Quartär

Internationales Jahrbuch zur Eiszeitalter- und Steinzeitforschung

International Yearbook for Ice Age and Stone Age Research

Band – *Volume*
64

Edited by

Sandrine COSTAMAGNO, Thomas HAUCK, Zsolt MESTER, Luc MOREAU,
Philip R. NIGST, Andreas PASTOORS, Daniel RICHTER, Isabell SCHMIDT,
Martin STREET, Yvonne TAFELMAIER, Elaine TURNER, Thorsten UTHMEIER

Verlag Marie Leidorf GmbH · Rahden/Westf.
2017

287 Seiten mit 187 Abbildungen

Manuskript-Richtlinien und weitere Informationen unter http://www.quartaer.eu
Instructions for authors and supplementary information at http://www.quartaer.eu

Bibliographische Information der Deutschen Nationalbibliothek

**Costamagno, Sandrine / Hauck, Thomas / Mester, Zsolt /
Moreau, Luc / Nigst, Philip R. / Pastoors, Andreas / Richter, Daniel / Schmidt, Isabell /
Street, Martin / Yvonne Tafelmaier / Turner, Elaine / Thorsten Uthmeier (Eds.):**
Quartär: Internationales Jahrbuch zur Eiszeitalter- und Steinzeitforschung; Band 64
International Yearbook for Ice Age and Stone Age Research; Volume 64
Rahden/Westf.: Leidorf, 2017
ISBN: 978-3-86757-930-8

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliographie.
Detaillierte bibliographische Daten sind im Internet über http://dnb.ddb.de abrufbar.

Gedruckt auf alterungsbeständigem Papier

Verlag Marie Leidorf GmbH
Geschäftsführer: Dr. Bert Wiegel
Stellerloh 65 - D-32369 Rahden/Westf.

Tel: +49/(0)5771/ 9510-74
Fax: +49/(0)5771/ 9510-75
E-Mail: info@vml.de
Internet: http://www.vml.de

ISBN 978-3-86757-930-8
ISSN 0375-7471

Umschlagentwurf: Werner Müller, CH-Neuchâtel, unter Mitwirkung der Herausgeber
Redaktion: Sandrine Costamagno, F-Toulouse, Thomas Hauck, D-Köln, Zsolt Mester, H-Budapest,
Luc Moreau, D-Neuwied, Philip R. Nigst, GB-Cambridge, Andreas Pastoors, D-Mettmann, Daniel Richter, D-Leipzig,
Isabell Schmidt, D-Köln, Martin Street, D-Neuwied, Yvonne Tafelmaier, D-Tübingen, Elaine Turner, D-Neuwied und
Thorsten Uthmeier, D-Erlangen
Satz, Layout und Bildnachbearbeitung: Nicole Bößl, D-Erlangen, unter Mitwirkung von Andreas Pastoors, D-Mettmann

Druck und Produktion: druckhaus köthen GmbH & Co. KG, D-Köthen

Inhalt - *Contents*

Non-flint from the Middle Pleistocene site of Bilzingsleben (excavation from 1971 to 2002)

Die Gesteine aus der mittelpleistozänen Fundstelle Bilzingsleben (Ausgrabungen 1971-2002)

C. Bock, V. Neubeck & C. Pasda*

Friedrich Schiller-Universität Jena; Institut für Orientalistik, Indogermanistik, Ur- und Frühgeschichtliche Archäologie; Seminar für Ur- und Frühgeschichtliche Archäologie, Löbdergraben 24a, 07743 Jena, Germany;
email: clemens.pasda@uni-jena.de

Abstract - From 1971 to 2002, Dietrich Mania excavated at the Middle Pleistocene travertine deposit of Bilzingsleben (Thuringia, Germany). This study presents an analysis of the c. 23'000 rocks from this excavation. Only travertine and rock types from local bedrock, local glacial and fluvial deposits are present. Spatial distribution of small and large rocks is roughly the same as for small and large animal bones. Spatial distribution and orientation of refitted antler fragments, human bones and rocks show that the find-bearing sediments accumulated apparently naturally. No clear evidence of heat-altered stones is present. Intentionally modified pebbles are rare since only nine rocks bear negatives of removed flakes and could be considered cores or pebble tools. Three pieces, two flakes and a core refitted by Dietrich Mania 30 years ago are the only evidence of knapping so far.

Zusammenfassung - *Von 1971 bis 2002 grub Dietrich Mania auf der Steinrinne bei Bilzingsleben (Thüringen, Deutschland) ein umfangreiches Fundmaterial aus, das in ein mittelpleistozänes Interglazial gehört. Die vorliegende Arbeit behandelt die darin enthaltenen, etwa 23'000 Felsgesteine, d.h. die Nichtfeuersteine. Mit Travertin, Kalk-, Sandsteinen, Quarz, magmatischen und metamorphen Gesteinen kommen ausschließlich Gesteine lokaler Herkunft vor, die aus zeitgleichen Travertinvorkommen sowie aus lokalen Plateau- und Hanglagen beziehungsweise Moränen- und Schottervorkommen stammen. In der Grabungsfläche dominieren kleine und große Gesteine dort, wo auch kleine und große Knochen gefunden wurden. In Verbindung mit der räumlichen Ausrichtung der Zusammenpassungslinien von Geweihfragmenten, Menschenknochen und Gesteinen wird dies als Hinweis auf eine natürliche Akkumulation des archäologischen Fundhorizonts gesehen. Es liegen keine Gesteine vor, welche eindeutig Spuren von Feuereinwirkung aufweisen. Nur neun Gesteine sind eventuell anthropogen modifiziert. Als eindeutiger Beleg für Steinartefakte gilt ein vor über 30 Jahren von Dietrich Mania realisierter Zusammenpassungskomplex aus Gneiss, bei dem zwei große Abschläge auf einen Kern passen.*

Keywords - **Middle Pleistocene, interglacial, spatial distribution, site formation, refitting, core and flakes,** ***Mittelpleistozän, Interglazial, räumliche Verteilung, Fundplatzgenese, Zusammenpassen, Kern und Abschläge***

"The past (…) sediments in unpredictable ways and according to material trajectories that are beyond, or unrelated to, human control and intervention"
– Olsen (2010: 110)

Introduction

The site Steinrinne near Bilzingsleben (County Sömmerda, Federal State of Thuringia, Federal Republic of Germany) is a travertine deposit with bones of Pleistocene animals and Nordic flints. The site is most famous for its human fossils which are the oldest human remains in Central Germany (Street et al. 2006: Tab. 1; Vlček et al. 2002). Palaeontological research indicates their biostratigraphic position in a Late Middle Pleistocene interglacial, often designated as the ´Holsteinian´ (Kahlke 2002: 217; Maul 2002: 193-194; Meyrick 2002: 154-155; Stebich & Schneider 2002: 127-128). From 1971 to 2002 Dietrich Mania excavated c. 1'800m² of a sandy sediment below the travertine, containing a huge amount of rocks, flints and animal bones, which was interpreted as representing a Lower Palaeolithic living-floor of a camp site on a lake shore with huts, hearths, remains of hunting a diverse range of animals as well as thousands of pebble and flint tools (Mania & Mania 2005; Mania et al. 2017). In contrast, the data from the excavation conducted between 2003 and 2007 by the University of Jena has shown that the archaeological layer of the Steinrinne had been accumulated naturally, incorporating fluvial and limnic sediments as well as parts of the former Middle Pleistocene landscape (Beck et al. 2007; Liebermann & Pasda 2014; Müller & Pasda 2011;

*corresponding author

Pasda 2012). However, small isolated flint flakes and three animal bones with cut marks indicate an allochthonous character of ´Holsteinian´ human presence. Recently, the material excavated between 1971 and 2002 was re-investigated in two studies: first, Brasser (2017) examined the large mammal remains and found that the spatial distribution and the skeletal representation of elephant, rhinoceros, bovid and bear is likely a result of sorting through natural processes. Natural scratches occur on the surface of the majority of bones. Up to 7 % show traces of carnivore activities while human activities are limited to 19 bones with cut marks and six bone artefacts. Secondly, an analysis of non-flint rocks was undertaken. The results of this research are present in the following sections.

Data presentation

Among the c. 23'000 rocks 37 % are Triassic rocks like *Schillkalk*, arenite, limestone or sandstone, approximately 30 % consists of rock travertine (Fig. 1). Twenty-five percent of the assemblage is quartz, with small pieces predominating. All rock types derive from the immediate surroundings of the excavated area: the Upper *Muschelkalk* (lacustrine limestone), present today north of the Steinrinne, the Lower *Keuper* which occurs immediately below the Pleistocene deposits, pre-Elsterian fluvial gravels, Elsterian glacifluvial gravels and the Elsterian moraine (Unger 1963). With a height of 30 m, this moraine once covered the Steinrinne but was eroded before the ´Holsteinian´ (Unger 1963: 38, 50-51, 54). The travertine rocks also derive from the immediate ´Holsteinian´ surroundings of the excavated area since both the sandy archaeological layer and the rock travertine directly above are contemporaneous formations which developed within the same, peak-interglacial conditions (Kahlke 2002).

Representativeness of the finds

When comparing data from the 1971-2002 excavation with that from the recent excavation, a contrast becomes clear: in the 2003-2007 excavations the sandy sediment was sieved and every single rock particle was retained (Pasda 2012: Figs. 14-16). This explains why the 60-100 cm thick sandy sediment of each square-meter of this excavation is characterized by approximately 1'600-3'000 rocks of which >90 % are smaller than 5.4 cm (Figs. 2-3). When comparing these square-meters with their neighbouring, 1.5 x 1.5 m large quadrants of the 1971-2002 excavations not more than 20 rocks are present per square meter, 80 % of which are longer than 5.4 cm (Figs. 2-4). This may indicate that, despite sieving the sandy layer (Mania 1990: 51), a selection was made during the 1971-2002 excavation. The reason to keep some rocks and discard the others remains obscure but it seems plausible that the focus was on large size rocks. Thus, it is impossible to ascertain exactly how many rocks were present in the area excavated in 1971-2002. When taking into consideration the c. 19'000 rocks of ten square-meters of the 2003-2007 excavations (Figs. 2-4), it seems possible that up to 3.4 million rocks could have been present in the sediment excavated in 1971-2002. However, even with very low numbers of remaining rocks from the 1971-2002 excavation, a dominance of Triassic limestone in the highest part is evident (Fig. 2). In contrast, the lowest area is characterized by 99 % travertine (Fig. 4). In between these two areas (Fig. 3) travertine is more common, limestone is present in high numbers and quartz occurs very often.

