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„Dark Ages" illuminated – Rietberg and related assemblages possibly reducing the hiatus between the Upper and Late Palaeolithic in Westphalia

Licht im „Dunklen Zeitalter" – Rietberg und verwandte Inventare verkürzen möglicherweise den Hiatus zwischen Jung- und Spätpaläolithikum in Westfalen

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Abstract - A conspicuous feature of the Late Upper Palaeolithic settlement pattern in Northern Germany and adjacent regions is an about 100 km broad, east-west oriented zone, situated between the settlement areas of the Hamburgian in the north and the Magdalenian in the south, from which virtually no sites from either archaeological entity are reported so far. The Westphalian lowlands, which are situated in this empty zone, are usually thought to have been populated only during the late Allerød-Interstadial (GI-1_{c1}). Recent research, however, indicates that this zone became populated already during the early Allerød-Interstadial (GI-1_{c3}). From a typological point of view, the four investigated sites, namely Rietberg, Reken, Borken-Gemenkrückling and Haltern-Lavesum, can generally be attributed to the Early Federmessergruppen. However, since the tool spectrum exhibits certain idiosyncrasies in comparison to other sites of this period in Central and Northwestern Europe, we consider these assemblages to represent a distinguishable regional group within the Early Federmesser complex. In this paper, we present the typological and technological characteristics of the four Westphalian sites and discuss them in the context of the Late Upper to Late Palaeolithic transition.

Zusammenfassung - *Ein auffälliger Befund im Siedlungsmuster des späten Jungpaläolithikums in Norddeutschland ist eine etwa 100 km breite, Ost-West ausgerichtete Zone, die sich zwischen den Siedlungsgebieten der Hamburger Kultur im Norden und des Magdalénien im Süden erstreckt und aus der bisher keine spätjungpaläolithischen Fundstellen bekannt sind. Von der westfälischen Tieflandsbucht, die in dieser Zone liegt, wurde bisher angenommen, dass sie erst im späten Allerød-Interstadial (GI-1_{c1}) besiedelt wurde. Aktuelle Untersuchungen weisen hingegen darauf hin, dass dieses Gebiet bereits während des frühen Allerød-Interstadials (GI-1_{c3}) besiedelt wurde. Aus typologischer Sicht können die vier untersuchten Fundstellen Rietberg, Reken, Borken-Gemenkrückling und Haltern-Lavesum generell den frühen Federmessergruppen zugeordnet werden. Da die Werkzeugspektren jedoch im Vergleich mit anderen Fundstellen dieser Zeit in Mittel- und Nordwesteuropa bestimmte Eigenarten aufweisen, betrachten wir die Inventare als abgrenzbare Regionalgruppe innerhalb der frühen Federmessergruppen. In diesem Artikel präsentieren wir die typologischen und technologischen Charakteristika der vier westfälischen Fundstellen und diskutieren sie im Kontext des Übergangs vom späten Jungpaläolithikum zum frühen Spätpaläolithikum.*

Keywords - Upper to Late Palaeolithic transition, typology, technology, raw material, chronology, chorology
Übergang Jung- zu Spätpaläolithikum, Typology, Technologie, Rohmaterial, Chronologie, Chorologie

Prelude and regional exposition of the Westphalian post-LGM resettlement

As the case of Westphalia demonstrates, the resettlement process after the Last Glacial Maximum (LGM) was by no means completed by the end of the Magdalenian, but continued well into the Allerød-Interstadial. During the LGM, Central Europe was practically void of human settlement. Only few sites are discussed to attest for restricted and probably episodical human presence during this period: Grubgraben, Gera-Zoitzberg and Wiesbaden-Igstadt, subsumed by Th.Terberger as the "Grubgrabian" archaeological complex (Terberger & Street 2002; Küßner & Terberger 2006). After this period of climatic severity, humans re-occupied Central Europe from about 18 000 calBP onwards; and already around 16 000 calBP, a patchy but nonetheless continuous

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settlement system with hundreds of sites covered large parts of Central Europe (Maier 2012a).

The post-LGM resettlement process is usually seen as a unidirectional movement from Southwestern Europe, to which the earlier phases of the Magdalenian are thought to be restricted, towards the east (Miller 2012; Otte 2012). Recent evaluation of the Magdalenian dataset (Maier 2012a), however, has brought up an alternative theory of the post-LGM resettlement. Communication between hunter-gatherer groups east and west of the Alps was re-established with the occurrence of the Badegoulian/Grubgrabian technocomplex at around 23 000 calBP at the latest (Terberger 2003; Maier 2012a). On that basis, both communities developed typo- and technologically in a very similar way. With the climatic amelioration, both populations resettled Central Europe in a bidirectional process. Consequently, the bearers of the Magdalenian demographically originated from two distinct communities (one in Southwestern, the other in Eastern Central Europe), which, despite their spatial segregation, maintained continuous contacts. At its onset, the Magdalenian as a whole would thus rather appear as an informational pool than as a demographic unity. The post-LGM expansion of the eastern and western community eventually brought the two separated but communicating populations spatially into direct neighbourhood and thus established the Magdalenian ecumene. From about 16 000 calBP onwards, the Rhine-Meuse region was extensively repopulated by eastwards expanding Magdalenian hunter-gatherers, whereas Eastern Germany was very probably reoccupied by westward expanding groups (Maier 2012a). The intermediate area, however, only yields extremely vague traces of a possible Magdalenian occupation, namely in the low mountain ranges of Westphalia at the sites of Balver Höhle and Feldhofhöhle (Fig. 1; Günther 1988: 120, 129; Stevens et al. 2009; Maier 2012a).

The spatial distribution of Magdalenian sites is not homogeneous. On the contrary, regions where sites are densely clustered alternate with empty areas

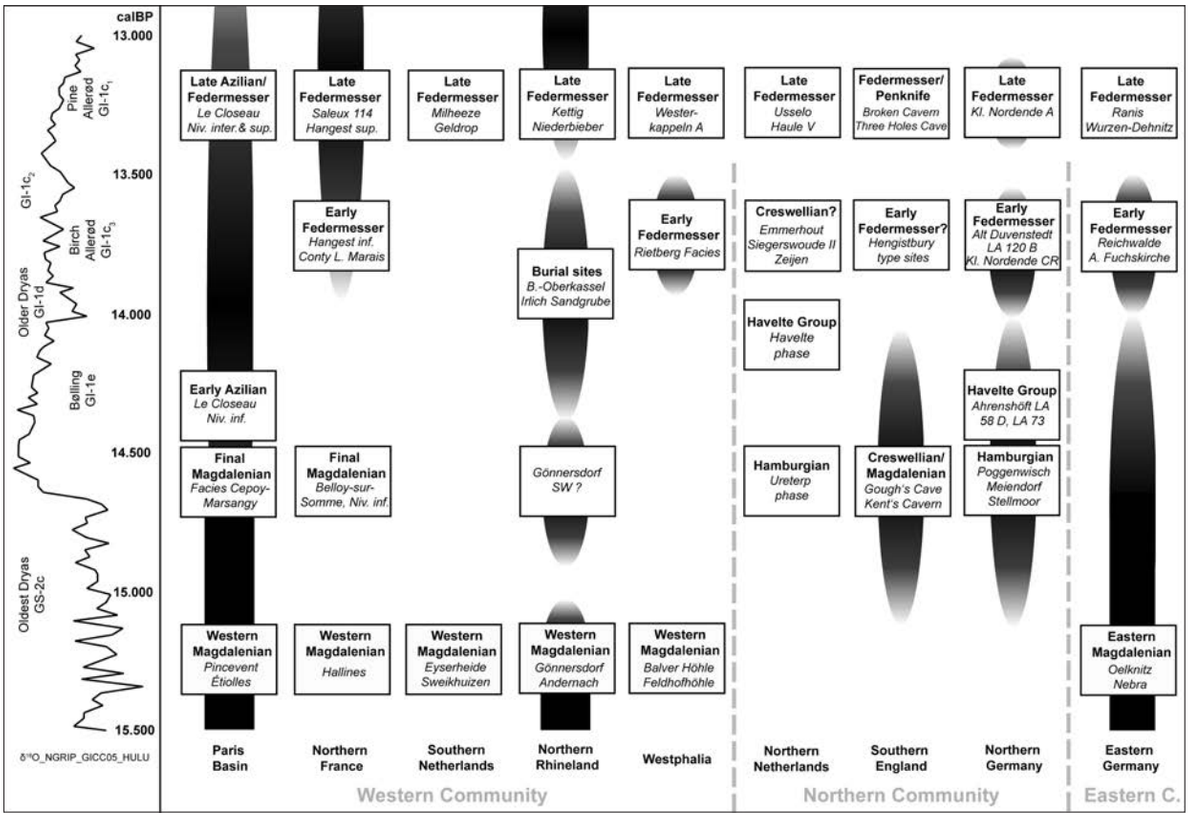

Fig. 1. Chronology and chorology of the Late Upper to Late Palaeolithic transition in Western Central and Northwestern Europe. The extents of the black bars indicate the time span comprised by ^{14}C-dates obtained for the mentioned sites and periods (in the boxes) in specific regions. All other boxes are placed according to their relative chronological position with regard to typological and stratigraphical observations. The three identified communities are not understood as definite, impermeable units, but rather as populations with a comparatively strong internal coherence and informational exchange. δ^{18}O: NGRIP_GICC05_HULU (Weninger & Jöris 2008).

Abb. 1. *Chronologie und Chorologie des Übergangs vom späten Jungpaläolithikum zum Spätpaläolithikum im westliche Mitteleuropa und in Nordwesteuropa. Die Länge der schwarzen Balken gibt die Zeitspanne der ^{14}C-Daten für die in den Kästen erwähnten Fundstellen und Perioden an. Alle anderen Kästen wurden relativchronologisch anhand typologischer und stratigraphischer Gesichtspunkte platziert. Die drei ausgewiesenen Gemeinschaften sind nicht als scharf abgegrenzte, undurchlässige Einheiten zu verstehen, sondern eher als Populationen mit einem vergleichsweise starken internen Zusammenhalt und Informationsaustausch. δ^{18}O: NGRIP_GICC05_HULU (Weninger & Jöris 2008).*

without any sign of occupation. Since not all areas of Central Europe were occupied homogeneously, the Magdalenian settlement pattern exhibits several gaps, one of them to be located in Westphalia. Here it should be mentioned that during the nineteenth century, many south Westphalian caves and rock-shelters were destroyed in the course of industrial exploitation of limestone and that the northwardly adjacent loess area was never systematically prospected. Therefore, it cannot be excluded that the observed gab is a result of preservation and/or research activities and it seems possible that the westwards expanding community occupied also some parts of Southern Westphalia. However, throughout the last four years, intensive research aiming at the detection of Upper Palaeolithic remains in North Rhine-Westphalia was conducted at the University of Cologne. Despite these efforts, no traces of a Magdalenian presence in the Westphalian lowlands were found (Holzkämper & Maier 2012a). Due to this lack of Late Upper Palaeolithic sites in the Westphalian bay, it seems that this region was not occupied during the Magdalenian resettlement process, and even when the Magdalenian was established, this part of Westphalia was apparently avoided. It remained a kind of no-man's land in the border area between the western and eastern Magdalenian community as well as the subsequently emerging Hamburgian in the North European Plain.

