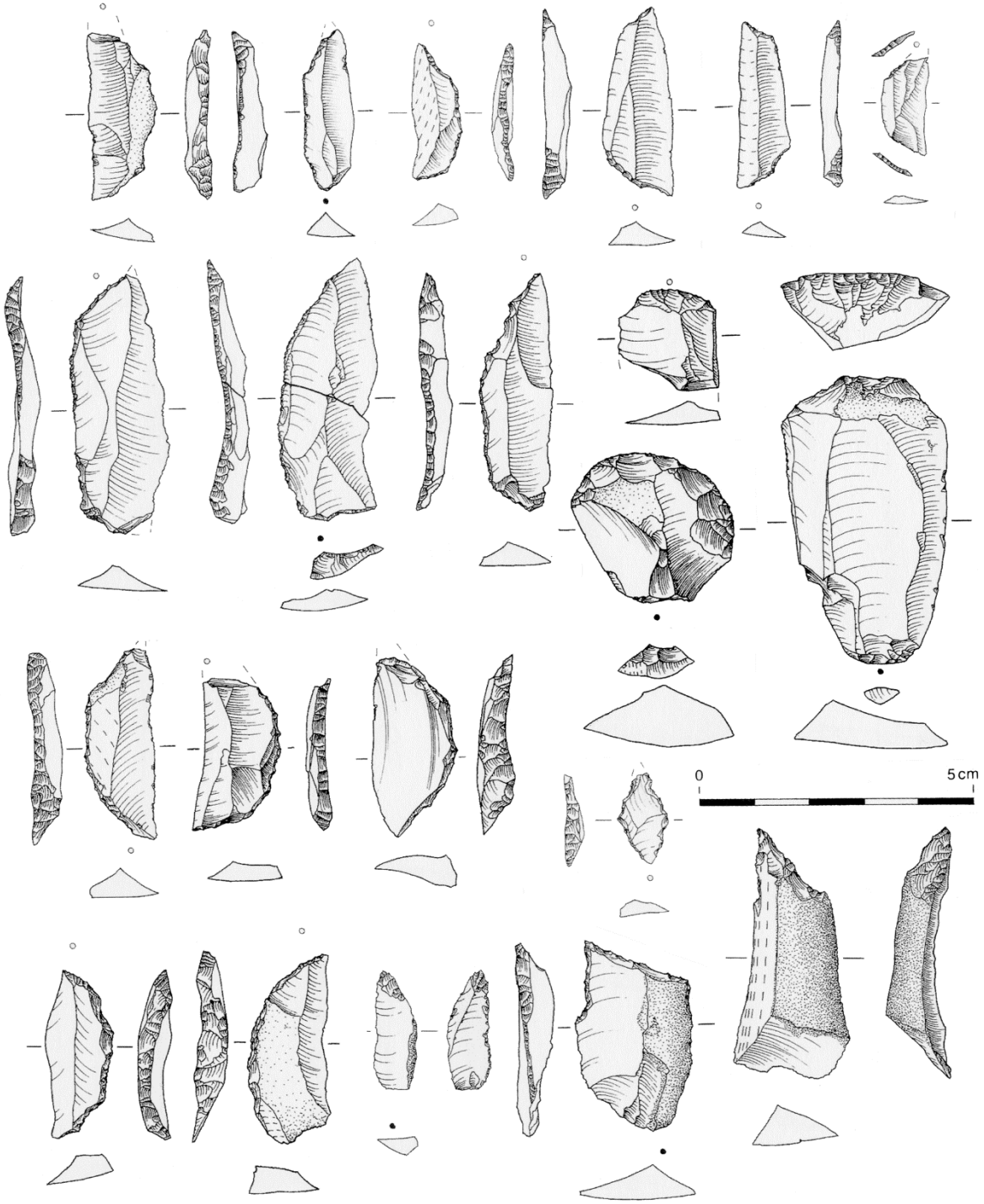

Fig. 5 Artefacts from Reichwalde (upper layer).