Spatial distribution

No information on vertical distribution and geological context was available for the rocks of the 1971-2002

rock type	<5.1 cm	5.1-15.0 cm	15.1-25.0 cm	25.1-35.0 cm	>35.0 cm	total
travertine	2'940	3'245	676	94	9	**6'964**
quartz	5'766	180	2	-	-	**5'948**
Schillkalk	1'860	2'565	245	13	2	**4'685**
arenite	1'330	1'820	110	10	1	**3'271**
quarzite	424	393	57	7	-	**881**
magmatic rocks	213	260	35	-	-	**508**
limestone	296	159	6	-	-	**461**
sandstone	73	157	16	1	-	**247**
metamorphic rocks	105	62	7	-	-	**174**
conglomerate	2	7	2	-	-	**11**
lydite	8	-	-	-	-	**8**
others	2	1	1	-	-	**4**
total (n)	**13'019**	**8'849**	**1'157**	**125**	**12**	**23'162**

Fig. 1. Rock types and length classes of the 1971-2002 excavation at Bilzingsleben. (note: "others" includes two brownstones, one feldspar and one mineral).

Abb. 1. *Rohmaterial und Längenklassen der Gesteine der Ausgrabungen in Bilzingsleben 1971-2002. („andere" enthält zwei braune Sandsteine, ein Feldspat und ein Mineral).*

rock type (size class)	C1	506	507
limestone (<5.4 cm)	1'162	-	2
limestone (5.4-14.4 cm)	126	17	7
Limestone (>14.4 cm)	7	4	1
limestone (total)	**1'295**	**21**	**10**
travertine (<5.4 cm)	237	-	-
travertine (5.5-14.4 cm)	-	6	9
travertine (>14.4 cm)	-	-	-
travertine (total)	**237**	**6**	**9**
quartz (<5.4 cm)	74	1	2
magmatic/metamorphic rock (<5.4 cm)	23	-	-
sandstone (<9.4 cm)	4	1	-
others (total)	**101**	**1**	**-**
total (n)	**1'633**	**28**	**19**
excavation period	2004-2007	1971-2002	1971-2002
excavated area	1 m²	2.25 m²	2.25 m²
rocks/m²	1'633	12	8

Fig. 2. Comparison of areas excavated from 1971 to 2002 (506 and 507) and from 2004 to 2007 (C1) in the highest part of the Steinrinne. (note: for location of C1, 506 and 507 see Pasda (2012: Fig. 6).

Abb. 2. *Vergleich der 1971-2002 (506, 507) und 2004-2007 ausgegrabenen Areale (C1) auf der höchsten Stelle der Steinrinne. (zur genauen Lage von C1, 506 und 507 siehe Pasda (2012: Abb. 6).*

rock type (size class)	B4-B6	752	753	641	642
travertine (<5.4 cm)	3'503	-	-	-	-
travertine (5.5-14.4 cm)	147	-	-	3	10
travertine (>14.4 cm)	2	-	1	-	1
travertine (total)	**3'652**	**-**	**1**	**3**	**11**
limestone (<5.4 cm)	1'112	-	-	-	-
limestone (5.4-14.4 cm)	16	1	-	-	3
limestone (>14.4 cm)	1	5	1	2	-
limestone (total)	**1'129**	**6**	**1**	**2**	**3**
quartz (<5.4 cm)	520	-	-	-	1
quartz (5.5-9.4 cm)	-	2	-	-	-
magmatic/metamorphic rocks (<5.4 cm)	267	2	-	-	-
magmatic/metamorphic rocks (>5.4 cm)	-	-	-	-	1
sandstone (<9.4 cm)	10	-	-	-	-
others (total)	**797**	**4**	**-**	**-**	**1**
total (n)	**5'578**	**10**	**2**	**5**	**15**
excavation period	2004-2007	1971-2002	1971-2002	1971-2002	1971-2002
excavated area	3 m²	2.25 m²	2.25 m²	2.25 m²	2.25 m²
rocks/m²	1'859	4	1	2	7

Fig. 3. Comparison of areas excavated from 1971 to 2002 (752, 753, 641, 642) and from 2004 to 2007 (B4-B6) in the central part of the Steinrinne. (note: for location of B4-B6, 752, 753, 641 and 642 see Pasda (2012: Fig. 5).

Abb. 3. *Vergleich der 1971-2002 (752, 753, 641, 642) und der 2004-2007 ausgegrabenen Areale (B4-B6) im mittleren Teil der Steinrinne. (zur genauen Lage von B4-B6, 752, 753, 641 und 642 siehe Pasda (2012: Abb. 5).*

rock type (size class)	A12-A15	533	536	537
travertine (<5.4 cm)	11'584	9	14	10
travertine (5.5-14.4 cm)	229	20	27	17
travertine (>14.4 cm)	11	3	1	2
travertine (total)	**11'824**	**32**	**42**	**29**
limestone (<5.4 cm)	35	-	-	-
limestone (5.4-14.4 cm)	1	-	1	3
quartz (<5.4 cm)	27	-	-	-
quartz (5.5-9.4 cm)	2	-	-	-
magmatic/metamorphic rocks (<5.4 cm)	15	-	-	-
magmatic/metamorphic rocks (>5.4 cm)	1	-	-	-
others (total)	**81**	**-**	**-**	**-**
total (n)	**11'905**	**32**	**43**	**32**
excavation period	2004-2007	1971-2002	1971-2002	1971-2003
excavated area	4 m^2	2.25 m^2	2.25 m^2	2.25 m^2
rocks/m^2	2'976	14	19	14

Fig. 4. Comparison of areas excavated from 1971 to 2002 (533, 536, 537) and from 2004 to 2007 (A12-A15) in the southern part of the Steinrinne. (note: for location of A12-A15, 533-537 see Pasda (2012: Fig. 4).

Abb. 4. *Vergleich der 1971-2002 (533, 536, 537) und der 2004-2007 ausgegrabenen Areale (A12-A15) im südlichen Teil der Steinrinne. (zur genauen Lage von A12-A15, 533-537 siehe Pasda (2012: Abb. 4).*

excavations, but a two-dimensional plotting of size classes and rock types to squares of varying size, often 1.5 x 1.5 m large, is possible (Appendix, Plate 1-8).

Small size rocks occur in the whole excavated area (Appendix, Plate 1). Like the spatial distribution of small bones (Brasser 2017: Fig. 3.146; 3.147), a more dense distribution of small rocks occurs in a longer, west-east strip located in the northern half as well as in a short north-south strip located in the southern half.

To obtain a comparable quantitative record, only rocks larger than 20 cm are presented here. Their spatial distribution (Appendix, Plate 2) shows that few large rocks occur widely scattered with a higher number in the central part. This spatial pattern corresponds well with the spatial distribution of 20-50 cm long animal bones (Brasser 2017: Abb. 3.143).

Travertine occurs in the whole excavated area, with more specimens in the south-eastern part (Appendix, Plate 3). The latter area was interpreted by the excavator as part of an artificial, *"almost circular pavement with a diameter of c. 9 meters (…) with flat non-local travertine and Muschelkalk stones (…) used for special cultural activities"* (Mania & Mania 2005: 102; see also: Mania & Mania 1999: Fig. 2). This interpretation is difficult to verify given that no detailed profile sketches for this area have been published and no information on the vertical distribution is available.

The spatial distribution of *Schillkalk* does not support the interpretation of the artificial pavement mentioned above, as most specimens occur elsewhere (Appendix, Plate 4).

However, the spatial distribution of *Schillkalk* (Appendix, Plate 4), quartzite (Appendix, Plate 5), arenite (Appendix, Plate 6) and magmatic/metamorphic rocks (Appendix, Plate 7) may match that of small-sized rocks (Appendix, Plate 1). Travertine (Appendix, Plate 3) shows a distinct cluster in the south and quartz a distinct stripe in the north (Appendix, Plate 8), each corresponding to one of the two areas containing many rocks <10 cm (Appendix, Plate 1).

Site formation

As stated above, during the excavations in 1971-2002 not every rock was preserved. Therefore proper interpretation of Appendix, Plate 1-8 is more or less impossible. However, the following general conclusions can be made: i) the presence of many small rocks, most often travertine, characterize the sandy, find-bearing layer, ii) only a few large rocks are present and they occur widely scattered in the central part of the excavated area, iii) the spatial distribution of the rock sizes corresponds to that of bone sizes, iv) spatial distribution of raw materials may be connected to rock size. This may indicate a natural accumulation of rocks mirroring that of animal bones (Brasser 2017: 204) but says nothing about the processes responsible for that accumulation.

The former investigators of the 1971-2002 excavations refitted antlers (Vollbrecht 2000), human bones (Vlçek et al. 2002) and non-flint rocks (Mania 1986: 303). Breakage of refitted antlers was due to natural processes (Vollbrecht 2000). The approx. thirty skull fragments, the single teeth and part of a mandible, representing two or three human individuals (Vlček et al. 2002), may be a typical bias resulting from natural disarticulation and selective transport in fluvial environments (Evans

2013; Fernández-Jalvo & Andrews 2003: 149-150; Orschiedt 1999: 60; Street et al. 2006: 554). The occurrence of a refitted *débitage* sequence of three lithic artefacts (see below) does not contradict the interpretation of the find-bearing layer of Bilzingsleben as being accumulated by natural processes: the experiments made by Kathy Schick (1986: 84-85, 267; Schick & Toth 1993: 205) indicate that refitting of single flakes is also possible in lithic assemblages disturbed heavily by fluvial processes. When plotting the direction of refitting lines of antlers, human remains and rocks of the 1971-2002 excavations, a NW/SE and a SW/NE direction of the connections between fragmented specimens is visible (Fig. 5). These two main axes correspond well to the two strips that are densely packed with small rocks (Appendix, Plate 1) as well as to the orientation of rocks in area B and C of the 2004-2007 excavation (Fig. 5). Both axes correspond roughly to the spatial distribution of *Schillkalk* (Appendix, Plate 4) but well with the NW/SE strip of quartz (Appendix, Plate 8). This combination of the direction of refitting lines, of fabrics of rocks from the recent excavations and of spatial distribution of some rock materials may indicate sand with numerous rocks and bones deposited by turbulent mass flows (Bertran & Lenoble 2002; Bertran et al. 1997; Lenoble & Bertran 2004; Major 1998).