Until about 15 000 calBP, the Central European low mountain ranges marked the northernmost border of human settlement in Europe, and only with the onset of the Bølling-Interstadial (sensu Iversen 1942), the Greenland-Interstadial (GI) 1e, the North European Plain was populated by hunter-gatherers of the Hamburgian and Creswellian (Fig. 1), which probably

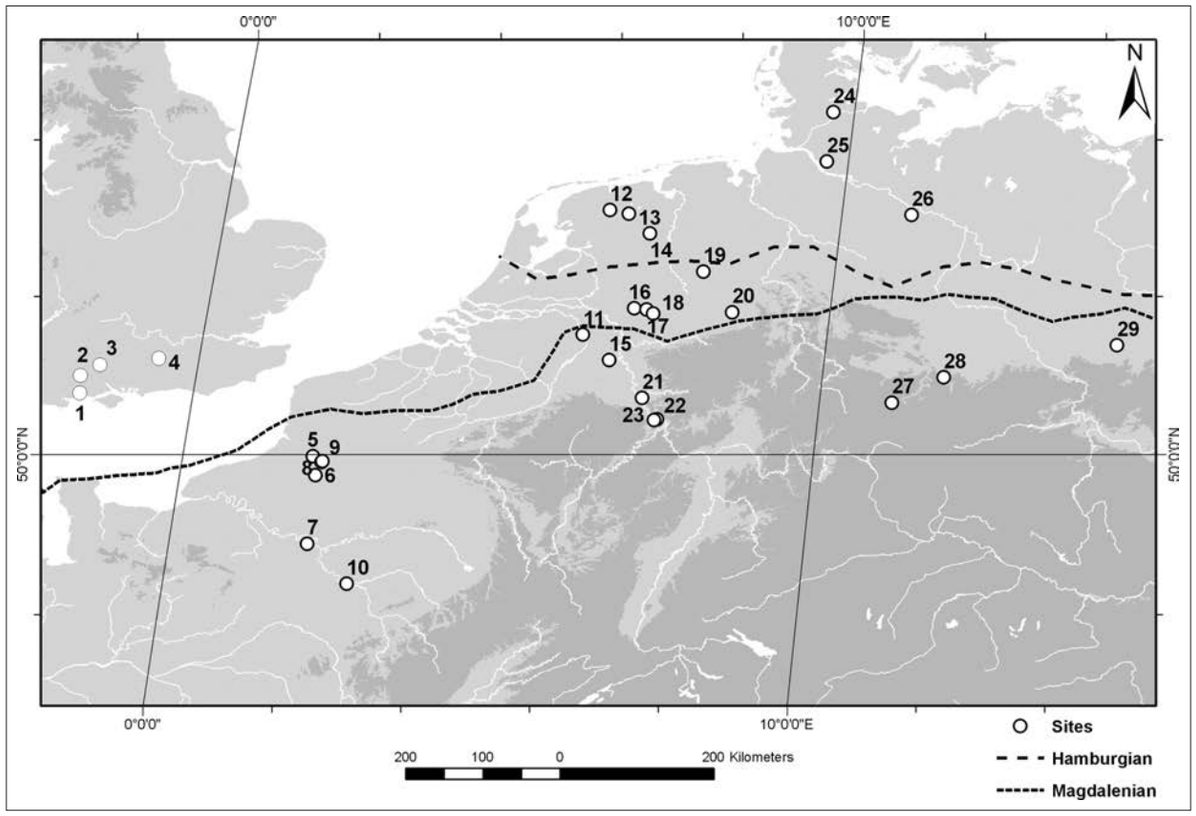

Fig. 2. Map with selected sites of the Late Upper to Late Palaeolithic transition in Western Central and Northwestern Europe. Short dashed lines: northern borderline of Magdalenian settlement. Long dashed lines: southern borderline of Hamburgian settlement. White dots represent: 1 Hengistbury Head. – 2 Nea Farm. – 3 La Sagesse. – 4 Brockhill. – 5 Hangest-sur-Somme III,1, lower level. – 6 Conty Le Marais, lower level. – 7 Le Closeau. – 8 Amiens-Étouvier. – 9 Dreuil-lès-Amiens. – 10 Pincevent III, 27. – 11 Op de Hees. – 12 Siegerswoude II. – 13 Zeijen. – 14 Emmerhout. – 15 Kleinenbroich. – 16 Borken-Gemenkrückling . – 17 Reken. – 18 Haltern-Lavesum. – 19 Westerkappeln C. – 20 Rietberg. – 21 Bonn-Oberkassel. – 22 Irlich-Sandgrube. – 23 Gönnersdorf Southwest. – 24 Alt Duvenstedt LA 120 B. – 25 Klein Nordende CR. – 26 Weitsche. – 27 Abri Fuchskirche I, Layer 3. – 28 Etzdorf, Nasser Wald. – 29 Reichwalde.

Abb. 2. *Karte mit ausgewählten Fundstellen des Übergangs vom späten Jungpaläolithikum zum Spätpaläolithikum im westliche Mitteleuropa und in Nordwesteuropa. Kurz gestrichelte Linie: nördliche Grenze des Magdalénien-Siedlungsgebietes. Lang gestrichelte Linie: südliche Grenze des Siedlungsgebietes der Hambuger Kultur. Weiße Punkte: 1 Hengistbury Head. – 2 Nea Farm. – 3 La Sagesse. – 4 Brockhill. – 5 Hangest-sur-Somme III,1, lower level. – 6 Conty Le Marais, lower level. – 7 Le Closeau. – 8 Amiens-Étouvier. – 9 Dreuil-lès-Amiens. – 10 Pincevent III, 27. – 11 Op de Hees. – 12 Siegerswoude II. – 13 Zeijen. – 14 Emmerhout. – 15 Kleinenbroich. – 16 Borken-Gemenkrückling . – 17 Reken. – 18 Haltern-Lavesum. – 19 Westerkappeln C. – 20 Rietberg. – 21 Bonn-Oberkassel. – 22 Irlich-Sandgrube. – 23 Gönnersdorf Southwest. – 24 Alt Duvenstedt LA 120 B. – 25 Klein Nordende CR. – 26 Weitsche. – 27 Abri Fuchskirche I, Layer 3. – 28 Etzdorf, Nasser Wald. – 29 Reichwalde.*

developed from the Magdalenian (Schwabedissen 1954; Bohmers 1956, 1960; Burdukiewicz 1986; Barton et al. 2003). However, the Late Upper Palaeolithic settlement pattern does not show a gradual and continuous expansion of hunter-gatherers from the low mountain ranges to the northwardly adjacent areas, but – to the contrary – exhibits a conspicuous, up to 100 km broad gap that stretches roughly from the Hercynian Mountains in the east up to the mouth of the Rhine river in the west, from where virtually no Late Upper Palaeolithic finds are reported so far (Fig. 2). Until recently, the earliest settlement of the Westphalian lowlands after the LGM was believed to be connected with the Late Federmessergruppen and thus said to have taken place not before the *Pinus* phase of the Allerød-Interstadial, that is not before the end of GI-1_{c1} around 13 500 calBP (Fig. 1). It was not until the results of the 1999/2000 excavations at the Westphalian site of Rietberg were analysed (Richter ed. 2012) that an Early Federmesser occupation in the region could be demonstrated. Palynological evidence and radiocarbon dates place this earliest post-LGM settlement of the Westphalian lowlands in the first part of the Allerød-Interstadial (GI-1_{c3}), roughly between 14 000 and 13 500 calBP, and thus at the end of the Late Upper Palaeolithic to Late Palaeolithic transition and the early Late Palaeolithic. The "transitional" character of the Rietberg material, which includes elements of both Late Upper Palaeolithic and Late Palaeolithic industries, led previous research to interpret it as a "mixed" inventory, within which finds from different archaeological entities such as Magdalenian, Creswellian, Hamburgian, Federmessergruppen, and Ahrensburgian are intermingled (e.g. Adrian 1982: 106 ff.; Günther 1988: 152). However, analyses of taphonomic processes and spatial distribution of finds could prove the chronological and typological integrity of the Rietberg assemblages. Against this background, it was possible to re-evaluate three private collections and to attribute them to the same regional manifestation of the Early Federmesser spectrum.

Eventually, it appears that Westphalia was not earlier resettled than during the early Allerød, at about 14 000 calBP, when people established a small group of settlements with a characteristic lithic inventory, probably represented by the four sites discussed below. In this article, we aim to describe the typological and technological characteristics of this group of sites and discuss it against the chronological and chorological background of the Late Upper Palaeolithic and Late Palaeolithic entities on a regional and supra-regional scale in Northwestern and Eastern Germany, the Netherlands, Belgium, Northern France and Southern England. As we will show, the assemblages show more resemblance to contemporaneous groups in Western than in Northern Europe. The Westphalian group of sites thus appears as a chronologically and chorologically distinguishable, regional variant of the Early Federmesser complex with a strong affinity to Northern France.

The four assemblages from Westphalia

All four sites which will be presented in the following are located in the Westphalian lowlands (Fig. 2). This area is characterised geologically by the widespread appearance of cover sands with poor conditions for organic preservation. Reken, Borken-Gemenkrückling and Haltern-Lavesum form a small cluster of surface sites. The distances between these sites range from only 8 to 21 km. Rietberg, in contrast, is located eastwardly of this cluster with a minimal distance of 87 km to the other sites. Except for Rietberg (Adrian 1982; Richter 1998; Richter ed. 2012), all sites are largely unpublished and to date only briefly discussed in a summarising article (Holzkämper & Maier 2012b). In this paper, they will be presented for the first time in more detail. It needs to be stressed that Reken, Borken-Gemenkrückling and Haltern-Lavesum are surface collections and thus have to be treated with the necessary caution. As a matter of fact, stratigraphic control cannot be ensured. However, stratigraphy is not the only criterion to assess the internal coherence of an assemblage, but typological and technological observations can also be consulted. Since both categories are suitable measures to evaluate an assemblage's integrity, they were given special attention in the analyses. J. Holzkämper has thoroughly studied the typological attributes and A. Maier studied the characteristics of the *chaînes opératoires* of the presented assemblages. A joint evaluation of both aspects resulted in a positive evaluation of the integrity of the surface assemblages.

Rietberg (District of Gütersloh)

In the eastern part of the Westphalian bay, more precisely in the southern part of the town of Rietberg, lies the land lot "Große Höppe". Here, on the western lower terrace of the Ems river at 78 m above sea level (ASL), three concentrations of Palaeolithic artefacts – discovered by H. Bolte and M. Orlob – were excavated in 1974 by the Westphalian cultural heritage management (Adrian 1982: 102 ff.) and 1999/2000 by the University of Cologne (Richter 1998; Richter ed. 2012). The artefacts were located along a strip of light-coloured sand, the remnants of a sandy dune, which today is levelled due to agricultural activities. These activities also affected the find horizon. However, the spatial analysis of the concentrations suggests that the disturbances were not very severe. The total number of finds from surface collections and excavations amounts to 16 207 artefacts, including 401 cores/core fragments, 12 158 flakes, blades and bladelets, as well as 256 tools. Three concentrations could be excavated: Rietberg 1 (5 061 artefacts), Rietberg 2 (274 artefacts) and Rietberg 5 (2 448 artefacts). In addition, 8 424 surface finds were

collected, the majority of which was found in the area of Rietberg 1. Whereas Rietberg 1 represents the largest concentration, where most of the tools (including specimens of backed bladelets, shouldered points, angle-backed points, trapezoidal points, bipoints, curve-backed points and long B-points) were found, Rietberg 5 yielded mostly finds from blank production. Rietberg 2 appears to be the leftover of retooling activities (Maier 2012b, c).

The artefacts are almost exclusively made on Baltic flint. Only one backed bladelet consists of siliceous slate. Both raw materials are regionally available. The blank production aimed at obtaining rather regular blades with a straight profile. The size spectrum of the cores comprises large and small specimens, the latter of which do not represent strongly reduced stages of the former, but are the remnants of intentionally selected small pieces of raw material. However, the size spectrum of the blanks shows a continuous, unimodal distribution and does not speak in favour of an independent bladelet production. The cores were predominantly reduced in a unipolar way. Regularly occurring secondary striking platforms served almost exclusively for core correction and the renovation of the flaking face (Fig. 3: 20). Since hinges are numerous and because the mostly straight or only slightly curved profiles of the blades quickly led to a flattening of the distal convexities of the cores, such corrections became often and regularly necessary. Impact points and other features of the striking platform remnants and proximal parts of the blanks, such as *esquillements du bulbe* (Fig. 3: 19), speak strongly in favour of the usage of soft stone hammers (cf. Madson 1983; Pelegrin 2000). *En éperon* preparation, on the other hand, is absent.

The tool assemblage is dominated by burins (n=51; 19 %) and scrapers (n=46; 18 %). Burins were predominantly produced on truncations (n=32; Fig. 3: 16). Most scrapers are made on flakes (n=23; Fig. 3: 13), but scrapers on blades are also well represented (n=15; Fig. 3: 14-15), two of which are laterally retouched (Fig. 3: 14). Truncations are also numerous (n=29; 11 %; Fig. 3: 12). Projectile points constitute a remarkably diverse morphological group (n=27; 11 %; Fig. 3: 2-11). The point spectrum is dominated by curve-backed forms (n=13) including short (<5 cm; Fig. 3: 7) and long pieces (>5 cm; Fig. 3: 8). Two short curve-backed points show a straightly retouched base (Fig. 3: 7). The second most numerous type of points, so-called long B-points, are characterised by a simple oblique truncation (n=8, Fig. 3: 9-11; cf. Stapert 2005: Fig. 1). Some of them show a base with more or less straight or left-sided, oblique retouch (Fig. 3: 9-10). Furthermore, trapezoidal points comparable to Creswellian cheddar points (n=3; Fig. 3: 4-5), a slightly curved bipoint (Fig. 3: 6), a small shouldered point with a base that is straightly retouched on the ventral face (Fig. 3: 2), and the fragment of an angle-backed point (Fig. 3: 3) belong to the assemblage. Generally, blades of very different length, but with a rather straight profile were chosen for the production of backed points without any discernable preferences for certain types. Other important tool types are zinken/becs (n=9; 4 %; Fig. 3: 17-18) and borers (n=3; 1 %), pointed blades (n=6; 2 %), backed bladelets (n=3; 1 %; Fig. 3: 1) and a combined scraper-burin. Additionally, backed fragments (n=21; 8 %), laterally retouched pieces (n=30; 12 %), and notched and denticulated pieces (n=30; 12 %) appear.