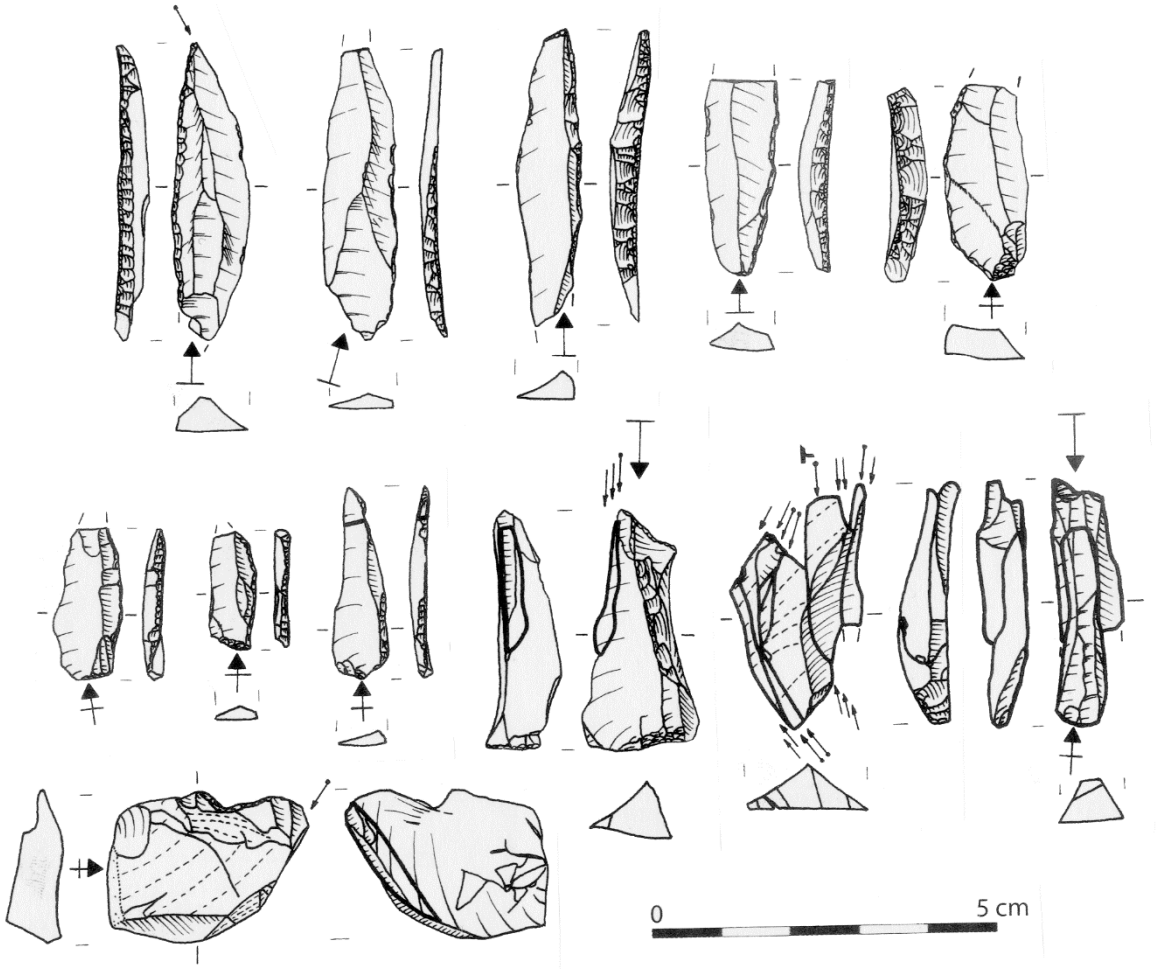

Fig. 6 *Federmesser* artefacts from Groß Lieskow.