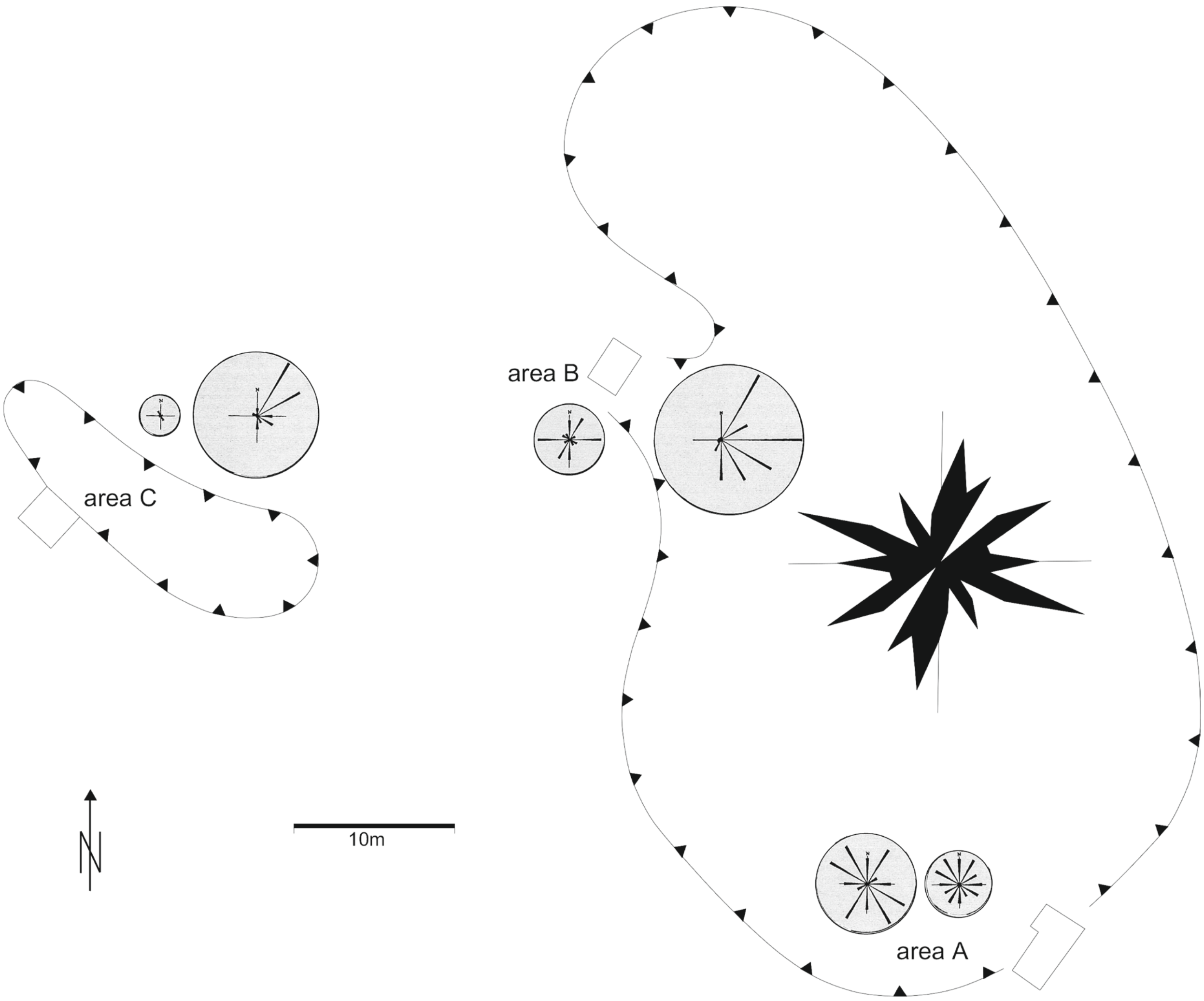


Fig. 5. Steinrinne with large area excavated in 1971-2002 and small areas A, B and C excavated in 2004-2007. Orientation of rocks in areas A, B and C in grey circles (left grey circle: horizontally embedded rocks, right grey circle: obliquely embedded rock). Direction of refitting lines (black star) between antler fragments (n=40; Steguweit 2003: fig. 30), fragmented human bones (n=9; Mania 1997: fig. 29) and lithic artefacts (n=3; this article); graphic: modified from Liebermann & Pasda (2014: fig. 1) by C. Pasda.

Abb. 5. *Steinrinne mit grossem, 1971-2002 und kleinem, 2004-2007 ausgegrabenen Areal A, B und C. Einregelung der Gesteine aus Areal A, B und C in grauen Kreisen (linker, grauer Kreis: horizontal gelagerte Gesteine, rechter, grauer Kreis: schräg liegende Gesteine). Richtung der Zusammenpassungslinien (schwarzer Stern) von Geweihfragmenten (n=40; Steguweit 2003: fig. 30), Fragmenten von Menschenknochen (n=9; Mania 1997: fig. 29) und Steinartefakten (n=3; dieser Beitrag); Grafik: verändert aus Liebermann & Pasda (2014: fig. 1) durch C. Pasda.*

Evidence of fire

As with the animal bones excavated between 1971 and 2002 (Brasser 2017: 216-217), not a single piece among the c. 23'000 rocks displays unequivocal traces of being burnt by fire. Only seven rocks were found which show possible traces of being burnt: six with changes in color and a single one with some cracks. These seven rocks occur widely dispersed in the excavated area (Appendix, Plate 9) and are far away from spots where charcoal was documented (Mania & Mania 2005: Fig. 7.1).

Evidence of human modification

Almost none of the c. 23'000 rocks show traces of human modification. A handful of flake-like rocks may be present but, as mentioned by Thomas Weber (1986: 89), these are difficult to distinguish from naturally fractured rocks. Four rocks displaying many flake-like negatives were found: a 30-35 cm long quartzite, a 20-25 cm long metamorphic rock, a 15-20 cm long travertine and a 10-15 cm long limestone. Five other rocks show series of flake-like negatives (e.g. Mania 1986: table 36, 2, 3) on one face (n=3) or two faces (n=2): two 10-15 cm long *Schillkalk*, two 5-10 cm long metamorphic rocks and a 5-10 cm long magmatic rock. The nine probable pebble tools occur scattered throughout the excavated area (Appendix, Plate 9). Considering that the find-bearing layer was accumulated through natural processes where rolling stones collide with each other (Sanvitale & Bowman 2012: 137), a wide range of naturally fractured rocks may be present (e.g. Borrazzo 2016; Chu et al. 2015; de la Torre & Mora 2005; Demeter et al. 2010; Driver 2001; Garvey & Mena 2016; Gillespie et al. 2004; Lopinot & Ray 2007; Wiśniewski et al. 2014). Therefore, it is impossible to determine if one of these nine rocks was modified by ´Holsteinian´ humans or by being embedded in turbulent mass flows together with numerous rocks and bones. In contrast, the best and – so far – only evidence of anthropogenic lithic knapping at Bilzingsleben are three rocks which were refitted by Dietrich Mania about 30 years ago. The refitted group (Fig. 6) was once briefly described as representing a chopping tool, a scraper and a spall (Mania 1986: 49, 303, table 46, 5), yet does not seem to be mentioned in later publications. Due to its coarse rock structure, the identification of negatives is possible as with flint, but the co-occurrence of two flakes, each one with a clear ventral face, a butt and dorsal scars organized parallel to the core scars, and a core with a distinct striking platform connected to a flaking surface, all refitted to a group indicating an operation chain with preparation followed by *débitage*, indicate that these three rocks are artefacts.

The rock type is a mica-poor garnet gneiss (pers. comm. T. Voigt, University of Jena, 2016) which occurs in local, secondary deposits (see above). Knapping this coarse-grained gneiss may have been difficult as rough rocks have a low fracture predictability, and a large hammer stone would have been necessary (Braun et al. 2009: 1607; Schick & Toth 1993: 122, 238; Wadley & Kempson 2011: 100-102). In contrast to local flint, which occurs only in small nodules, chunks and frost sherds (Pasda 2012: 29-32), this gneiss may have been used because of its larger size and its coarse structure resulting in flakes with long lasting durability of cutting edges (Braun et al. 2009: 1607; Wadley & Kempson 2011: 100-102). The refitting group (Fig. 6) is interpreted as being the result of an operational chain using a pebble more than 11 cm in size with a U-shaped outline in two phases of preparation preceding *débitage*: first, a few short (<5 cm) but broad flakes with cortical butts and hinged distal ends were detached, possibly the outcome of a unilateral preparation to obtain a V-shaped cross section for the flaking surface (Fig. 7). Second, the striking platform was prepared by detaching one long (>6 cm) cortical flake and a few smaller ones. These two preparation stages resulted in a steep angle between the striking platform and flaking surface. The core was then ready for *débitage*, as ten to fifteen up to 7 cm long flakes were detached unidirectionally on the V-shaped surface between the cortical side and the prepared side. The detached flakes were thin but had a non-regular outline (Fig. 6: upper left). After the detachment of the large refitted flake with a thick, cortical back, single small flakes were detached from the upper part and from the base of the core. The core seems to have been abandoned before it was completely exhausted.

As Bilzingsleben is a site without a living-floor, where the excavated assemblage was accumulated naturally, the question of why the preparation flakes and first *débitage* flakes are missing is easy to answer: the most parsimonious explanation is that the nodule was flaked somewhere else and the resulting lithic scatter then dispersed by natural processes. Whether human behavior, the *"very clear fragmentation of Middle Palaeolithic stone working in space, time and social dimensions"* (Turq et al. 2013: 651), was involved, remains speculative. Therefore, it is also mere speculation whether the refitted episode (Fig. 6) does indeed represent the activity of a single human knapper: there seems to be consensus in Lower/Middle Palaeolithic archaeology that a single refitting group represents the activity of an individual human knapper (e.g. Eren et al. 2011: 230; Foulds 2010: 7, 9; Gowlett 2005; Hopkinson & White 2005: 16; Pope & Roberts 2005: 85-86; Schlanger 1996: 248; Sinclair & McNabb 2005: 177; Uthmeier 2013: 231-233; van Peer 2007: 91) but this attitude was criticized recently (Dibble et al. 2017: 825-826, 823-833). However, the refitted episode (Fig. 6) represents a very short time period within an operational chain lasting only a few minutes (e.g. Cziesla 1990: 184; Wenban-Smith 2004: 49).