Thus, the diversity of the artefact spectrum raises indeed the question whether the Rietberg assemblage represents an admixture of several different archaeological entities. The distribution of finds and features at the site, however, argues against such a view. Therefore, the spatial structures of Rietberg 1, the largest concentration, are briefly presented. The limit of the concentration is, although slightly affected by ploughing, well discernable and comprises an area with approximately 8 m in diameter (Fig. 4). Additionally, the distribution of tools shows a clear spatial segregation: scrapers, zinken and burins are mainly located in the central part of the concentration and backed pieces are mainly found in the north-eastern part. In the southwestern part, in contrast, three smaller specialised working places are located semicircular around the centre of Rietberg 1, which yielded mainly notched and denticulated pieces (Maier 2012b). The three excavated concentrations 1, 2 and 5 probably originated during the same occupation. Raw material, technology and typology are identical and the concentrations show furthermore a partly complementary activity pattern (Maier 2012c). Thus, it can be concluded that the Rietberg assemblage represents a consistent collection of artefacts, which are the remains of a single and rather short-termed occupation, since in the case of several successive occupations, such a clear activity pattern most probably would have been blurred.

Due to a permanently high groundwater-level at the site, organic preservation was quite good and allowed for extensive palynological studies and a detailed reconstruction of the environmental situation of the site (Meurers-Balke et al. 2012). The species-rich vegetation varied according to the location from submerged over moist to steppe-like patches. Birch trees were already present in the landscape, whereas pines made their first appearance at the time of the occupation. Finds of bones from wild boar and roe deer – the latter showing cut marks (H. Berke pers. comm.) – correspond well with the palynological impression of a light birch forest in the wider surrounding of the site.

A conventional radiocarbon measurement obtained on charcoal found at Rietberg 5 in close association with lithic artefacts gave a date of 12 000 ± 380 BP (KN-5380). The calibrated timespan of more than 1 000 calendar years (14 740 – 13 620 calBP) thus ranges from the late Pleniglacial up to the early

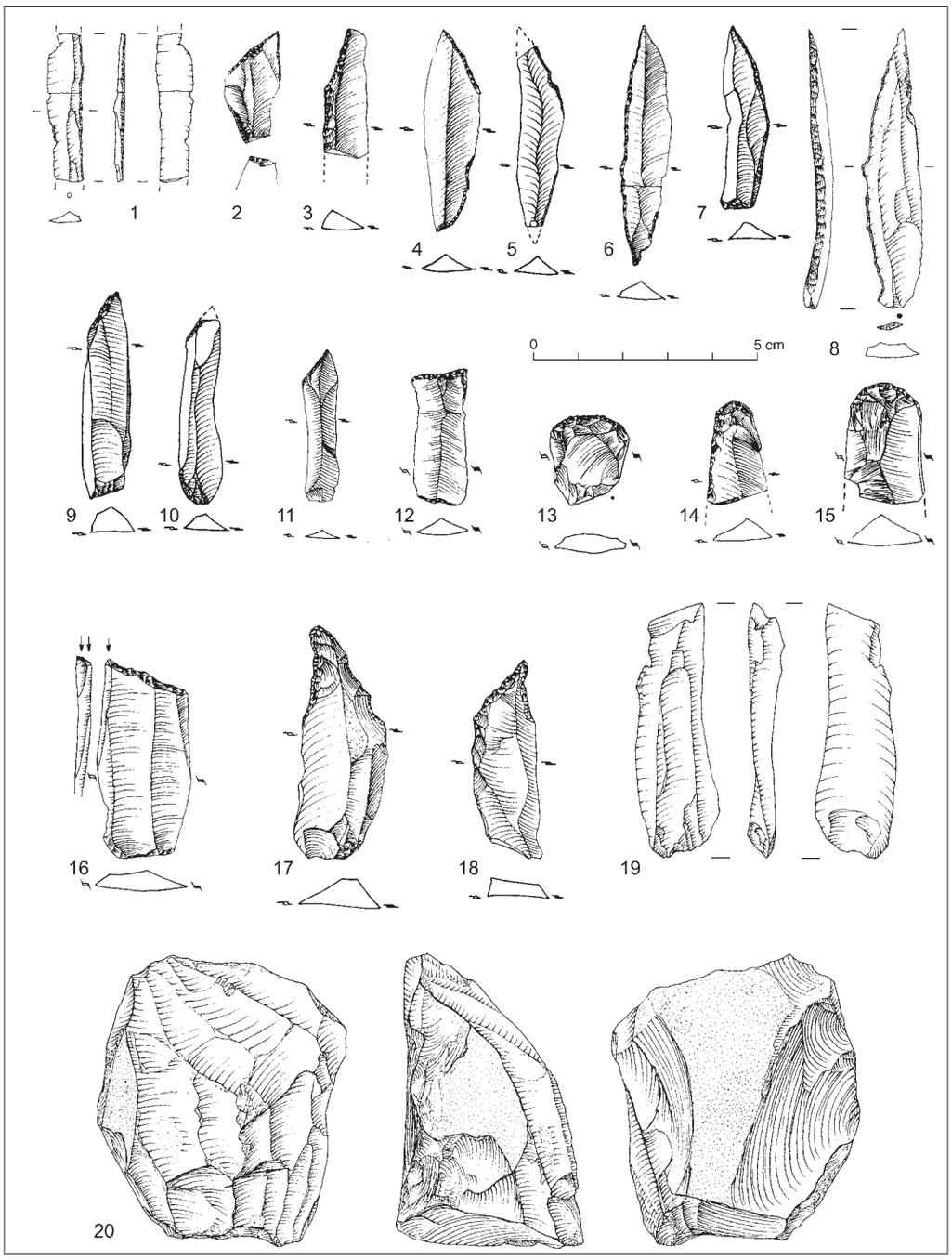

Fig. 3. Rietberg: 1 backed bladelet. – 2 shouldered point. – 3 angle-backed point. – 4-5 trapezoidal points. – 6 bipoint. – 7-8 curve-backed points. – 9-11 long B-points. – 12 truncation. – 13-15 scrapers. – 16 burin. – 17-18 zinken. – 19 blade. – 20 core. – (1, 8, 19 & 20 after Richter (2012: figs. 4-2, 4-10, 6-5); 2 - 7 & 9 - 18 after Adrian (1982, figs. 300-302, 304, 306 & 307). Scale 2:3.

Abb. 3. *Rietberg: 1 Rückenmesser. – 2 Kerbspitze. – 3 geknickte Rückenspitze. – 4-5 Trapezspitzen. – 6 Doppelspitze. – 7-8 Federmesser. – 9-11 endretuschierte Spitzen. – 12 Endretusche. – 13-15 Kratzer. – 16 Stichel. – 17-18 Zinken. – 19 Klinge. – 20 Kern. – (*1, 8, 19 & 20 *nach Richter (2012, Abb. 4-2, 4-10, 6-5); 2 - 7 & 9 - 18 nach Adrian (1982, Abb. 300-302, 304, 306 & 307). Maßstab 2:3.*

Allerød. However, this span can be narrowed down considerably. The measurement was obtained on *Pinus* charcoal, and although a date from Ahrenshöft LA 73 indicates the presence of Pine trees in parts of the North European Plain already during the GI-1e (Clausen 1998), the immigration of *Pinus* into Westphalia is not to be expected prior to about 13 800 calBP (Lang 1994; Meurers-Balke et al. 2012: 191). Therefore, the timeframe of the occupation can be reduced to 13 800 to 13 500 calBP. This is in good

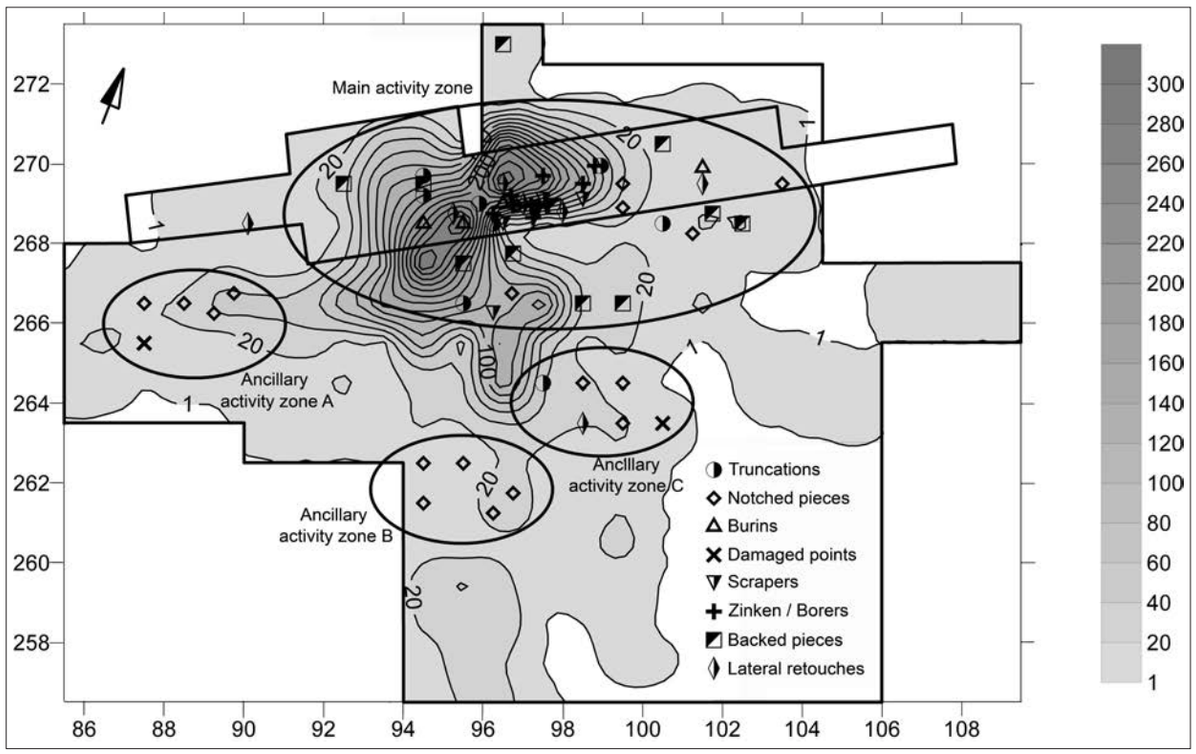

Fig. 4. Rietberg, concentration 1: find distributions and activity zones.
Abb. 4. *Rietberg, Konzentration 1: Fundverteilung und Aktivitätszonen.*

accordance with three AMS dates (weighted average: 13 790 – 13 630 calBP) obtained on terrestrial plant remains (Fig. 5) selected from the lower part of a sediment profile, which was taken at the fringe of Rietberg 1. The samples were taken from a humic layer (PAZ Riet 1, see Meurers-Balke et al. 2012) which corresponds with the lowermost part of the find horizon directly overlying the archaeologically sterile Pleistocene sand. Additionally, macroscopic pieces of charcoal, which may have derived from the Palaeolithic occupation, were detected only in this part of the profile (for more details see Meurers-Balke et al. 2012). Eventually, the Palaeolithic occupation at Rietberg can most likely be dated between about 13 800 and 13 600 calBP.

Reken (District of Borken)

The site of Reken was discovered by Hans Georg Wendhof in the late 1970s about 4 km northeast of the town Groß Reken. It is situated at an elevated position at 56 m ASL and therefore slightly overlooks the otherwise rather flat landscape and the Heubach creek, which nowadays flows in a distance of about 50 m north-easterly to the site. The surface collection with more than 1 400 finds from the collections of H. G. Wendhof and Alfred Tönsmann comprises 184 cores, 325 flakes, 597 blades, and 121 tools. Among the tools, three microliths deserve mention. Although a Mesolithic age for these artfacts cannot be excluded, refittings from concentrations 5 010 and 5 048 at Reichwalde could prove that microliths were a part of these Early Federmesser assemblages (Vollbrecht 2005: 40, 375). Taking into account that Reichwalde is dated even earlier than Rietberg (Figs. 5 and 10), the occurrenec of a few microliths within the Reken inventory does not contradict its possible integrity. Similar observations are also reported from Berlin Tegel I, III, VII and XIX (Probst 1989: Tab. 34). Apart from the dominant Late Palaeolithic component, three Mesolithic microliths are present. The preservation of the artefacts is excellent and the main raw material is non-patinated Baltic flint that can be collected in the vicinity of the site. Two small cores and three flakes, however, are identified as Rijckholt or Meuse gravel flint (B. Stapel LWL-Archäologie für Westfalen, unpub. report 2009) comparable to the finds of Lavesum (see below). The blank production at Reken aimed at obtaining regular blades with a straight profile. It is characterised by the usage of a soft stone hammer as is indicated by impact points on the striking platform remnants as well as *esquillements du bulbe* (Fig. 6: 13). *En éperon* preparation is absent. Blade production was mainly carried out in a unipolar way. However, many cores exhibit two striking platforms opposed to each other. Here, the second striking platform was predominantly used to restore the convexity of the flaking face (Fig. 6: 14).

The majority of tools consists of scrapers (n=57; 47 %), mainly endscrapers on blades (n=35), eight of which show laterally retouched edges (Fig. 6: 9).