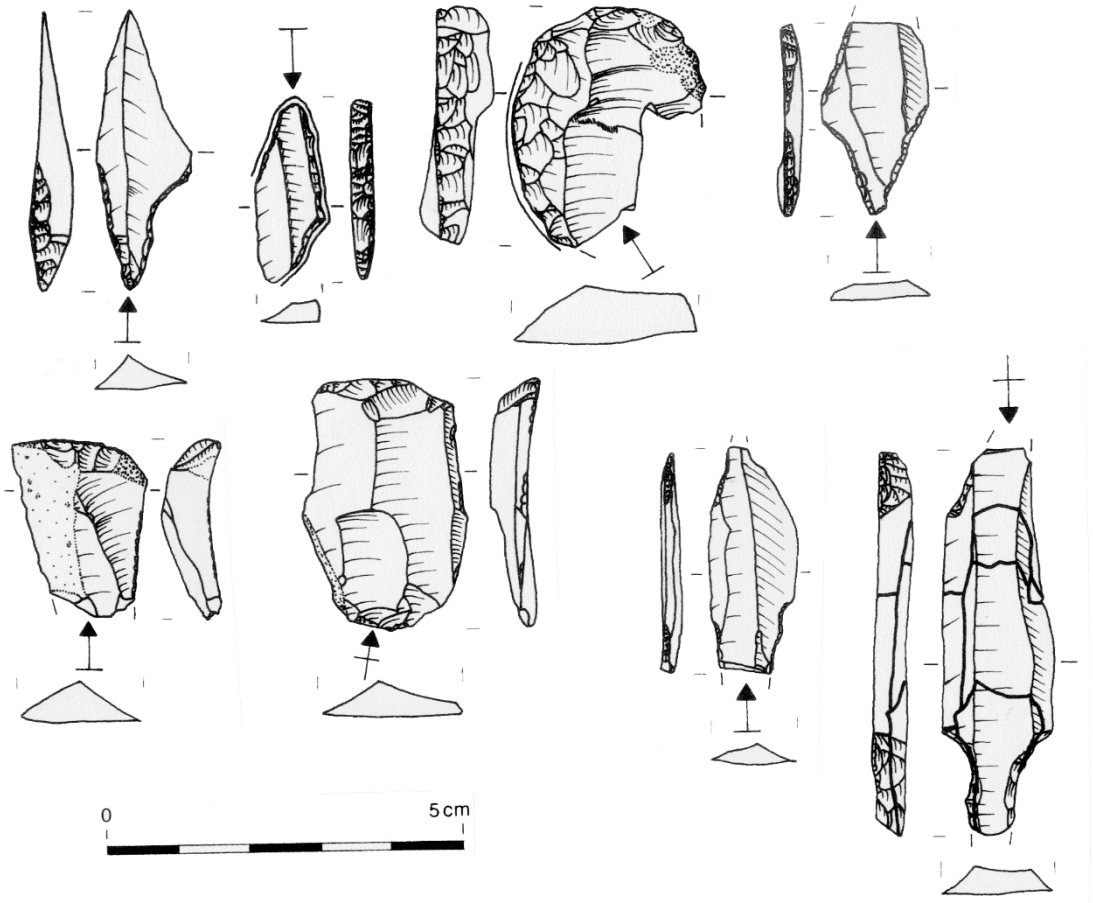

Fig. 7 Ahrensburgian artefacts from Groß Lieskow.