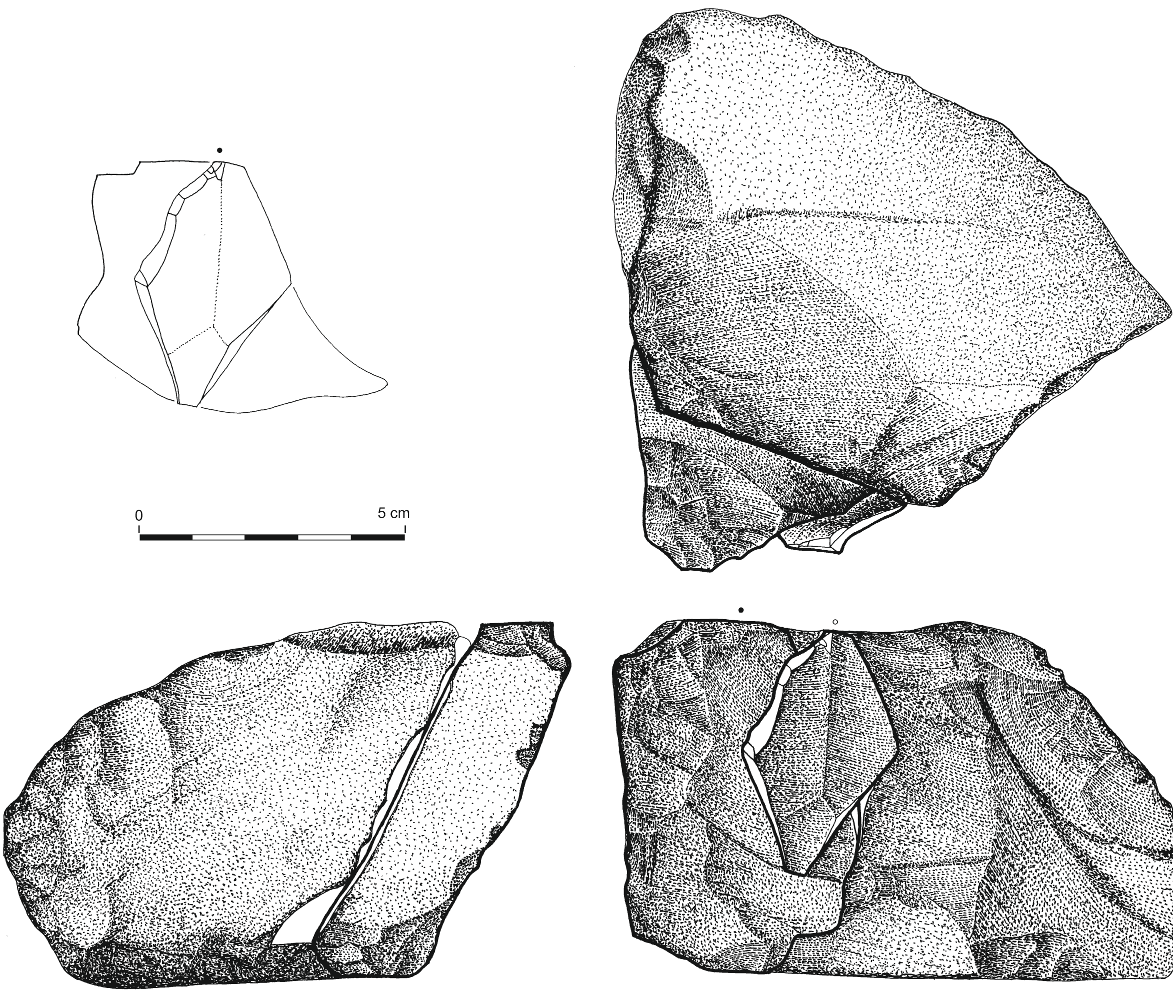


Fig. 6. Refitted group with two flakes and a core; upper left: reconstructed flake (note: refitting by Dietrich Mania; drawing: C. Pasda).

Abb. 6. *Zusammenpassungskomplex mit zwei Abschlägen und einem Kern; oben links: rekonstruierter Abschlag (Zusammenpassung durch D. Mania; Zeichnung: C. Pasda).*

Researchers investigating the Magdalenian of the Paris Basin used the results of Ploux (1983, 1991) to show differences in characteristic attributes of refitted lithic groups indicating distinct individuals (e.g. Bodu 1996; Bodu et al. 1990; Cahen et al. 1979; Coudret & Larrière-Cabiran 1991; Pigeot 1987, 1988). Interpretation of spatial data from experiments indicated that individual knapping resulted in small, dense clusters of lithcs (Boëda & Pélégrin 1985a: 20; 1985b) but the Magdalenian individual may have also been moving while knapping (Bodu 1996; 2007: 28-29; Cahen et al. 1979: 665, 670; Julien et al. 1992). A significant break within the operational chain of a refitted group was interpreted as being the result of a second knapper using the core for *débitage de seconde main* (e.g. Cahen et al. 1980: 241; Pigeot 1987: 62-68; 2004: 32-37, 51-52). As no such break is indicated by the reconstruction of the operational chain of the refitted group from Bilzingsleben (Fig. 6), one may speculate that a single ´Holsteinian´ human selected a large nodule of coarse-grained rock locally, prepared a core in order to adapt the shape of the nodule to use its volume to detach several large and thin but non-regular flakes with durable, long lasting cutting edges. This activity lasted a few minutes only. It was done in the ´Holsteinian´ landscape without using fire, perhaps to utilize a flake for cutting a few remains of large mammals. Shortly after this brief visit of one or a few humans the locality was destroyed by natural processes, shifting all elements of this ´Holsteinian´ landscape: sand, thousands of rocks and animal bones, few human bones and very few artefacts.

Final remark

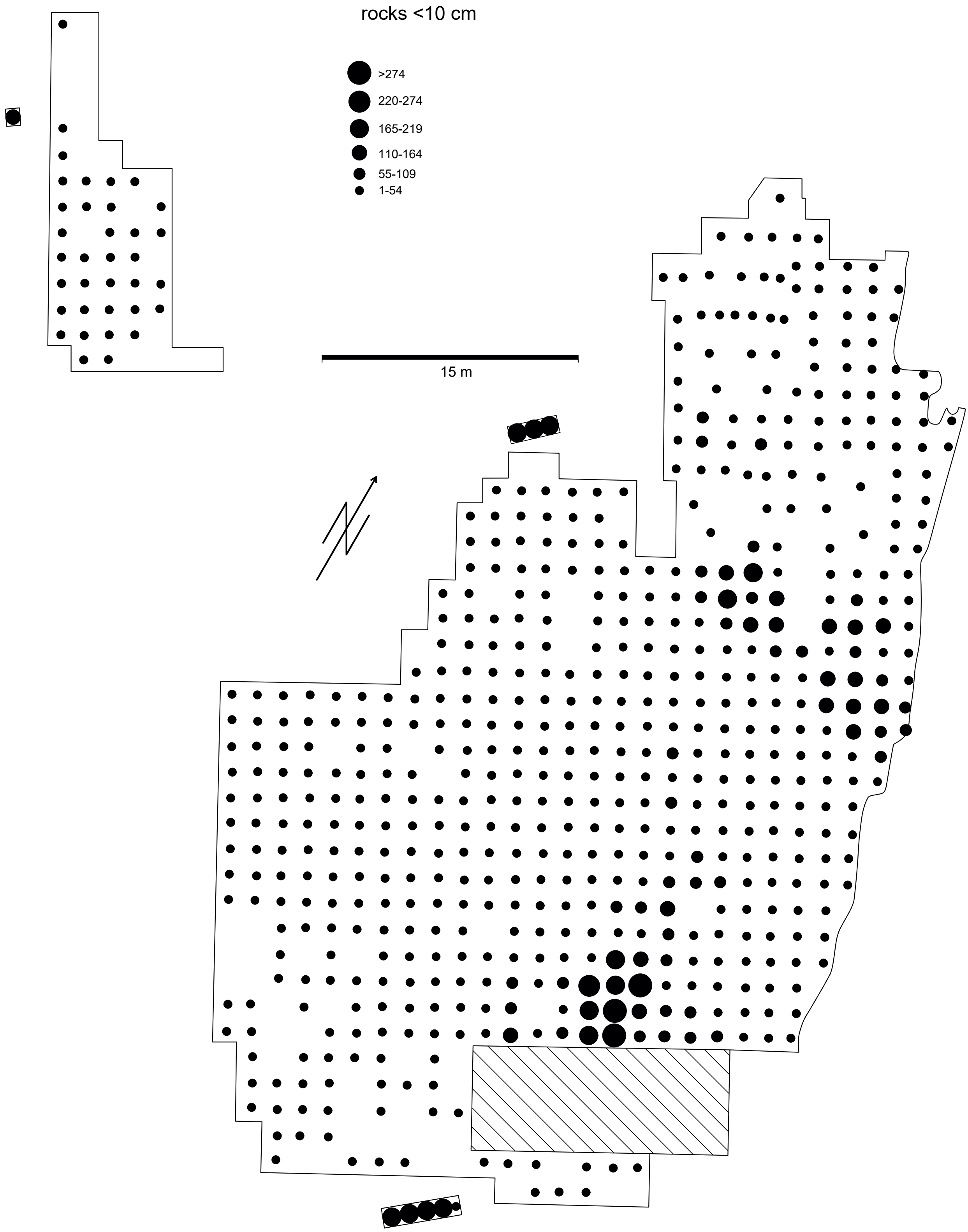
Recent research has shown that among the huge animal bone assemblage of Bilzingsleben human impact is surprisingly small: for example, only about 20 bones with human cutmarks are present (Brasser 2017; Müller & Pasda 2011). This may indicate that human subsistence activities in the ´Holsteinian´ landscape of Bilzingsleben were very brief. The lack of burnt rocks and bones as well as the presence of only three non-flint rock artefacts support this interpretation. However, there is ongoing dispute about how many flint artefacts were present at Bilzingsleben: according

Fig. 7. Refitted group with two flakes and a core (note: refitting by Dietrich Mania; photo: V. Neubeck).

Abb. 7. *Zusammenpassungskomplex mit zwei Abschlägen und einem Kern (Zusammenpassung durch D. Mania; Foto: V. Neubeck).*