Site	Lab. Number	*Species*	Material	P	Age BP	calBP	References
Gönnersdorf SW	OxA-15296	*Alces alces*	bone		12 385 ± 65	14 610 ± 210	Street 2007
Abri Fuchskirche	KIA-12926	*Alces alces*	bone		12 232 ± 50	14 320 ± 220	Benecke et al. 2006
Abri Fuchskirche	KIA-12925	*Alces alces*	bone		12 158 ± 50	14 220 ± 200	Benecke et al. 2006
Abri Fuchskirche	KIA-12927	*Bos prim.*	bone		12 030 ± 52	13 910 ± 80	Benecke et al. 2006
Reichwalde 5049	GrA-15437	*Capreolus sp.*	bone	*	12 350 ± 50	14 540 ± 200	Vollbrecht 2005
Reichwalde 5055	GrA-15436	Indet.	bone	*	12 280 ± 50	14 420 ± 190	Vollbrecht 2005
Reichwalde 5055	KIA-13412	*Salix/Populus*	charcoal	*	12 193 ± 58	14 280 ± 210	Vollbrecht 2005
Reichwalde 5049	KIA-8530	not specified	charcoal	*	12 176 ± 48	14 240 ± 190	Vollbrecht 2005
				5.3	12 252 ± 26	14 350 ± 210	
Reichwalde 5049	KIA-8531	not specified	charcoal	*	11 922 ± 48	13 820 ± 80	Vollbrecht 2005
Reichwalde 5049	KIA-9663	not specified	charcoal	*	11 890 ± 43	13 760 ± 90	Vollbrecht 2005
				62	11 904 ± 32	13 790 ± 80	
Bonn-Oberkassel	OxA-4793	*Canis fam.*	bone		12 270 ± 100	14 390 ± 260	Baales & Street 1998
Bonn-Oberkassel	KIA-4162	*Canis fam.*	bone		12 210 ± 60	14 300 ± 220	Baales & Street 1999
Bonn-Oberkassel	OxA-4792	*H. Sap. sap. f.*	bone		12 180 ± 100	14 280 ± 250	Baales & Street 2000
Bonn-Oberkassel	KIA-4161	*Canis fam.*	bone		12 100 ± 45	14 070 ± 130	Baales & Street 2001
Bonn-Oberkassel	OxA-4791	*Ursus sp.*	bone		11 780 ± 90	13 680 ± 90	Baales & Street 2002
Bonn-Oberkassel	KIA-4163	*Canis fam.*	bone		11 620 ± 60	13 500 ± 80	Baales & Street 2003
Bonn-Oberkassel	OxA-4790	*H. Sap. sap. m.*	bone		11 570 ± 100	13 460 ± 100	Baales & Street 2004
Ahrenshöft LA 58 D	AAR-2784	Indet.	charcoal		12 030 ± 60	13 920 ± 90	Clausen 1998
Klein Nordende CR	KI-2124	*Hippophaë*	wood	*	12 035 ± 110	14 030 ± 210	Bokelmann et al.1983
Klein Nordende CR	KI-2152	*Hippophaë*	wood	*	11 990 ± 100	13 930 ± 150	Bokelmann et al.1983
				76.2	12 010 ± 74	13 910 ± 100	
Klein Nordende D	KIA-33951	*Alces alces*	bone		11 035 ± 50	12 920 ± 100	Riede et al. 2010
Irlich, Sandgrube	OxA-9736	*H. Sap. sap.* 1	bone		12 310 ± 120	14 460 ± 290	Baales 2002
Irlich, Sandgrube	UtC-9221	*H. Sap. sap.* 2	bone	*	12 110 ± 90	14 170 ± 240	Baales 2002
Irlich, Sandgrube	OxA-9848	*H. Sap. sap.* 2	bone	*	11 965 ± 65	13 860 ± 80	Baales 2002
				19.2	12 015 ± 53	13 900 ± 70	
Irlich, Sandgrube	OxA-9847	*H. Sap. sap.* 3	bone		11 910 ± 70	13 790 ± 110	Baales 2002
Pincevent III.27	OxA-391	not specified	bone		11 870 ± 130	13 780 ± 150	Gowlett et al. 1986
Rietberg 5	KN-5380	*Pinus*	charcoal		12 000 ± 380	14 180 ± 560	Meurers-Balke et al. 2012
Rietberg 1	Col-1038 - 1039	*Salix*	bud scale	*	11 935 ± 44	13 840 ± 80	Meurers-Balke et al. 2012
Rietberg 1	Col-1040	*Salix*	bud scale	*	11 855 ± 66	13 750 ± 110	Meurers-Balke et al. 2012
Rietberg 1	Col-1041 - 1043	mixed remains	mixed	*	11 808 ± 43	13 690 ± 70	Meurers-Balke et al. 2012
				12	11 867 ± 28	13 710 ± 80	
Weitsche	KIA-26439	Indet.	bone	*	11 980 ± 120	13 960 ± 240	Veil et al. 2012
Weitsche	KIA-35664	Indet.	bone	*	11 755 ± 50	13 670 ± 70	Veil et al. 2012
				8	11 788 ± 46	13 680 ± 70	
Westerkappeln C	KI-271	not specified	charcoal		11 800 ± 200	13 730 ± 240	Günther 1973
Alt Duvenstedt LA 120b	AAR-2244	not specified	charcoal		11 780 ± 110	13 680 ± 110	Kaiser & Clausen 2005
Hangest-s.-S. Niv. inf. III,1	OxA-4432	not specified	tooth	*	11 660 ± 110	13 550 ± 130	Fagnart 1997
Hangest-s.-S. Niv. inf. III,1	OxA-4936	not specified	tooth	*	11 630 ± 90	13 510 ± 100	Fagnart 1997
				83.3	11 642 ± 70	13 520 ± 90	
Conty Le Marais Niv. inf.	OxA-6151/Ly-260	*Bos prim.*	bone		11 890 ± 90	13 780 ± 120	Fagnart 1997
Conty Le Marais Niv. inf.	OxA-6148/Ly-257	*Bos prim.*	bone		11 620 ± 90	13 500 ± 100	Fagnart 1997
Conty Le Marais Niv. inf.	OxA-6149/Ly-258	*Bos prim.*	bone		11 560 ± 90	13 450 ± 100	Fagnart 1997
Conty Le Marais Niv. inf.	OxA-6150/Ly-259	*Bos prim.*	bone		11 410 ± 80	13 310 ± 100	Fagnart 1997

Fig. 5. Radiocarbon dates of the sites discussed in the text. P: percentage values give the probability of two or more ^{14}C dates being identical in terms of statistics. *: measurements included in the calculation of the average date. Calibration and calculation of average dates carried out with CalPal2007_HULU (Weninger & Jöris 2008).

Abb. 5. *Radiokarbon-Daten der im Text diskutierten Fundstellen. P: Prozentwerte geben die Wahrscheinlichkeit an, mit der zwei oder mehr ^{14}C Daten statistisch identisch sind. *: Messungen, die in die Berechnung der Mittelwerte eingegangen sind. Kalibration und die Berechnung der Mittelwerte erfolgte mit CalPal2007_HULU (Weninger & Jöris 2008).*

17 scrapers are made on flakes (Fig. 6: 8). However, since this type also occurs in Mesolithic contexts it has to be treated with caution. Five broken scrapers cannot be classified accurately. Burins on blades

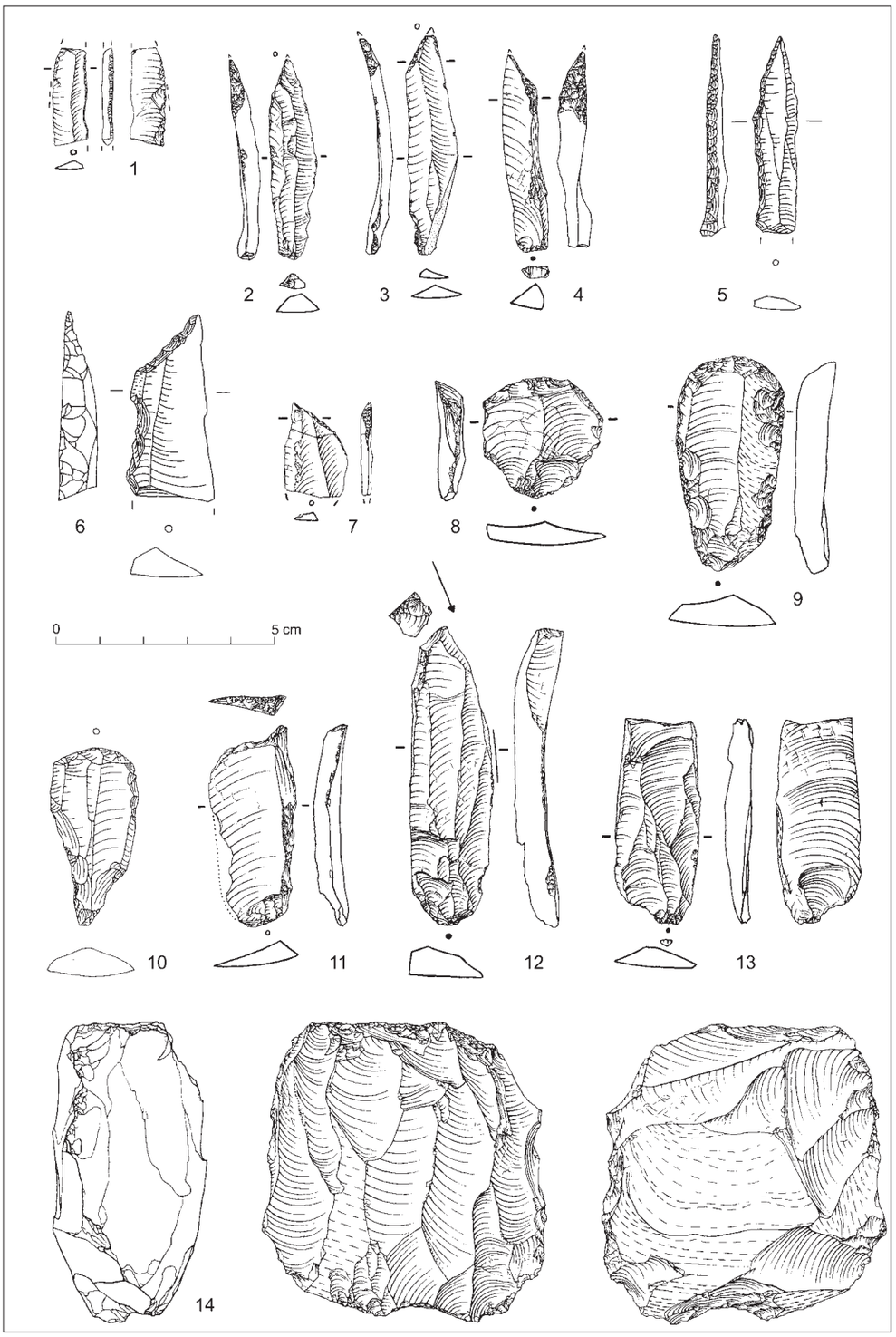

Fig. 6. Reken: 1 backed bladelet. – 2-4 long B-points. – 5 curve-backed point. – 6 shouldered point. – 7 truncation. – 8-9 scrapers. – 10 scraper-zinken. – 11 zinken. – 12 burin. – 13 blade. – 14 core. Scale 2:3.

Abb. 6. *Reken: 1 Rückenmesser. – 2-4 endretuschierte Spitzen. – 5 Federmesser. – 6 Kerbspitze. – 7 Endretusche. – 8-9 Kratzer. – 10 Kratzer-Zinken. – 11 Zinken. – 12 Stichel. – 13 Klinge. – 14 Kern. Maßstab 2:3.*

constitute the second most numerous tool type (n=14; 12 %) and are dominated by burins on oblique truncation (n=9; Fig. 6: 12). The third largest tool group includes various forms of points (n=13; 11 %) among which long B-points are most frequent (n=9; Fig. 6: 2-4). Two pieces show retouched bases (straight and obliquely left-sided) comparable to Rietberg (Fig. 6: 3-4). Additionally, there are two small curve-backed points (Fig. 6: 5), one shouldered point (Fig. 6: 6), and one backed point fragment.

Furthermore, the assemblage contains zinken/becs (n=7; 6 %; Fig. 6: 11), borers (n=4; 3 %), truncated blades (n=6; 5 %; Fig. 6: 7), laterally retouched blades (n=3; 3 %), and combined tools (n=3; 3 %): a zinken-scraper (Fig. 6: 10), a scraper-truncation and a scraper-burin on truncation. The attribution of two backed bladelets (2 %; Fig. 6: 1), one transverse side scraper, two backed fragments, three retouched flakes and three retouched frost sherds remains unclear and also may belong to the Mesolithic.