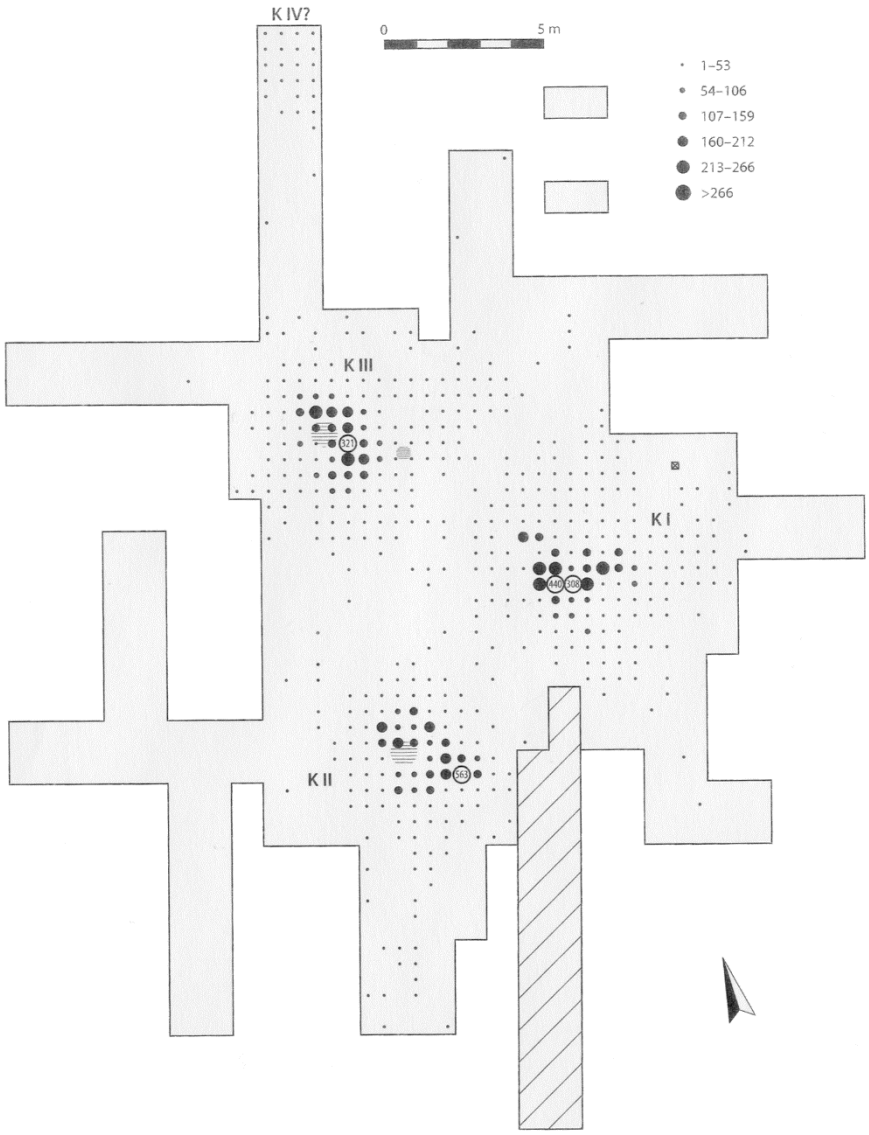

Fig. 8 Site plan with find concentrations of Kleinlieskow.

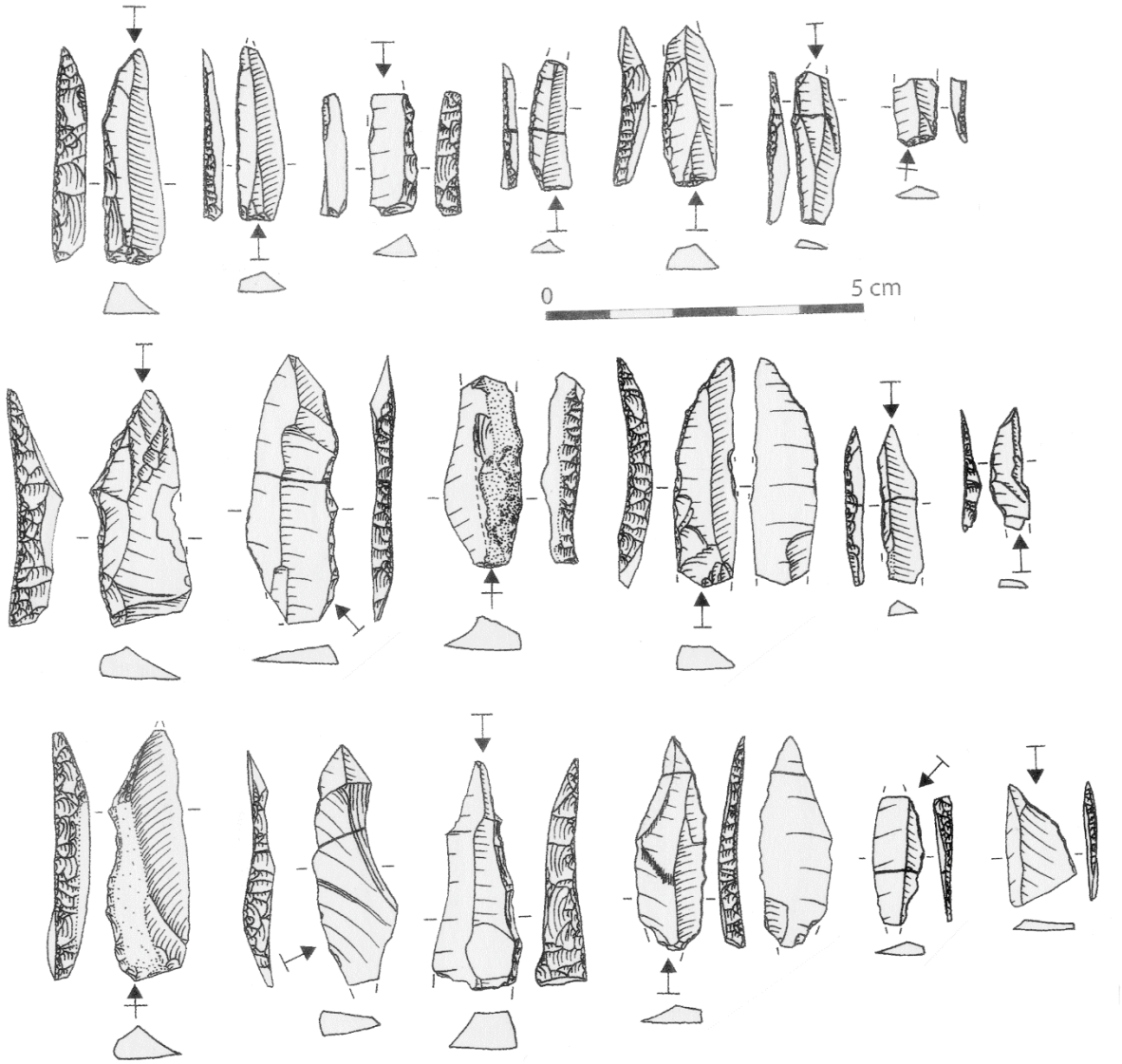

Fig. 9 Artefacts from Kleinlieskow.