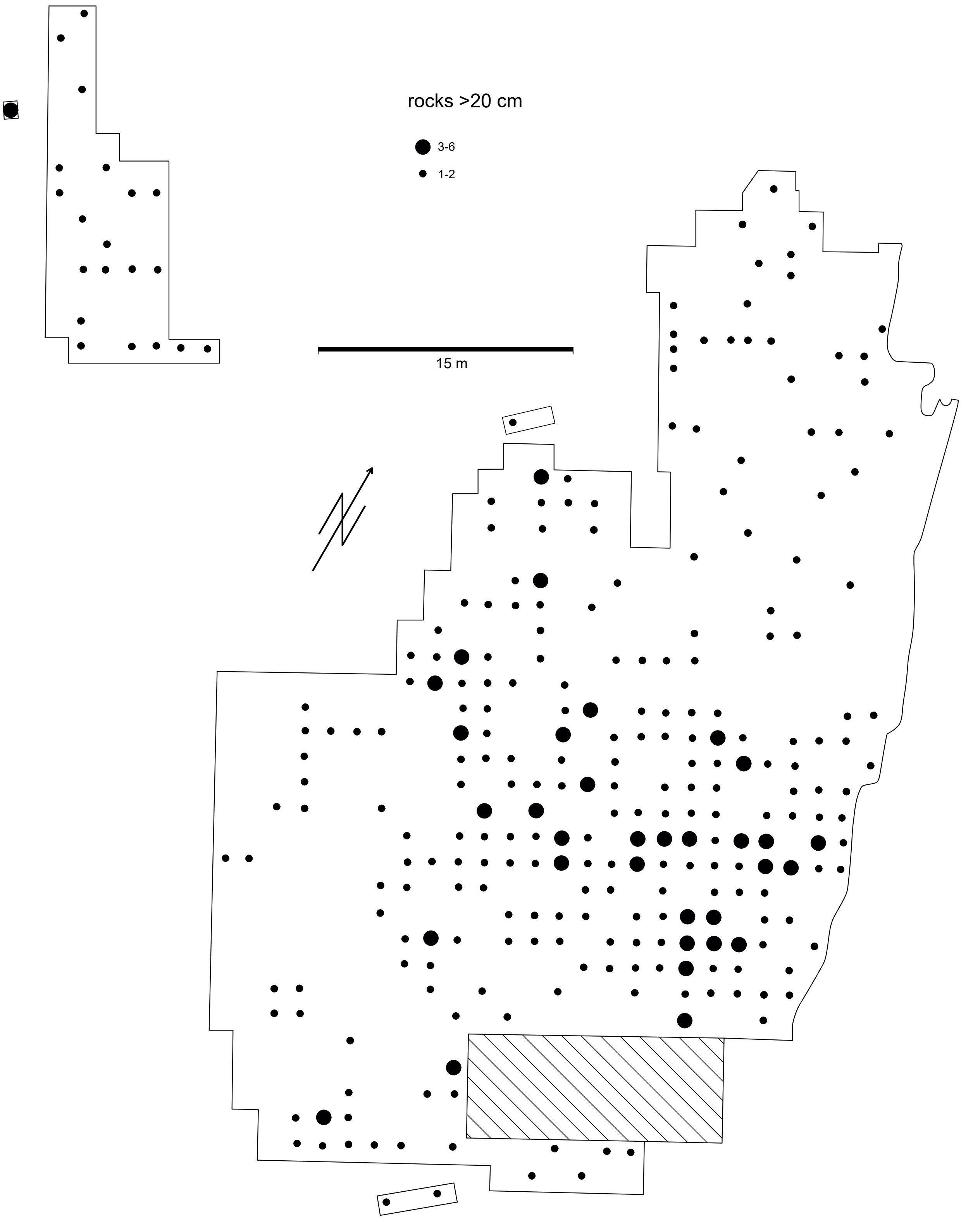
to former investigators between c. 9'400 and c. 140'000 flint artefacts are present (Laurat 2001: 125; Mania et al. 2017: 100). Jordi Serangeli and Nicholas Conard accept this claim, as they emphasize the presence of *"scrapers, points, notched pieces, and denticulates, (…) drills (…) and (…) knives or (…) Keilmesser"* (Serangeli & Conard 2015: 295) at Bilzingsleben to argue that similar flint tools are present at the ´Spear Horizon´ of Schöningen. Roxanne Rocca (2016a, 2016b; Rocca et al. 2016) selected c. 800 flints out of the Bilzingsleben assemblages by "putting aside the doubtful pieces" (Rocca 2016a: 215) to analyze them by *lecture des schémas diacritiques* (see comments on this method by Monnier & Missal 2014: 61). In contrast to them, the recent excavators of Bilzingsleben do not find any objective criteria that indicate human flint flakes and tools among the excavated thousands of erratic flints fractured naturally (Liebermann & Pasda 2014). However, the investigation presented here has shown that refitting is one of the best methods to distinguish artefacts from naturally fractured rocks (e.g. Ashton 2004; Delagnes & Roche 2005; Kroll & Isaac 1984; López-Ortega et al. 2011, 2017; Stout et al. 2010).

Acknowledgements: Research on non-flint rocks of Bilzingsleben was funded by the *Deutsche Forschungsgemeinschaft* in 2014-2016 (grant PA 527/13-1). The paper has benefited from comments made by M. Baales (Olpe, Germany), N. Uomini (Jena, Germany), T. Uthmeier (Erlangen, Germany), T. Voigt (Jena, Germany), A. Wiśniewski (Wrocław, Poland) and two anonymous reviewers.



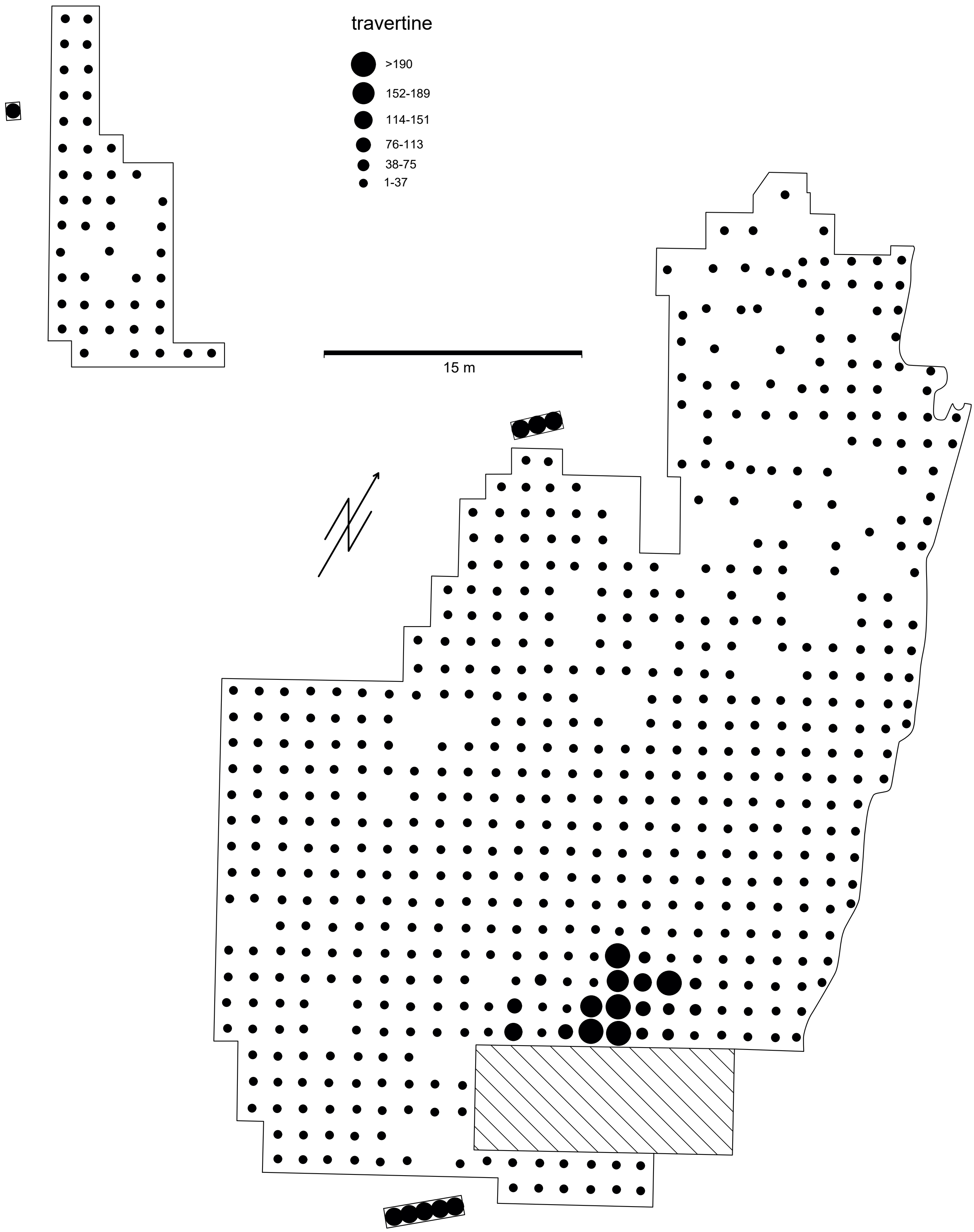
Appendix, Plate 1. Spatial distribution of rocks smaller than 10 cm in Bilzingsleben (note: hatched area is not excavated completely; graphic: C. Pasda).

Appendix, Tafel 1. *Räumliche Verteilung der Gesteine <10 cm in Bilzingsleben (schraffiertes Areal ist nicht vollständig ausgegraben; Grafik: C. Pasda).*



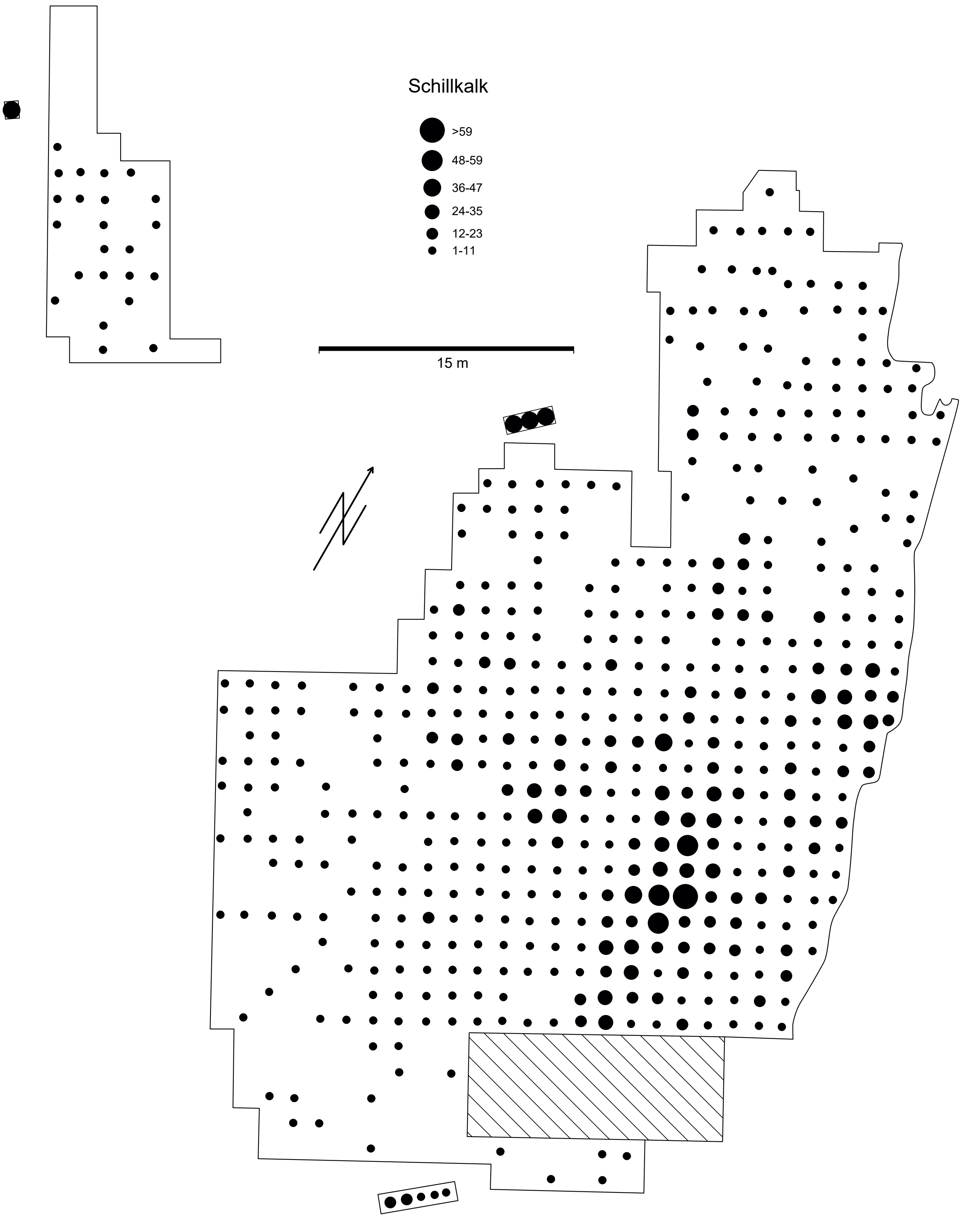
Appendix, Plate 2. Spatial distribution of rocks longer than 20 cm in Bilzingsleben (note: hatched area is not excavated completely; graphic: C. Pasda).