Borken-Gemenkrückling (District of Borken)

Günther Deppe discovered the site of Borken-Gemenkrückling during field surveys in the 1980s. The landscape in the region is comparatively flat and the site is situated on the eastern slope of the Meßlingsbach valley at 46 m ASL. Today, the Meßlingsbach creek flows at a distance of about 100 m south-easterly to the site. The surface collection of Gemenkrückling comprises a considerable amount of Mesolithic artefacts. However, a selection of 14 tools, 7 big blade cores and 49 blades made on non-patinated Baltic flint are excellently preserved, show a very different morphology from the rest of the inventory and clearly are not of Mesolithic age. Among the non-Mesolithic finds, cores with a single striking-platform occur together with specimens that show two opposed striking-platforms. As is the case for Rietberg and Reken, the *débitage* was characterised by a unipolar production of blades and the second platform was predominantly used to restore the convexity of the flaking face. One specimen from Gemenkrückling shows a surprisingly strong morphological similarity to a core from Reken (Fig. 7: 8 and

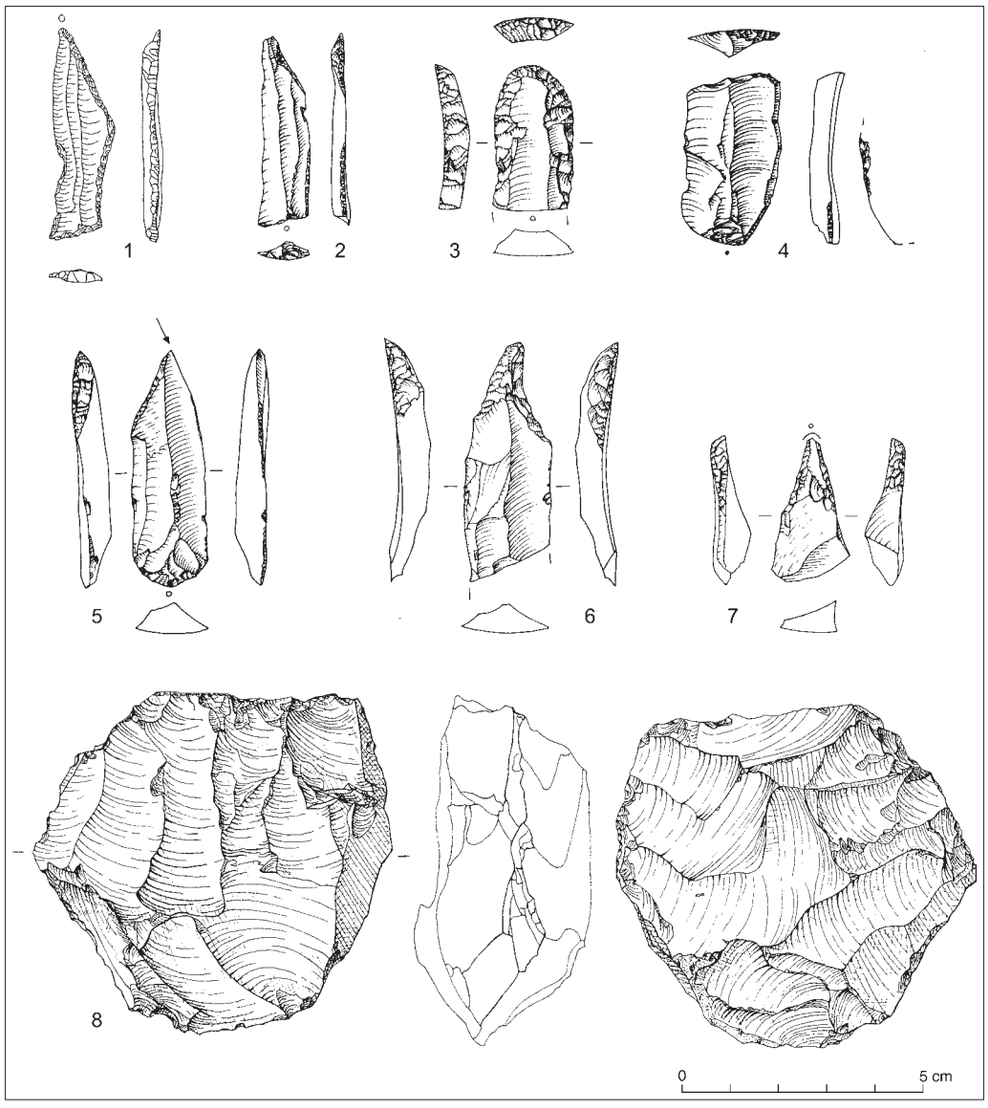

Fig. 7. Borken-Gemenkrückling: 1 shouldered point. – 2 angle-backed point. – 3 scraper. – 4 truncation. – 5 burin. – 6 zinken. – 7 bec. – 8 core. Scale 2:3.

Abb. 7. *Borken-Gemenkrückling: 1 Kerbspitze. – 2 geknickte Rückenspitze. – 3 Kratzer. – 4 Endretusche. – 5 Stichel. – 6 Zinken. – 7 Grobbohrer. – 8 Kern. Maßstab 2:3.*

Fig. 6: 14). Blades were produced using a soft stone hammer and the *en éperon* preparation is absent as is the case in Rietberg and Reken.

The tool spectrum consists of two endscrapers on blades with lateral retouches (Fig. 7: 3), two burins on oblique truncation, two truncations (Fig. 7: 4), three zinken/becs (Fig. 7: 6-7), one combined tool: burin on oblique truncation – scraper (Fig. 7: 5), and two laterally retouched blades. Furthermore, there is a partly retouched angle-backed point (Fig. 7: 2), which is reminiscent of a Creswell point, as well as a shouldered point, which initially was a major argument to attribute the assemblage to the Hamburgian (Fig. 7: 1; Gaffrey 1997: 313). Both points show a straightly retouched base as was observed on some points from Rietberg. The affiliation of numerous flake scrapers remains due to the high component of Mesolithic artefacts unclear.

Haltern-Lavesum (District of Recklinghausen)
The site of Lavesum was discovered in 2001 by Horst Klingelhöfer about four kilometres northwest of the town Haltern am See. It is located on the edge of a plateau at an elevation of 66 m ASL, and situated in a gently rolling landscape between the streams of Lippe, Heubach and Mühlbach, which flow today at a distance of four to five kilometres to the site. H. Klingelhöfer collected 147 artefacts until a forest plantation was laid out, which today prevents further surveys or excavations at the site. The artefacts occurred in a discrete area with a diameter of approximately 30 m. The assemblage is very well preserved, typologically and technologically homogeneous, and artefacts of other Stone Age periods were found neither at the site itself nor in its vicinity.

The lithic artefacts from Lavesum show no trace of patination. Most artefacts are made on Baltic flint, which can be gathered locally. Additionally, two larger blades (Fig. 8: 8) of Rijckholt or Meuse gravel flint were discovered (cf. Chapter 2.2). The closest source of sufficiently large nodules of this raw material is the river bed of the Rur in the Northern Rhineland at a distance of approximately 100 km to the southwest (J. Weiner, LVR, pers. comm.). An endscraper (Fig. 8: 5) is probably made of chalcedony, which might come from the outcrops at Bonn-Muffendorf (Floss 1994, 41 ff.). However, since the moraine deposits in Northern Westphalia contain a wide variety of erratic raw materials, such macroscopic analyses of raw materials must be treated with caution.

About 90 % (n=131) of the finds are non-modified artefacts from all steps of the *chaîne opératoire*. Flakes (n=51) mostly originated from decortification as well as core preparation and renovation. The *débitage*, which was carried out with a soft stone hammer, mainly aimed at producing blades (n=53), which mostly show a smooth butt, pronounced dorsal reduction, diffuse bulbs, sometimes *esquillements du bulbe* (Fig. 8: 9) and a straight or only slightly curved profile; *en éperon* preparation, in contrast, is absent. The longest complete blade has a length of 8.6 cm and a width of 2.3 cm. As is the case in Rietberg, bladelets (n=4) occur embedded in the blade production and appear to represent the lower part of the blade spectrum rather than a discrete category of blanks with an independent *débitage* sequence. The six cores are strongly reduced and predominantly show negatives of a unipolar blade production from a single striking platform (Fig. 8: 10). Only one core has a second striking platform, which served to restore the convexity of the flaking face. Two less exploited cores show a pointed angle between the striking platforms and flaking faces.

The spectrum of lithic tools (n=16) comprises three scrapers on flakes (Fig. 8: 5), two burins: burin on break, double burin (Fig. 8: 7), two obliquely truncated blades (Fig. 8: 3), three zinken/becs (Fig. 8: 4), one backed bladelet (Fig. 8: 1), one laterally retouched blade, one combined tool: scraper – burin on truncation (Fig. 8: 6) and one splintered piece. The only lithic point may be described as an atypical long B-point (Fig. 8: 2) that corresponds to similar finds from Reken and Rietberg. A blade of Rijckholt-flint shows an intensively rounded proximal end (Fig. 8: 8) and may be interpreted as a strike-a-light that was used in combination with marcasite or pyrite (cf. Stapert & Johansen 1999).

Technology, typology and raw material procurement

The presented Westphalian assemblages exhibit strong similarities with regard to their technological and typological characteristics (Fig. 9). The focus of blank production in the presented assemblages is generally on blades with a straight or only slightly curved profile. The continuous size spectrum of blades and bladelets indicates that – despite the selection of small volumes of raw material – bladelets were not an independent blank category with a distinguishable *chaîne opératoire*, but simply small and narrow blades. Blank production was generally carried out in a unipolar manner. Several cores, however, show a second striking platform which was used to restore the convexity of the reduction face or to remove hinge fractures. Since most blades show a straight or only slightly curved profile and since hinge fractures are numerous, the renewal of the reduction face often became necessary. Taking into account that most blades show intensive dorsal reduction and a diffuse bulb, and considering that many exhibit impact points on their butts and sometimes *esquillements du bulbe* on their ventral faces, while the *en éperon* preparation is completely missing, the predominant usage of soft stone hammers during blade production is most likely.

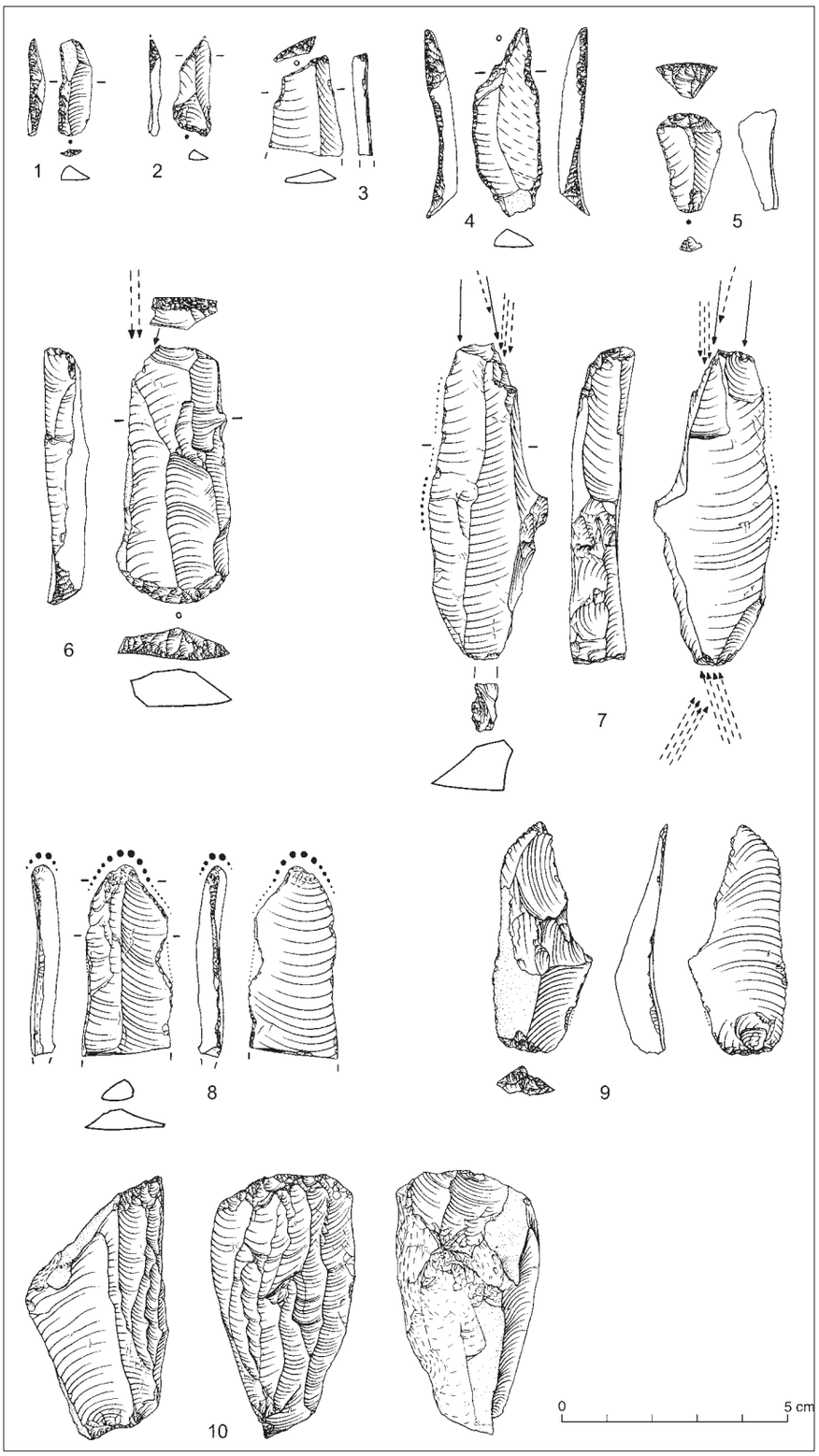

Fig. 8. Haltern-Lavesum: 1 backed bladelet. – 2 long B-point. – 3 truncation. – 4 zinken. – 5 scraper. – 6 scraper-burin. – 7 double burin. – 8 blade with rounded proximal end. – 9 blade. – 10 core. Scale 2:3.