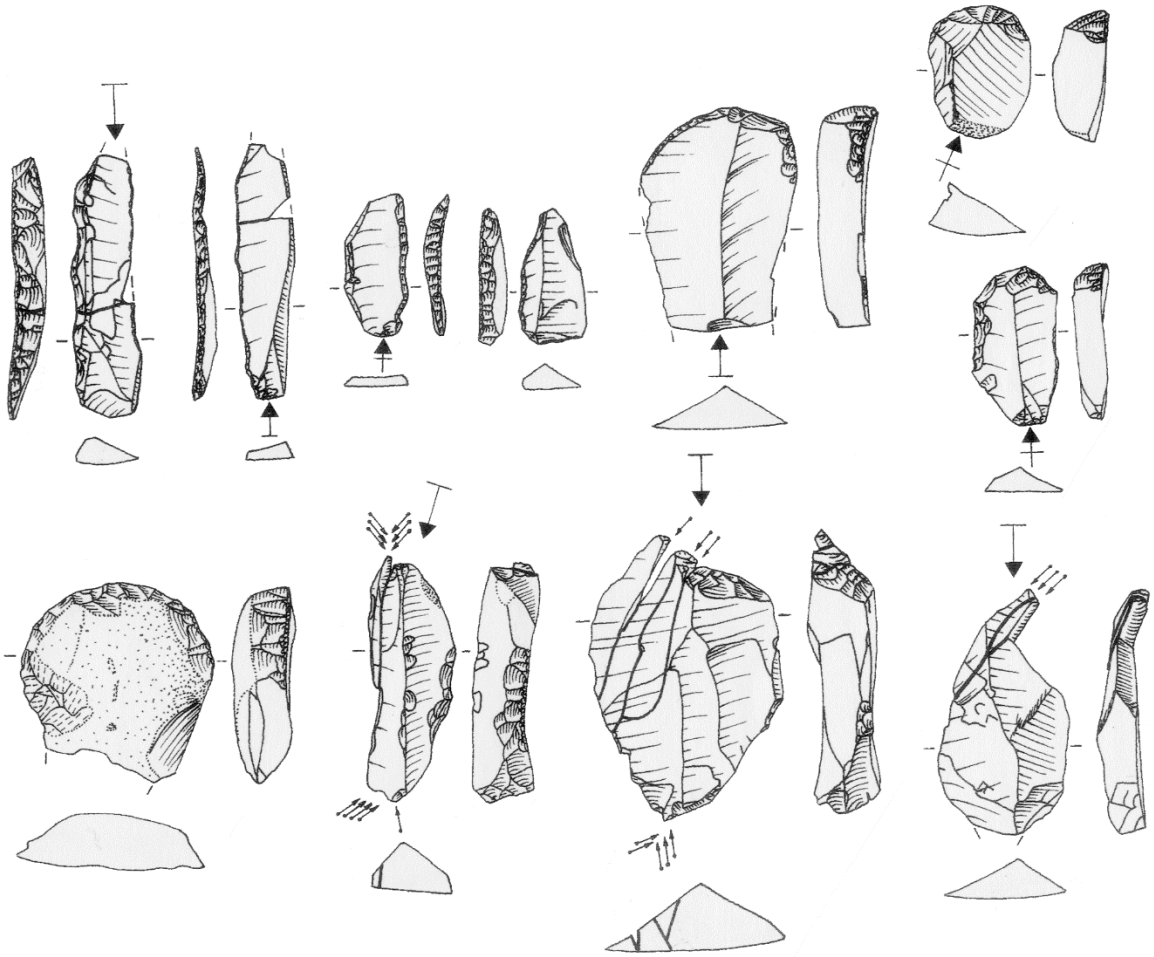

Fig. 10 Artefacts from Kleinlieskow.