Appendix, Tafel 2. *Räumliche Verteilung der Gesteine >20 cm in Bilzingsleben (schraffiertes Areal ist nicht vollständig ausgegraben; Grafik: C. Pasda).*

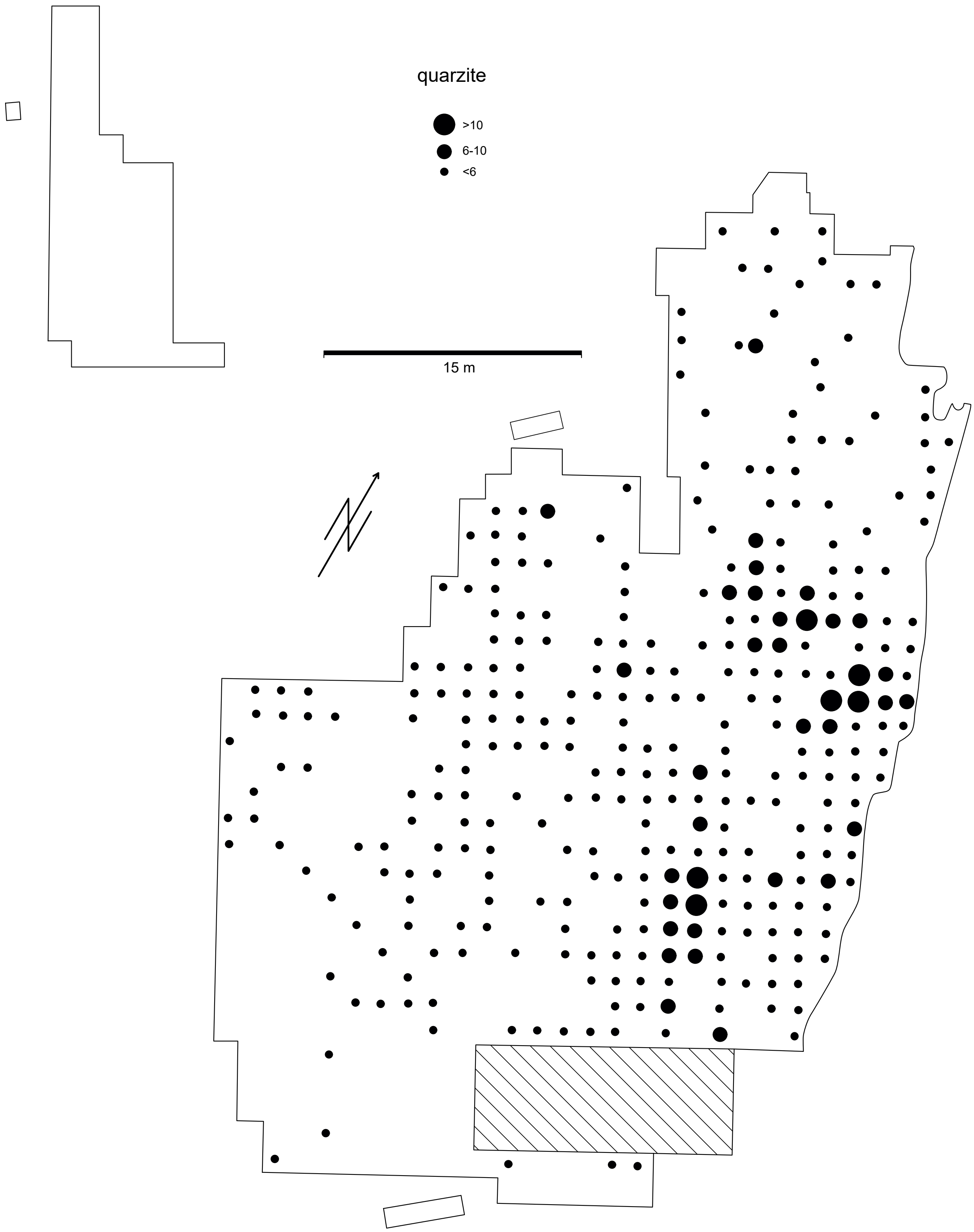


Appendix, Plate 3. Spatial distribution of travertine in Bilzingsleben (note: hatched area is not excavated completely; graphic: C. Pasda).

Appendix, Tafel 3. *Räumliche Verteilung von Travertin in Bilzingsleben (schraffiertes Areal ist nicht vollständig ausgegraben; Grafik: C. Pasda).*

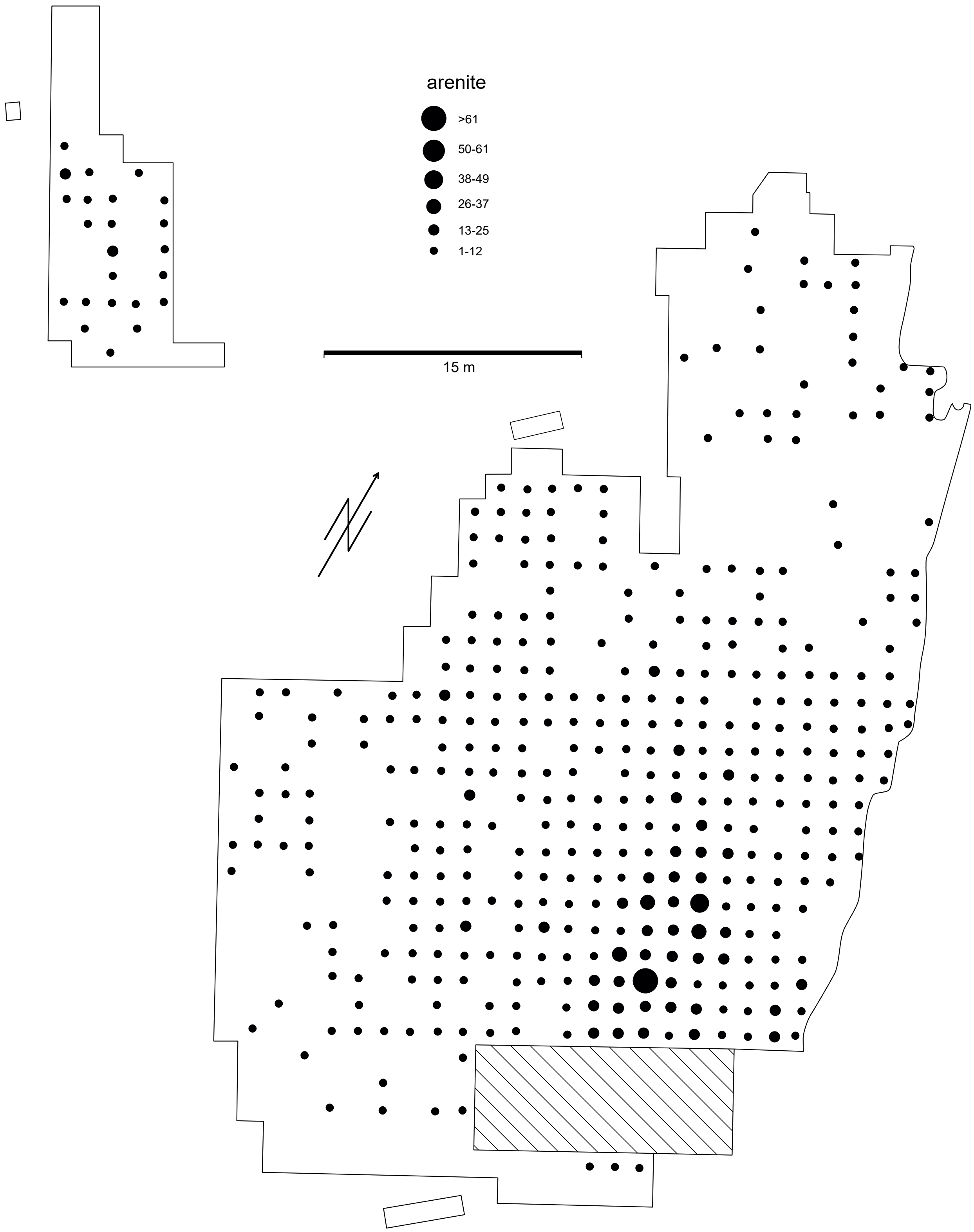


Appendix, Plate 4. Spatial distribution of Schillkalk in Bilzingsleben (note: hatched area is not excavated completely; graphic: C. Pasda).
Appendix, Tafel 4. *Räumliche Verteilung von Schillkalk in Bilzingsleben (schraffiertes Areal ist nicht vollständig ausgegraben; Grafik: C. Pasda).*