Abb. 8. *Haltern-Lavesum: 1 Rückenmesser. – 2 endretuschierte Spitze. – 3 Endretusche. – 4 Zinken. – 5 Kratzer. – 6 Kratzer-Stichel. – 7 Doppelstichel. – 8 Klinge mit verrundetem Proximalende. – 9 Klinge. – 10 Kern. Maßstab 2:3.*

Sites	Backed bladelets	Shouldered points	Angle-backed points	Trapezoidal points	Long B-points	Bipoints	Curve-backed points	Zinken/becs	Laterally retouched scrapers	Scrapers on flakes	Usage of soft stone hammer	References
Northern France:												
Conty, Le Marais, niv. inf.	x	x	x	x		x	x	x		x	x	Fagnart 1997
Hangest-sur-Somme III.1, niv. inf.	x	x	x			x	x			x	x	Fagnart 1997
Dreuil-lès-Amiens & Amiens-Étouvier	x	x	x				x	x	x	x	?	Fagnart 1997
Southern England:												
Hengistbury Head	x	x	x		x	x	x	x	x	x	[*]	Barton 1992; 2010
Brockhill	x	x	x					x		x	?	Barton 2010
Nea Farm						x	x	x		x	x	Barton et al. 2009
La Sagesse	x							x		x	?	Barton 2010
Western Germany:												
Rietberg	x	x	x	x	x	x	x	x	x	x	x	Richter 2012
Borken-Gemenkrückling		x	x					x	x	(x)	x	this paper
Reken	(x)	x			x		x	x	x	(x)	x	this paper
Lavesum	x				x			x		x	x	this paper
Kleinenbroich					x		x	x	x	x	x	Thissen et al. 1996
Eastern Germany:												
Etzdorf Nasser Wald	x	x	x				x	x	x	x	?	Feustel 1957
Reichwalde	x		x	x	x	x	x	x	x	x	[*]	Vollbrecht 2005
Abri Fuchskirche I, Layer 3	x		x				x	x			?	Feustel & Musil 1977
Northern Germany:												
Weitsche	x		x		x		x			x	?	Veil & Breest 2002
Klein-Nordende CR	x	[x]			x		x	x		x	?	Bokelmann et al. 1983
Alt Duvenstedt LA 120 B					x		x			x	?	Kaiser & Clausen 2005
The Netherlands:												
Emmerhout			x		x			x	x		?	Stapert 1985
Siegerswoude II			x		x			x	x		?	Kramer et al. 1985
Zeijen			x	x	x			x	x		[*]	Stapert & Johansen 2001
Op de Hees			x						x		?	Stapert 1979

Fig. 9. Typological and technological components of Upper to Late Palaeolithic transitional sites in Northwestern and Central Europe. (x): uncertain attribution to the assemblage. [x]: uncertain typological classification. [*]: probably. ?: no data reported. Fields on grey background: In order to make appear tendencies, types occurring on at least two sites in a region are highlighted.

Abb. 9. *Typologische und technologische Elemente von Fundstellen des Übergangs vom Jung- zum Spätpaläolithikum aus Nordwesteuropa und Mitteleuropa. (x): Inventarzugehörigkeit unsicher. [x]: typologische Ansprache unsicher. [*]: wahrscheinlich. ?: keine Angaben vorhanden. Grau gekennzeichnete Felder: Um Tendenzen aufzuzeigen wurden Typen die an mindestens zwei Fundstellen auftreten hervorgehoben.*

With regard to the lithic tool spectrum, it can be stated that short endscrapers on flakes are numerous as are endscrapers on blades which often show lateral retouches. Burins are very common and are most often made on truncated blades. Another characteristic is the presence of zinken/becs. Borers frequently occur, but do not show any chronologically relevant characteristics. Besides, truncated blades and backed bladelets are also sometimes present. As for the combined tools, scrapers and burins on truncation occur together most often. A characteristic feature of the tool spectrum of the presented assemblages is furthermore the presence of points with a wide morphological variability, which is particularly pronounced at Rietberg. Long B-points appear in Reken, Rietberg and Lavesum. They clearly dominate the point spectrum in Reken (82 %) but also have a relatively high percentage value in Rietberg (35 %). Some points have a straight or obliquely, left-sided retouched base. Such retouches are known from several Late Upper and Late Palaeolithic assemblages (see below). Angle-backed points were found in Rietberg and Gemenkrückling, the specimen of the latter showing a straight retouched base. Long (≥ 5 cm) and small (<5 cm) curve-backed points are particularly numerous in Rietberg, but also occur in Reken; some of them having a straightly retouched base. One shouldered point is present in the assemblages of Reken, Gemenkrückling and Rietberg, the latter ones showing a straight retouched base. Furthermore, two trapezoidal points similar to Cheddar points as well as one slightly curved bipoint were found at Rietberg.

Another aspect of the presented sites which deserves mentioning is the catchment area of the raw materials present at the sites. Most artefacts are made on erratic material which has a very wide distribution and can be gathered in the vicinity of the sites. Five artefacts from Reken and two artefacts from Lavesum are, however, made on a flint variety which most probably can be identified as Rijckholt or Meuse gravels flint. Additionally, a piece from Lavesum is probably made on chalcedony. Both raw materials can be found at a distance of at least 100 km to the southwest.

Discussion

The archaeological context of the presented assemblages

The observations presented above illustrate the technological and typological proximity of the four assemblages from the Westphalian bay. One of the typological characteristics is the remarkable morphological diversity of the lithic projectile points (Fig. 9), which are usually considered indicative for different, spatially and chronologically distinct archaeological entities from the Late Upper Palaeolithic (Magdalenian, Hamburgian, Creswellian) and the Late Palaeolithic (Azilian, Federmessergruppen). At the same time, the technological features of the blank production and the morphology of the blades also incorporate characteristics of both the Upper Palaeolithic and Late Palaeolithic industries. It is thus not surprising that some of these assemblages were initially seen as palimpsests of several occupations of hunter-gatherers of different Palaeolithic entities (e.g. see Adrian 1982: 106 ff.; Günther 1988: 152). Now that the integrity of the assemblages excavated at Rietberg is demonstrated (see above; Richter ed. 2012), the palimpsest interpretation is also for the other assemblages no longer mandatory, but demands a critical reevaluation. In order to sharpen the typological and technological profile of the group of sites discussed in this paper, we try to delimit the Westphalian sites from immediately older or younger industries and discuss them against the background of the Magdalenian, Hamburgian and Creswellian, dating to the period of GS-2a to GI-1e, as well as the Azilian and Federmessergruppen, with a chronological position between GI-1e and GI-1a (Figs. 1, 5, 10).

An important technological change at the transition from the Late Upper to the Late Palaeolithic is the extensive usage of a soft stone hammer for the production of blades. In comparison to Late Upper Palaeolithic (particularly Magdalenian) specimens, the obtained blades are generally shorter and thicker. In comparison to Late Palaeolithic (Late Federmesser) assemblages, on the other hand, the blades appear to be quite large and more regular. Although seldom present in Late Upper Palaeolithic contexts (e.g. Bodu et al. 2006), soft stone hammers gained significance for blank production only with the onset of the Late Palaeolithic (Valentin 2000; Valentin et al. 2004; Maier 2012c). Despite the persistence of the *en éperon* preparation and the usage of organic hammers during the Late Upper Palaeolithic, an increasing usage of soft stone hammers becomes apparent in assemblages of the Final Magdalenian Facies Cepoy-Marsangy (Valentin 2000; Weber 2006), as well as in some assemblages of the Creswellian (Barton 2010) and the Hamburgian (Weber et al. 2010). This technological change is probably related to the increasing production of lithic projectile points at the end of the Late Upper Palaeolithic, since blades with straight profile appear to be better suited for their production than curved ones.

From a typological point of view, classical Magdalenian assemblages like Gönnersdorf and Andernach-Martinsberg are characterised by high percentages of backed bladelets and the virtual absence of lithic points (Holzkämper 2006, Fig. 217). This stands in sharp contrast to the tool spectrum of the presented Westphalian assemblages. However, in Final Magdalenian contexts, lithic projectile points become increasingly frequent as can be observed in the assemblages of the Facies Cepoy-Marsangy (e.g. Weber 2006) or at Bois Laiterie (Sano et al. 2011). For inventories of the Facies Cepoy-Marsangy, shouldered

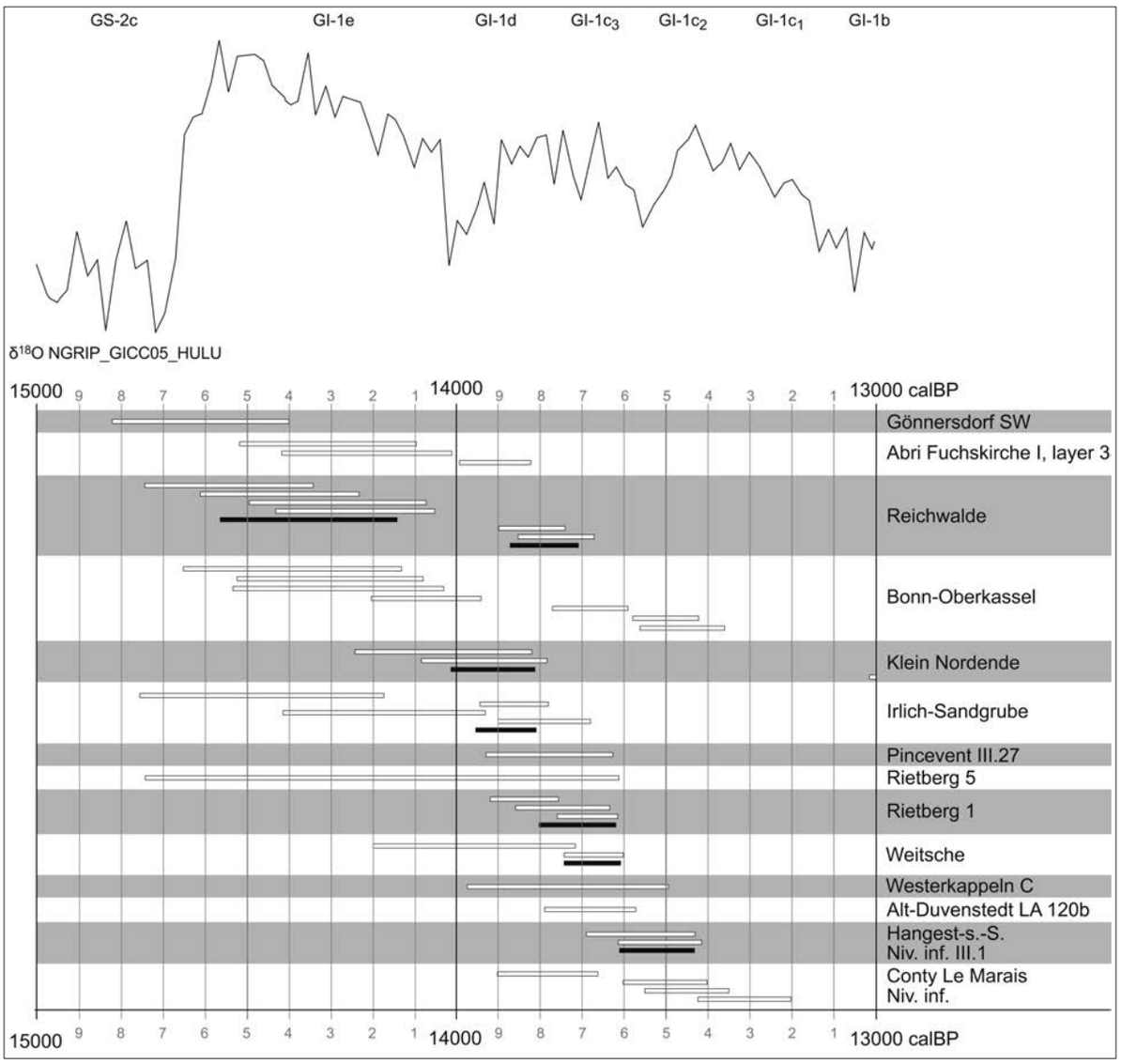

Fig. 10. Chronology of the Late Glacial and radiocarbon dates of selected sites. All dates calibrated with CalPal2007_HULU, $\delta^{18}O$: NGRIP_GICC05_HULU (Weninger & Jöris 2008). Bars represent 1σ standard deviation. Black bars correspond to the average ages given in Figure 5.