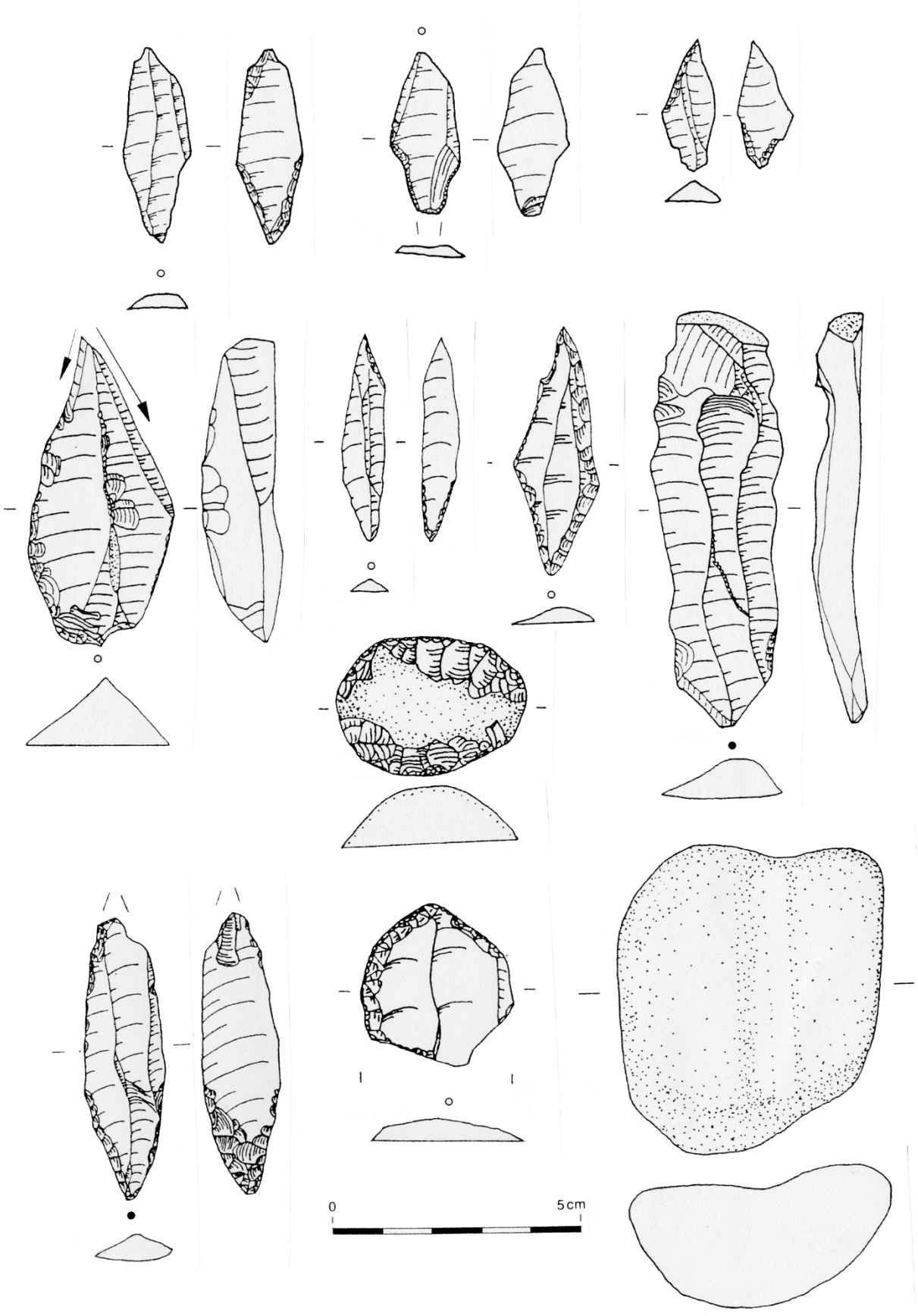

Fig. 11 Artefacts from Weißagk/Grötsch.