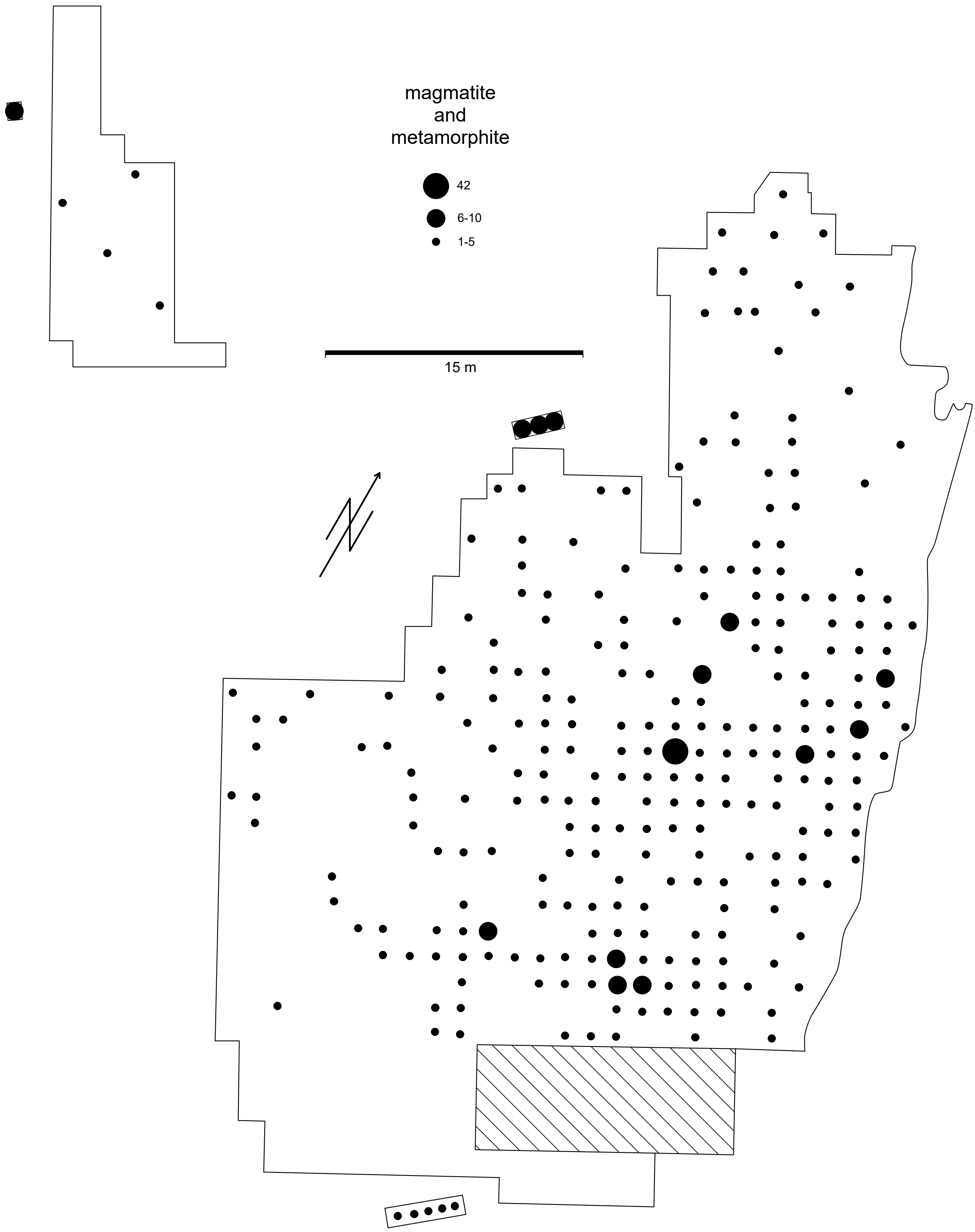


Appendix, Plate 5. Spatial distribution of quarzite in Bilzingsleben (note: hatched area is not excavated completely; graphic: C. Pasda).

Appendix, Tafel 5. *Räumliche Verteilung von Quarzit in Bilzingsleben (schraffiertes Areal ist nicht vollständig ausgegraben; Grafik: C. Pasda).*

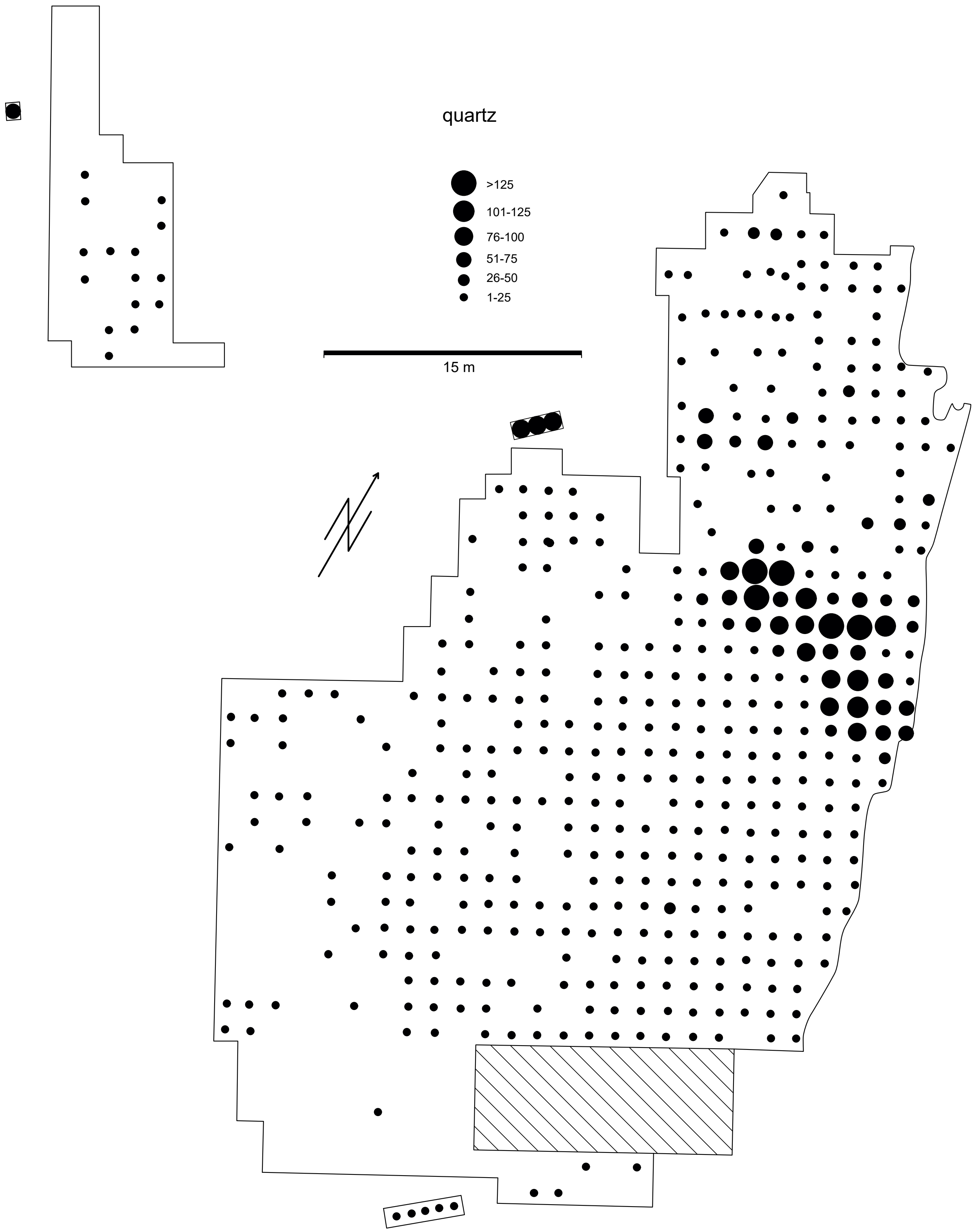


Appendix, Plate 6. Spatial distribution of arenite in Bilzingsleben (note: hatched area is not excavated completely; graphic: C. Pasda).
Appendix, Tafel 6. *Räumliche Verteilung von Arenit in Bilzingsleben (schraffiertes Areal ist nicht vollständig ausgegraben; Grafik: C. Pasda).*

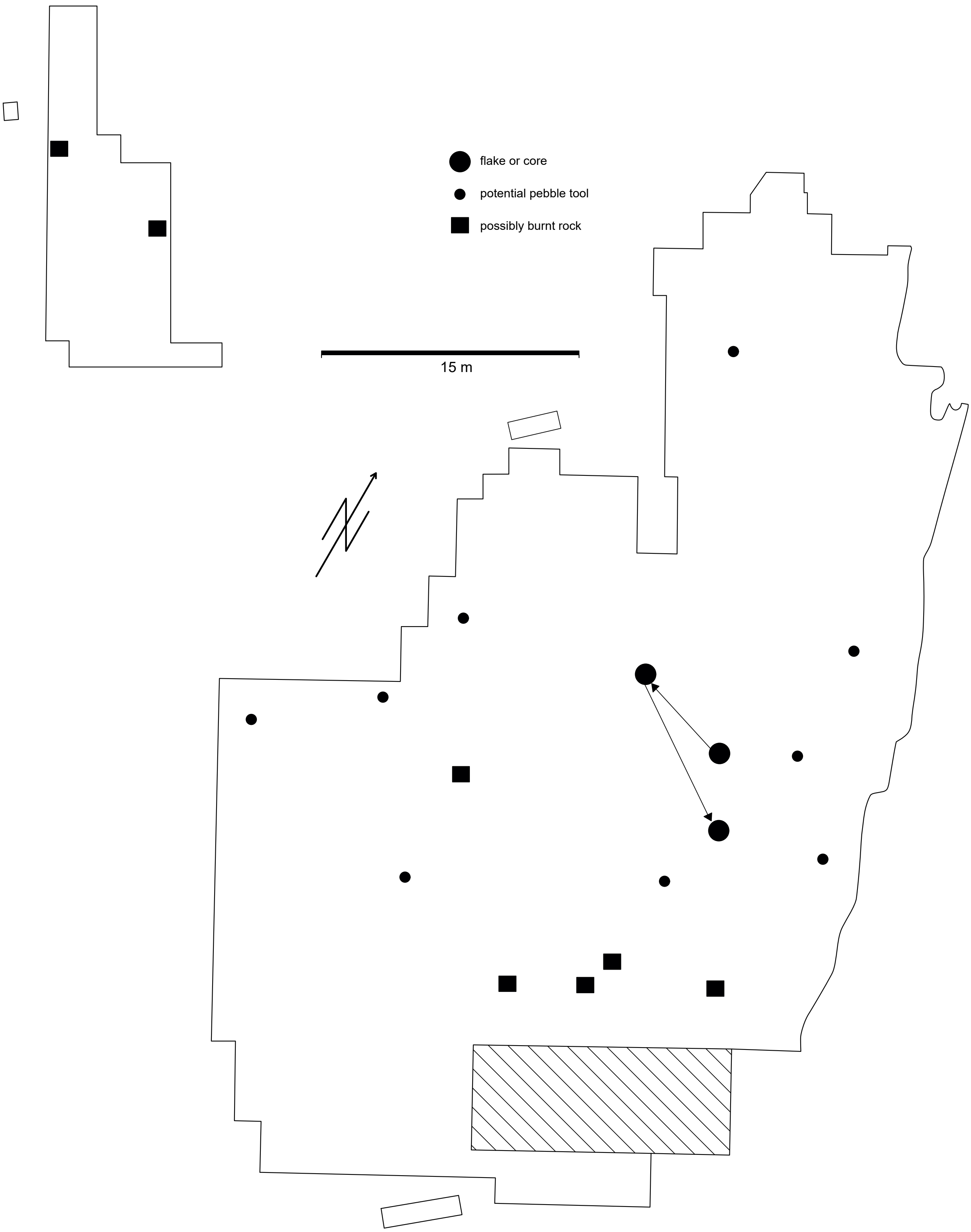


Appendix, Plate 7. Spatial distribution of magmatic and metamorphic rocks in Bilzingsleben (note: hatched area is not excavated completely; graphic: C. Pasda).