Abb. 10. *Chronologie des Spätglazials und Radiokarbon-Daten ausgewählter Fundstellen. Alle Daten kalibriert mit CalPal2007_HULU; $\delta^{18}O$: NGRIP_GICC05_HULU (Weninger & Jöris 2008). Die Balken geben die 1σ Standardabweichung wieder. Schwarzen Balken beziehen sich auf die Mittelwerte aus Abbildung 5.*

points and angle-backed points are characteristic, whereas the amount of backed bladelets decreases. In Bois Laterie, trapezoidal, angle-backed and curve-backed points as well as bipoints occur. At the same time, the amount of backed bladelets is at about 40 %. Zinken/becs show high values in the Facies Cepoy-Marsangy and are also present in Bois Laterie.

The classical Hamburgian, Havelte and Creswellian tool set includes zinken/becs and laterally retouched endscrapers on blades (e.g. Burdukiewicz 1986: 14; Barton et al. 2003; Weber et al. 2010). These types also occur in the presented Westphalian assemblages. The Hamburgian point spectrum, however, is strictly limited to shouldered points. During the Havelte phase, a late development of the Hamburgian in northern Germany, the Netherlands, Denmark and Scotland (Johansen 2000; Ballin et al. 2010; Weber et al. 2010), the lithic point spectrum is dominated by tanged points. Whereas shouldered points do occur in our assemblages, tanged points are completely absent. Typical tool types of the Creswellian of the British Isles are trapezoidal and angle-backed points. A mayor difference to the Westphalian assemblages is the lack of Late Palaeolithic elements like curve-backed points and scrapers on flakes as well as the low morphological variability of the lithic point spectrum.

Significant features of Early Azilian assemblages are endscrapers on blades and short endscrapers on flakes as well as bipoints, i.e. standardised, regular shaped and elongated segments (Bodu & Valentin

1997; Baales 2002: 48 ff.). Furthermore, short (<5 cm) and long (≥5 cm) curve-backed points occasionally appear (Bosinski 2008: 419, Fig. 401-403). All these features can be found in the presented assemblages, but here, in contrast to Early Azilian inventories, bipoints are not a dominant feature in the lithic point spectrum. Early Federmessergruppen assemblages show a high variability in the spectrum of lithic points (Fagnart 1997) as is the case for the Westphalian assemblages. At the same time, the tools of the *fond commun* are likewise very similar (see below). Late Azilian and Late Federmessergruppen assemblages are considered largely equivalent in typological and technological terms (for the terminological discussion see e.g. Baales 2002: 56 ff.; Kegler 2011: 297 ff.). Distinctive tool types are curve-backed points (monopoints, sometimes with a retouched base) and scrapers on flakes (e.g. Baales 2002; Gehlhausen 2012). Additionally, backed bladelets occur (e.g. Bolus 2012: 433). In contrast to our assemblages, Late Federmesser assemblages in the region are generally characterised by smaller blanks and morphologically much more standardised curve-backed points.

The incipient usage of soft stone hammers for blade production and the increasing variability of the morphology of lithic projectile points mark the beginning of the transition from the Late Upper Palaeolithic to the Late Palaeolithic industries. The transitional process, which is termed "azilianisation", is relatively well understood in the western part of Europe, especially in the Paris Basin, where it takes place during the Bølling-Interstadial (GI-1e), a phase of environmental change, and seems to happen as a gradual development (Bodu 2000: 336). In Northwestern and Western Central Europe, however, the course of this development is less clear and yet rather poorly understood. In order to shed new light on the period at the transition from the Late Upper to Late Palaeolithic and thereby to better understand the chorological position of the presented sites in the patchwork of the archaeological landscape at that time, we will now discuss them in their supra-regional context.

Typologically, technologically and chronologically comparable sites

A number of sites in Northwestern and Central Europe, more precisely in Germany, The Netherlands, Belgium, Northern France and southern Great Britain, have a typological and technological composition and/or age determination similar to the Westphalian assemblages and are thus of special interest for a discussion of the chorological position of the presented assemblages (Figs. 1, 5, 10). The *chaîne opératoire* is not always reported in detail from every site, especially with regard to the applied percussion instrument. However, a general feature of all sites discussed below is the absence of the *en éperon* preparation. For the typological comparison, only those artefacts are taken into account that can be considered as characteristic for the presented assemblages. Less distinctive types, such as burins on blades and endscrapers on blades were, however, not considered, because they occur in all mentioned sites. Furthermore, a typological fuzziness exists in the distinction between zinken on the one hand and becs (abrasive borers) on the other. Thus, these tool groups had to be considered collectively.

Germany

The site of Westerkappeln C in Westphalia provided a radiocarbon age between 13 970 and 13 490 calBP (Figs. 5, 10; Günther 1973), which situates the assemblage in chronological proximity to the Rietberg inventory. The small tool assemblage contains – besides two tool fragments – two scrapers on flakes and two curve-backed points. Although comparable to our assemblages, these elements might as well occur in a Late Federmesser context.

The typologically and technologically best comparable site in North Rhine-Westphalia is Kleinenbroich in the Lower Rhine Embayment (Fig. 9). Due to typological analogies with Siegerswoude II (Kramer et al. 1985) the assemblage was interpreted to belong to a late continental Creswellian during the Allerød-Interstadial (Thissen et al. 1996). The surface collection contains laterally retouched endscrapers on blades as well as scrapers on flakes, zinken/becs and two long B-points. Other artefacts most likely represent fragments of large curve-backed points. Some blades show the characteristics of the soft stone mode of percussion as could be observed by the authors during a revision of the inventory. One core and a long B-point are apparently made of a raw material from Southern Germany (Abensberger Plattenhornstein) with a distance of approximately 430 km to the site (Thissen et al. 1996). Rounded and scarred ends at the core show that it was used as a hammerstone. As this raw material usually appears in Late Neolithic contexts in the Rhineland, and a Neolithic component in the collection cannot be excluded, the affiliation of these finds to the assemblage is afflicted with uncertainty.

Based on the occurrence of angle-backed points, shouldered points, long B-points, long curve-backed points, laterally retouched endscrapers on blades as well as zinken/becs, further small artefact assemblages and single finds from North Rhine-Westphalia most likely belong to the Upper to Late Palaeolithic transition period. These are Barmen-West (Heinen & Schol 2000: 105 ff.), Erkelenz 2, Haberg (Heinen 2000: 47 ff.), Korschenbroich (Thissen 1995: 225 ff.), Rheindahlen A1 (Thieme 1978: 56 ff.), Kartstein-Felswand (Baales 1996: 52), Schwerte-Wandhofen and Petershagen-Frille (Günther 1988: 129, 156) as well as Nordwalde (Kr. Steinfurth, collection Horstmann).

The site Gönnersdorf Southwest should also be discussed in the context of the Upper to Late Palaeolithic transition. Typologically, the assemblage is dated

to the Allerød-Interstadial, more precisely to the GI-1_{c1} (Buschkämper 1993; Bosinski 2008: 429). The attribution is based on the occurrence of three "point à base rétrécie", typical forms of the Azilian for example from Le Closeau, niveau intermédiaire (Bodu 1998). The assemblage thus could possibly represent a link between the presented Westphalian sites and the Late Federmesser assemblages in the region. This view is contradicted by a radiocarbon date obtained on a elk bone, which indicates an early age between 14 820 and 14 400 calBP (Figs. 5, 10; Street 2007). However, the connection between the elk bones and the discussed artefacts is not entirely clear (Bosinski 2008: 384).

In Eastern Germany, the sites Reichwalde (Vollbrecht 2005), Abri Fuchskirche I, layer 3 (Benecke et al. 2006; Feustel & Musil 1977) and Etzdorf, Nasser Wald (Feustel 1957) have to be mentioned. All inventories include angle- and curve-backed points as well as backed bladelets and zinken/becs (Fig. 9). In contrast to our Westphalian sites, Reichwalde and Abri Fuchskirche are characterised by the absence of shouldered points and a relatively high percentage of backed bladelets. Furthermore, the assemblages of Abri Fuchskirche and Etzdorf do not include long B-points and in the case of Abri Fuchskirche laterally retouched scrapers on blades and scrapers on flakes are absent. Reichwalde includes nearly all tool types that are important for the presented assemblages with the difference, that trapezoidal points and bipoints are much more compact and sometimes reach microlithic dimensions. A common technological feature in Reichwalde and the Westphalian assemblages is the usage of a mineral hammer during blank production (Vollbrecht 2005: 407). Radiocarbon dates from Reichwalde indicate at least two occupations: one during the Bølling-Interstadial (GI-1e) and the other during the birch phase of the Allerød-Interstadial (GI-1_{c3}) between 13 900 and 13 670 calBP (Figs. 5, 10; Vollbrecht 2005). At Abri Fuchskirche, radiocarbon dates also show two occupational events: the first during the Late Pleniglacial (GS-2a), the second during the late Bølling/early Allerød (GI-1e/GI-1_{c3}) between 14 520 and 13 830 calBP (Benecke et al. 2006). The dating thus points to around 14 000 calBP for the Late Palaeolithic occupations.

Comparable sites from Northern Germany are Weitsche (Veil & Breest 2002), Alt Duvenstedt LA 120 B (Kaiser & Clausen 2005) and Klein Nordende CR (Bokelmann et al. 1983). All assemblages are characterised by long and short curve-backed forms, long B-points and scrapers on flakes (Fig. 9). While backed bladelets were found in Weitsche and Klein Nordende CR, angle-backed points occur only in Weitsche and an atypical shouldered point and zinken/becs were only found in Klein Nordende CR. A conspicuous difference to the Westphalian group consists in the absence of laterally retouched endscrapers on blades in all sites. Weitsche was dated between 13 750 and 13 610 calBP (Veil et al. 2012) and Alt Duvenstedt LA 120 B between 13 790 and 13 570 calBP (Kaiser & Clausen 2005). For Klein Nordende CR, a date between 14 240 and 13 780 calBP (Bokelmann et al. 1983) was obtained by conventional dating of *Hippophaë* twigs (Figs. 5 & 10). The palynological results also point to an occupation during the *Hippophaë*-maximum of the Bølling-Interstadial (sensu Iversen 1942), i.e. the GI-1e. Recent investigations brought forward a new AMS date for area D that ranges between 13 020 and 12 820 calBP (Riede et al. 2010). Since "the stratigraphy is complex and varies between profiles" (Riede & Edinborough 2012: 749), the significance of the new date from area D for the finds from Klein Nordende CR is not entirely clear. However, Riede and Edinborough suggest that the older dates should be considered with caution (ibid.).

The assemblage of Schweskau in Lower Saxony (Breest & Veil 1991) comprises angled, shouldered, trapezoidal, and long B-points. At the same time, long borers and zinken/becs are present and the *en éperon* preparation is a dominant characteristic of the blank production. The site is interpreted as a mixture between the Magdalenian and the Hamburgian. However, from a typological point of view, it might also be seen as a very late stage of the Final Magdalenian which could immediately predate the presented assemblages. Another example that probably dates to the Final Magdalenian is Fußgönheim (Stodiek 1987). Here, shouldered points (some with a straight retouched base) as well as curve-backed and angle-backed points appear.

The Netherlands and Belgium

A couple of sites from the Netherlands show typological similarities to the Westphalian group of sites. The assemblages Zeijen (Stapert & Johansen 2001), Emmerhout (Stapert 1985), Siegerswoude II (Kramer et al. 1985) and Op de Hees (Stapert 1979) contain endscrapers on blades with laterally retouched edges and, except for Op de Hees, zinken/becs (Fig. 9). Most important point forms are angle-backed points and long B-points. In the case of Zeijen, additionally trapezoidal points occur which are found at Rietberg, but not at the other Westphalian sites. In contrast to the Westphalian sites, curve-backed points, shouldered points, bipoints, scrapers on flakes and backed bladelets do not appear. In Zeijen, the *en èperon* preparation is absent (Barton et al. 2003: 636). Whereas Zeijen's cultural affiliation to the Creswellian is commonly accepted, Emmerhout, Siegerswoude II and Op de Hees are controversially discussed for representing a continental Creswellian, mainly because of the absence of trapezoidal points (Barton et al. 2003: 636). According to stratigraphic observations, Emmerhout and Siegerswoude II were dated to the Allerød-Interstadial comparable to Rietberg (Stapert 1985; Kramer et al. 1985). Usselo and Neer II in the Netherlands (Stapert & Veenstra 1988; Kramer

2012) and the Belgium cave site Grottes de Presle (Dewez 1987: 15 ff.) revealed assemblages very similar to the presented assemblages with regard to the diversity of points and other tool types. However, due to several reasons (e.g. unclear stratigraphic context, preservation of the sites) an admixture of finds from different chronological units cannot be ruled out.