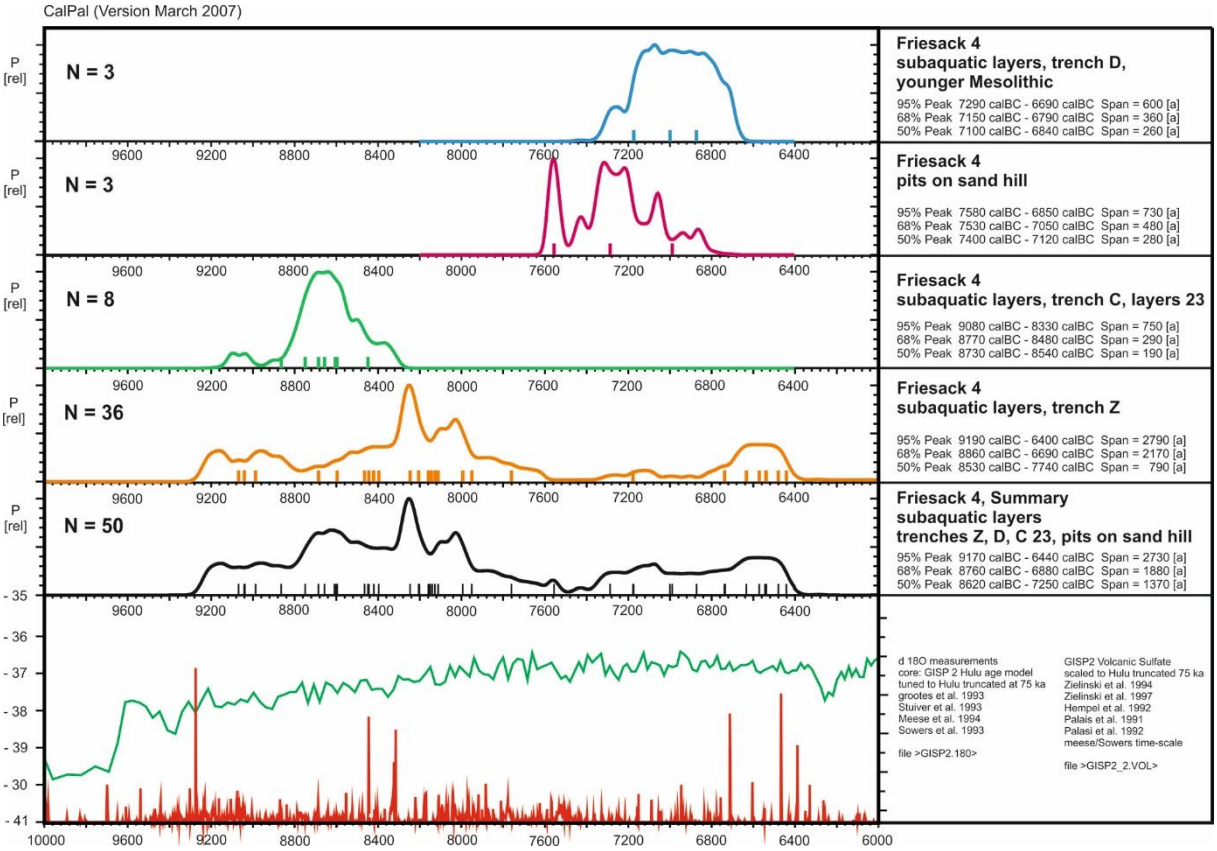

Fig. 12 Calibrated radiocarbon dates for the Mesolithic settlement in Friesack 4, Brandenburg. The dates for the merged stratigraphy from trenches Z, D and C show a nearly continuous sequence from 9000 to 6400 cal. BC onwards. The dates from three pits on the sand hill fill in the hiatus during the middle to late Boreal period between 7500 and 7000 cal. BC (graphics W. Schön / B. Gehlen).

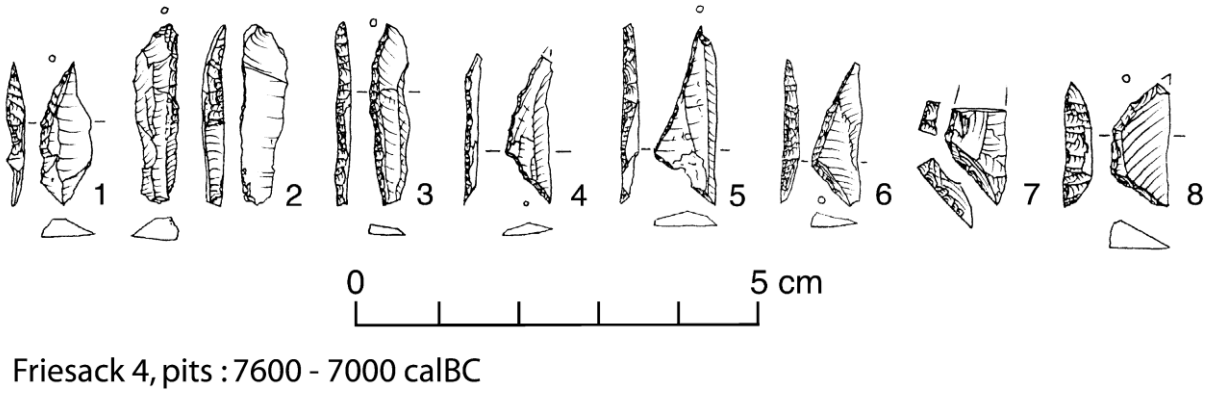

Fig. 13 Microliths from the pits on the sand hill, dated to the middle to late Boreal period (drawings from Wenzel 2003).