Northern France

Several sites comparable to the Rietberg Facies are located in the Somme valley in northern France (Fagnart 1997). For the lower levels of Hangest-sur-Somme III.1 and Conty Le Marais as well as for the neighbouring sites of Dreuil-lès-Amiens and Amiens-Étouvier, a rich and diverse spectrum of backed implements was documented. Angle-backed, shouldered and curve-backed points (some with a straight or obliquely retouched base like the presented assemblages) and scrapers on flakes are represented in all sites (Fig. 9). Additionally, bipoints occur in Hangest-sur-Somme and Conty Le Marais and a trapezoidal point is documented from Conty. In contrast to the Westphalian sites, long B-points were not reported from these sites and laterally retouched endscrapers on blades are only described for Dreuil-lès-Amiens and Amiens-Étouvier. Backed bladelets reach a rather high percentage of 37 % in the assemblage of Hangest-sur-Somme, but only occur in small amounts in the other assemblages. In Hangest-sur-Somme and Conty Le Marais, blank production is similar to the presented sites. Blades were produced with a soft stone hammer and show a straight profile. When a core has two striking platforms, the second platform was usually used to maintain the convexity of the striking face. Palynological results and radiocarbon dates from Hangest-sur-Somme and Conty place the sites between the end of the birch and the beginning of the pine phase of the Allerød. Whereas Hangest-sur-Somme revealed an age between 13 680 and 13 410 calBP, Conty has ^{14}C ages between 13 900 and 13 210 calBP (Figs. 5, 10; Fagnart 1997). Another site which is synchronous to Rietberg is Pincevent III, 27 in the Paris Basin (Bodu et al. 1996). A radiocarbon date points to an age between 13 930 and 13 630 calBP (GI- 1_{c3}, Figs. 5 & 10). The assemblage only contains three bipoints, short backed points and laterally retouched endscrapers on blades.

Southern England

A group of open air sites in Southern England referred to as Hengistbury-type sites (Conneller & Ellis 2007) provide assemblages comparable to the presented Westphalian sites as they show a high variability in the lithic point spectrum (Barton 2010). Shouldered and angle-backed points are present in Hengistbury Head and Brockhill and bipoints and curve-backed points occur in Hengistbury Head and Nea Farm (Fig. 9). One big curve-backed point from Nea Farm has a straightly retouched base (Barton et al. 2009: 13, Fig. 18). A documented truncation from Hengistbury Head could also be seen as a long B-point (Barton 1992: 126, Fig. 4.22, 7), whereas this point type seems to be absent at the other sites. Straight backed blades and bladelets are present in Brockhill, La Sagesse and in Hengistbury Head. In Hengistbury Head they are with 50 % the largest tool group (Barton 1992: 108; 2010) – a considerable difference to the presented inventories. Zinken/becs, endscrapers on blades (at Hengistbury Head also with lateral retouches) and scrapers on flakes occur in all of the Hengistbury-type sites (Barton 1992, 2010). Blades with rubbed proximal ends (so-called strike-a-lights) are present at Hengistbury Head, Nea Farm (Barton et al. 2009) and Lavesum (Fig. 8: 8), but also occur at Hamburgian sites. All sites are characterised by the production of long regular blades with a straight profile (Barton 2010). Blade cores from Hengistbury Head and Nea Farm show two striking platforms, whereof the second was used to restore the convexity of the striking face (Barton 1992; Barton et al. 2009). In Nea Farm, blades were often produced with a soft stone hammer. By typological and technological comparisons with the lower levels of Hangest-sur-Somme III.1 and Conty Le Marais, the Hengistbury-type assemblages were dated to the older phase of the Federmessergruppen (Barton 2010). In recent investigations, a possible attribution to Hamburgian has also been discussed (Pettitt & White 2012).

Burial sites from the transitional period

The famous double-burial of a man and a woman from Bonn-Oberkassel, which also yielded the remains of a dog and some art objects, was typologically dated to the Middle Magdalenian (Henke 1986; Wüller 1993). Radiocarbon dates obtained on animal and human bones place the site instead roughly around 14 000 calBP (Figs. 5, 10; Baales & Street 1998; Street & Wüller 1998). Since the only lithic artefact is a small flake, a further comparison to the above mentioned sites is not possible. Reddish coloured human remains of an adult woman, a neonatal and at least a third individual were recovered from a sand pit close to the village of Neuwied-Irlich (Rhineland-Palatinate; von Berg & Baales 2002; Baales 2004; Street et al. 2006). As is the case for Oberkassel, radiocarbon dates place these bones approximately around 14 000 calBP (Figs. 5 & 10; Baales 2002). Again, the few lithic artefacts are not suitable for a typological comparison.

The chorological position of the presented sites and the resettlement of the Westphalian lowlands

To better understand the internal structure of the Early Federmesser period and the chorological position of the Westphalian assemblages in the regionally diverse archaeological patchwork of Late Glacial Northwestern and Western Central Europe (Fig. 1), data on raw material procurement can produce valuable information. Most artefacts in the presented

assemblages are made on erratic material, which has a very wide distribution. This "Baltic flint" is therefore not very suitable for the reconstruction of catchment areas. Five artefacts from Reken and two artefacts from Haltern-Lavesum are, however, made on a flint variety which most probably can be identified as Rijckholt or Meuse gravel flint. Additionally, a piece from Lavesum is probably made on chalcedony. Both raw materials can be found at a distance of at least 100 km to the southwest. Although being not very numerous, all non-local raw-materials from Reken and Lavesum thus point towards the west and to a connection with the Rhine-Meuse region. In this context, it is interesting to note that a transport of artefacts made on Meuse gravel flint east of the Rhine can already be observed during the Late Magdalenian. Here it is attested for the assemblage of Gadenstedt in Lower Saxony (Simoneit & Veil 1999), which represents the easternmost occurrence of this raw material during the Late Upper and Late Palaeolithic.

The observation of a stronger linkage between the Westphalian sites and the westwards adjacent regions is supported by the results of the regional typological and technological comparisons. Pronounced similarities can be stated for the sites of Northern France and Southern England, indicating intense social interaction and exchange of technological and typological concepts. A difference to these regions is, however, the regular presence of bipoints and the rare occurrence of long B-points and laterally retouched endscrapers in these regions as opposed to Westphalia (Fig. 9). The westward orientation of the interaction network becomes even clearer when contemporaneous sites in other regions are taken into account.

Besides similarities, major differences to the presented sites are the following (see Fig. 9):

- in continental Creswellian sites from the Netherlands, Late Palaeolithic elements such as curve-backed points, scrapers on flakes and backed bladelets do not appear.
- Federmesser sites in northern Germany, such as Weitsche, Alt Duvenstedt LA 120 B and Klein Nordende CR are mainly characterised by Late Palaeolithic elements, such as curve-backed points, backed bladelets and scrapers on flakes.
- In the Eastern German sites Abri Fuchskirche and Reichwalde, backed bladelets are significantly more abundant and in the case of Reichwalde, lithic point size differs strongly. Furthermore, the assemblages of Abri Fuchskirche and Etzdorf contain no long B-points.

With regard to the chorological position of the presented sites, it can thus be argued that the regional hunter-gatherer group, which occupied the Westphalian lowlands during the Early Federmesser period, maintained the closest contact to those regional groups settling in the areas adjacent to the west (Fig. 1). It appears even possible that the first groups expanding into this area spread from the Rhine-Meuse area and Northern France. Nevertheless, the remaining question is: Why did the about 100 km broad region between the settlement area of the Magdalénien and the Hamburgian remain unoccupied until the onset of GI-1_{c3}, roughly about 13 800 calBP? A possible explanation seems to be connected with the observable technological changes of this time. In contrast to the highly standardised blade production of the Magdalenian that relied on high quality raw material, the more flexible *chaîne opératoire* of the Early Federmessergruppen and the usage of soft stone hammers to obtain rather short and thick blades with a straight profile allowed for the exploitation of raw materials of rather low quality. The technological emancipation enabled Early Federmesser hunter-gatherers to exploit a region which, except for a lack of high quality raw material, was rich in natural resources such as species-rich vegetation and game, which had not yet been depleted by hunting.

Conclusion

The pronounced environmental changes which began with the GI-1e, the Bølling-Interstadial sensu Iversen (1942), probably triggered a gradual conversion in the behaviour of hunter-gatherer groups, which becomes visible in the archaeological record of Western and Central Europe as the Upper to Late Palaeolithic transition. This process is characterised by the increasing usage of the soft stone hammer percussion, a pronounced regional diversification and an increasing variability of the tool spectrum, particularly of lithic points. Only during the pine phase of the Allerød (GI-1_{c1}), we see again a widespread homogenisation of the typological assemblages, which then are characterised by small curve-backed points and attributed to the Late Azilian or Late Federmessergruppen respectively (Baales 2002: 48 ff.). During the transitional phase from the Late Upper to the Late Palaeolithic, long B-points seem to be of chronological significance, since their occurrence appears to be limited to this period. Unfortunately, this point type often seems to be not recognised as such and is instead simply assigned to oblique truncations.

Until recently, the majority view was that the Westphalian lowlands saw their reoccupation after the LGM only during the Late Federmesser period. The new results argue instead for a resettlement already during the Early Federmesser period and thus during the GI-1_{c3}. Considering the differences in the composition of the assemblages from neighbouring regions, we conclude that the technological and typological characteristics of the presented assemblages from the Westphalian lowlands argue in favour of a regional phenomenon. The discussed Westphalian sites were probably occupied during the birch phase of the Allerød-Interstadial and represent one regional variant within the supra-regional pattern of

neighbouring groups of the Federmesser cultural complex (Fig. 1). These hunter-gatherers probably came from the west and maintained a close interaction with westward adjacent groups, which is indicated by the raw material procurement pattern as well as typological and technological idiosyncrasies. They probably were part of a regional settlement system, which might also include the burial sites of Bonn-Oberkassel and Irlich Sandgrube. Being attributable to an earlier phase of the Federmesser complex, the lithic industry of the presented sites is technologically well distinguishable from the later Federmessergruppen. It is well possible that Rietberg and related sites precede the later Westphalian Federmessergruppen by several hundred years. It may thus represent a short occupational episode of western European hunter-gatherers.

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Inhalt - *Contents*

Stone procurement and transport at the late Early Pleistocene site of Cueva Negra del Estrecho del Río Quípar (Murcia, SE Spain)
Rohmaterialbeschaffung und -transport am späten frühpleistozänen Fundplatz von Cueva Negra del Estrecho del Rio Quípar (Murcia, SO Spanien)

Winston Zack, Alexander Andronikov, Tomas Rodríguez-Estrella, Mariano Lopez-Martínez, María Haber-Uriarte, Vance Holliday, Dante Lauretta & Michael Walker.....7-28

Organization of Lower and Middle Palaeolithic Groups in the South-East of the Massif Central, France
Strategien der Landschaftsnutzung, Geräteinventare und soziale Organisation von alt- und mittelpaläolithischen Gruppen im südwestfranzösischen Zentralmassif

Jean-Paul Raynal, Marie-Hélène Moncel, Paul Fernandes, Peter Bindon, Camille Daujeard, Ivana Fiore, Carmen Santagata, Muriel Lecorre-Le Beux, Jean-Luc Guadelli, Jeanne-Marie Le Pape, Antonio Tagliacozzo, René Liabeuf, Laurent Servant, Marc Aulanier & Hélène Seret.....29-59

Ausgangsbasis oder Versorgungsstandort? Raumnutzung im Mittel- und Jungpaläolithikum des Ach- und Blautals bei Blaubeuren
Home base or supply location? Spatial behaviour during the Middle and Upper Palaeolithic of the Ach and Blau Valley near Blaubeuren

Berrin Çep.....61-83

The Early Upper Palaeolithic puzzle in Mediterranean Iberia
Das Frühe Jungpaläolithikum im mediterranen Spanien

Paloma de la Peña & Gerardo Vega Toscano.....85-106

New discoveries in the Sanctuary of Les Trois-Frères cave (Ariège)
Neue Entdeckungen in der Bilderhöhle von Les Trois-Frères (Ariège)

Éric Bégouën & Marie-Brune Bégouën.....107-114

„Dark Ages" illuminated – Rietberg and related assemblages possibly reducing the hiatus between the Upper and Late Palaeolithic in Westphalia
Licht im „Dunklen Zeitalter" – Rietberg und verwandte Inventare verkürzen möglicherweise den Hiatus zwischen Jung- und Spätpaläolithikum in Westfalen

Jörg Holzkämper, Andreas Maier & Jürgen Richter.....115-136

Late Palaeolithic Nørre Lyngby – a northern outpost close to the west coast of Europe
Nørre Lyngby in spätpaläolithischer Zeit – ein nördlicher Außenposten nahe der Westküste Europas

Anders Fischer, Lars B. Clemmensen, Randolph Donahue, Jan Heinemeier, Holger Lykke-Andersen, Per Lysdahl, Morten Fischer Mortensen, Jesper Olsen & Peter Vang Petersen.....137-162

Book reviews
Buchbesprechungen.....**163-175**