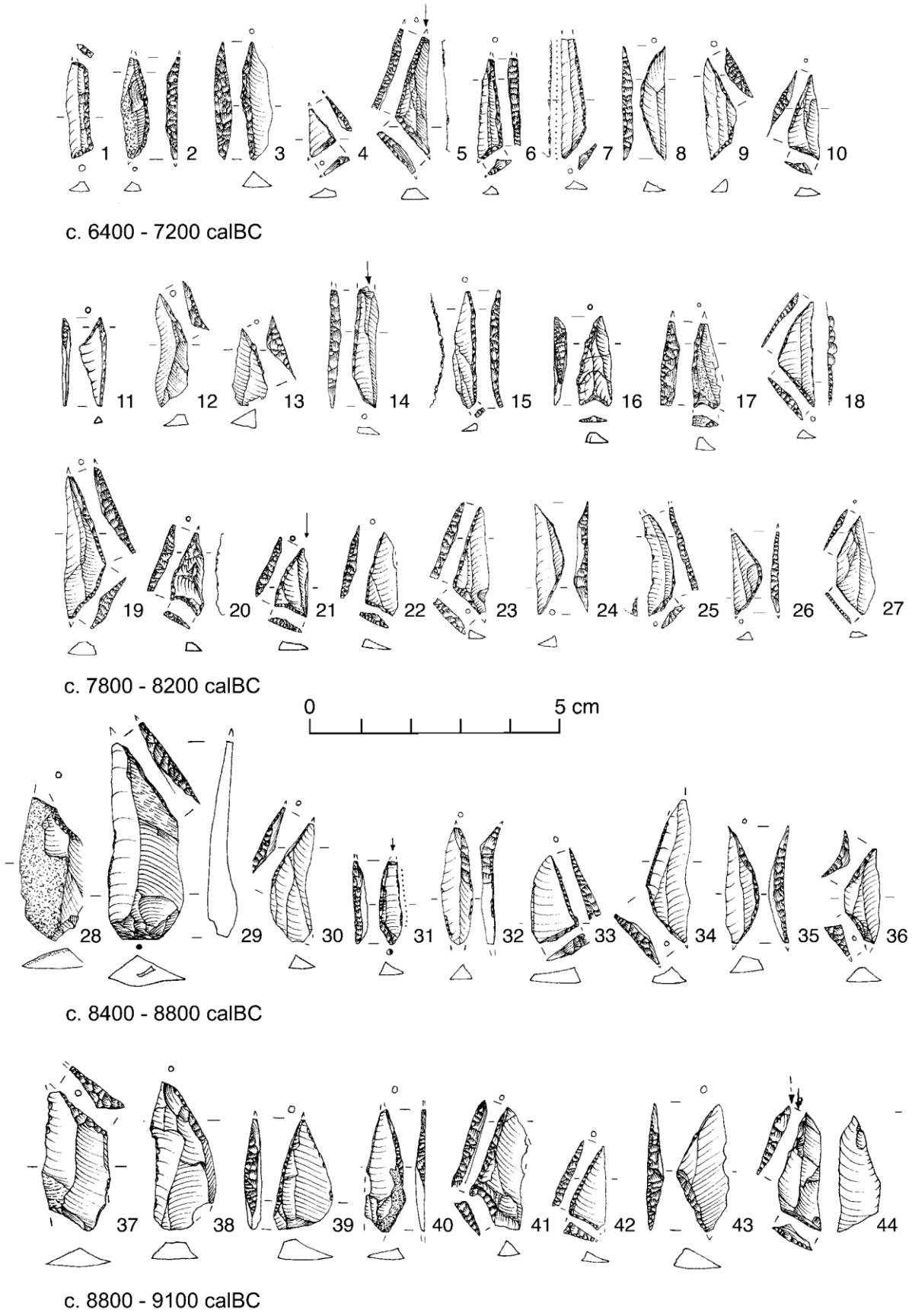

Fig. 14 Typical microliths for the dated sequence of the subaquatic stratigraphy from trenches Z, C layers 23x and D, Younger Mesolithic (drawings B. Gehlen / A. Rüschmann).