Appendix, Tafel 7. *Räumliche Verteilung von magmatischen und metamorphen Gesteinen in Bilzingsleben (schraffiertes Areal ist nicht vollständig ausgegraben; Grafik: C. Pasda).*



Appendix, Plate 8. Spatial distribution of quartz in Bilzingsleben (note: hatched area is not excavated completely; graphic: C. Pasda).
Appendix, Tafel 8. *Räumliche Verteilung von Quarz in Bilzingsleben (schraffiertes Areal ist nicht vollständig ausgegraben; Grafik: C. Pasda).*



Appendix, Plate 9. Spatial distribution of the supposedly burnt rocks, potential pebble tools, flakes and cores (lines with arrow: refitting of two flakes with a core, graphic: C. Pasda).

Appendix, Tafel 9. *Räumliche Verteilung von eventuell gebrannten Gesteinen, von möglichen Geröllgeräten sowie von Abschlägen und Kernen (Linien mit Pfeilen: Zusammenpassung von zwei Abschlägen auf einen Kern; Grafik: C. Pasda).*

Literature cited

Ashton, N. (2004). The role of refitting in the British Lower Palaeolithic: a time for reflection. *In*: E.A. Walker, F. Wenban-Smith & F. Healy (Eds.) *Lithics in action*. Lithic Studies Society Occasional Paper 8. Archaeopress, Oxford, 57-64.

Beck, M., Gaupp, R., Kamradt, I., Liebermann, C. & Pasda, C. (2007). Bilzingsleben site formation processes – Geoarcheological investigations of a Middle Pleistocene deposit: preliminary results of the 2003-2005 excavations. *Archäologisches Korrespondenzblatt* 37: 1-18.

Bertran, P. & Lenoble, A. (2002). Fabriques des niveaux archéologiques: méthode et premier bilan des apports à l´étude taphonomique des sites préhistoriques. *Paléo* 14: 13-28.

Bertran, P., Hétu, B., Texier, J.-P. & van Steijn, H. (1997). Fabric characteristics of subaerial slope deposits. *Sedimentology* 44: 1-16.

Bodu, P. (1996). Les chasseurs magdaléniens de Pincevent; quelques aspects de leurs comportement. *Lithic Technology* 21: 48-70.

Bodu, P. (2007). Partage d´une experience de remontologue. *In*: U. Schurmanns & M. de Bie (Eds.) *Refitting rocks: lithic refitting examined*. British Archaeological Reports International Series 1596. Archaeopress, Oxford, 25-30.

Bodu, P., Karlin, C. & Ploux, S. (1990). Who´s who? The Magdalenian flintknappers of Pincevent (France). *In*: E. Czisla, S. Eickhoff, N. Arts & D. Winter (Eds.) *The big puzzle*. Studies in Modern Archaeology 1. Holos, Bonn, 143-164.

Boëda, E. & Pélégrin, J. (1985a). Approche expérimentale des amas de Marsangy. *Archéologie expérimentale* 1: 19-36.

Boëda, E. & Pélégrin, J. (1985b). Réflexions méthodologiques à partir de l´étude de quelques remontages. *Archéologie expérimentale* 1: 37-58.

Borrazzo, K. (2016). Lithic taphonomy in desert environments: contributions from Fuego-Patagonia (Southern South America). *Quaternary International* 422: 19-28.

Brasser, M. (2017). *Die Megafauna von Bilzingsleben*. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt 73. Landesmuseum für Vorgeschichte, Halle/Saale.

Braun, D.R., Plumer, T., Ferraro, J.V., Ditchfield, P. & Bishop, L.C. (2009). Raw material quality and Oldowan hominid toolstone preferences: evidence from Kanjera South, Kenya. *Journal of Archaeological Science* 36: 1605-1614.

Cahen, D., Keeley, L.H. & van Noten, F.L. (1979). Stone tools, toolkits, and human behavior in prehistory. *Current Anthropology* 20: 661-683.

Cahen, D., Karlin, C., Keeley, L.H. & van Noten, F. (1980). Méthodes d´analyse technique, spatial et fonctionelle d´ensembles lithiques. *Helinium* 20: 209-259.

Chu, W., Thompson, C. & Hosfield, R. (2015). Micro-abrasion of flint artefacts by mobile sediments: a taphonomic approach. *Archaeological and Anthropological Sciences* 7: 3-11.

Coudret, P. & Larrière-Cabiran, M. (1991). Reconnaissance des comportements techniques dans une nouvelle occupation du gisement d´Étiolles (Essonne, France): l´unité A17. *In*: Anon. (Ed.) *25 ans d´études technologiques en préhistoire*. APDCA, Juan-les-Pins, 187-200.

Cziesla, E. (1990). *Siedlungsdynamik auf steinzeitlichen Fundplätzen*. Studies in Modern Archaeology 2. Holos, Bonn.

Delagnes, A. & Roche, H. (2005). Late Pliocene hominid knapping skills: the case of Lokalelei 2C, West Turkana., Kenya. *Journal of Human Evolution* 48: 435-472.

de la Torre, I. & Mora, R. (2005). Unmodified lithic material at Olduvai Bed I: manuports or ecofacts? *Journal of Archaeological Science* 32: 273-285.

Demeter, F., Patole-Edoumba, E., Duringer, P., Bacon, A.-M., Sytha, P., Bano, M., Laychour, V., Cheangleng, M. & Sari, V. (2010). Reinterpretation of an archaeological pebble culture from the Middle Mekong River Valley, Cambodia. *Geoarchaeology* 25: 75-95.

Dibble, H.L., Holdaway, S.J., Lin, S.C., Braun, D.R., Douglass, M.J., Iovita, R., McPherron, S.P., Olszewski, D.I. & Sandgathe, D. (2017). Major fallacies surrounding stone artifacts and assemblages. *Journal of Archaeological Method and Theory* 24: 813-851.

Driver, J.C. (2001). Preglacial archaeological evidence at Grimshaw, the Peace River area, Alberta: discussion. *Canadian Journal of Earth Science* 38: 871-874.

Eren, M.I., Bradley, B.A. & Sampson, C.G. (2011). Middle Paleolithic skill level and the individual knapper: an experiment. *American Antiquity* 76: 229-251.

Evans, T. (2013). Fluvial taphonomy. *In*: J.T. Pokines & S.A. Symes (Eds.) *Forensic Taphonomy*. CRC, Boca Raton, 115-142.

Fernández-Jalvo, Y. & Andrews, P. (2003). Experimental effects of water abrasion on bone fragments. *Journal of Taphonomy* 1: 147-163.

Foulds, F.W.F. (2010). Investigating the individual? An experimental approach through lithic refitting. *Lithics* 31: 6-19.

Garvey, R. & Mena, F. (2016). Confronting complexities of artifact-geofact debates: re-analysis of a coarse volcanic rock assemblage from Chilean Patagonia. *Lithic Technology* 41: 114-129.

Gillespie, J.D., Tupakka, S. & Cluney, C. (2004). Distinguishing between naturally and culturally flaked cobbles: a test case from Alberta, Canada. *Geoarchaeology* 19: 615-633.

Gowlett, J.A.J. (2005). Seeking the Palaeolithic individual in East Africa and Europe during the Lower-Middle Pleistocene. *In*: C. Gamble & M. Porr (Eds.) *The hominid individual in context*. Routledge, London, 50-67.

Hopkinson, T. & White, M.J. (2005). The Acheulian and the handaxe. *In*: C. Gamble & M. Porr (Eds.) *The hominid individual in context*. Routledge, London, 13-28.

Julien, M., Karlin, C. & Valentin, B. (1992). Déchets de silex, déchets de pierres chauffées de l´intéret des remontages à Pincevent (France). *In*: J.L. Hofmann & J.G. Enloe (Eds.) *Piecing together the past: application of refitting studies in archaeology*. British Archaeological Reports International Series 578. Archaeopress, Oxford, 287-295.

Kahlke, R.-D. (2002). Bedeutende Fossilvorkommen des Quartärs in Thüringen Teil 5: Großsäugetiere. *Beiträge zur Geologie von Thüringen* N.F. 9: 207-232.

Kroll, E.M. & Isaac, G.L. (1984). Configurations of artifacts and bones at early Pleistocene sites in East Africa. *In*: H.J. Hietala (Ed.) *Intrasite spatial analysis in archaeology*. Cambridge University, Cambridge, 4-31.

Laurat, T. (2001). Spitzenartige Geräte aus Feuerstein im Inventar von Bilzingsleben – Zu ihrer Morphologie und Morphometrie. *Praehistoria Thuringica* 8: 125-142.

Lenoble, A. & Bertran, P. (2004). Fabric in Palaeolithic levels: methods and implications for site formation processes. *Journal of Archaeological Science* 31: 457-469.

Liebermann, C. & Pasda, C. (2014). Silexfunde aus dem Mittelpleistozän von Bilzingsleben (Lkr. Sömmerda). Archäologisches Korrespondenzblatt 44: 443-462.

López-Ortega, E., Rodriguez, X.P. & Vaquero, M. (2011). Lithic refitting and movement connections: the NW area of level TD10-1 at the Gran Dolina site (Sierra de Atapuerca, Burgos, Spain). *Journal of Archaeological Science* 38: 3112-3121.

López-Ortega, E., Bargalló, A., de Lombera-Hermida, A., Mosquera, M., Ollé, A. & Ródriguez-Álvarez, X.P. (2017). Quartz and quartzite refits at Gran Dolina (Sierra de Atapuerca, Burgos): connecting lithic artefacts in the Middle Pleistocene unit of TD10.1. *Quaternary International* 433: 85-102.

Lopinot, N.H., & Ray, J.H. (2007). Trampling experiments in the search for the earliest Americans. *American Antiquity* 72: 771-781.

Major, J.J. (1998). Pebble orientation on large, experimental debris-flow deposits. *Sedimentary Geology* 117: 151-164.

Mania, D. (1986). Die Siedlungsspuren des Homo erectus von Bilzingsleben. *In*: D. Mania & T. Weber (Eds.) *Bilzingsleben III*. VEB Deutscher Verlag der Wissenschaften, Berlin, 9-64.

Mania, D. (1990). *Auf den Spuren des Urmenschen – Die Funde aus der Steinrinne von Bilzingsleben*. Deutscher Verlag der Wissenschaften, Berlin.

Mania, D. (1997). Bilzingsleben – Ein kulturgeschichtliches Denkmal der Stammesgeschichte des Menschen. *Praehistoria Thuringica* 1: 30-80.

Mania, D. & Mania, U. (1999). Zur Kultur des Homo erectus von Bilzingsleben. *Praehistoria Thuringica* 3: 27-63.

Mania, D. & Mania, U. (2005). The natural and socio-cultural environment of Homo erectus at Bilzingsleben, Germany. *In*: C. Gamble & M. Porr (Eds.) *The hominid individual in context*. Routledge, London, 98-114.

Mania, D., Mania, U., Altermann, M. & Schoch, W.H. (2017). *Bilzingsleben VII. Homo erectus – seine Kultur und Umwelt*. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt 73. Landesmuseum für Vorgeschichte, Halle/Saale.

Maul, L.M. (2002). Bedeutende Fossilvorkommen des Quartärs in Thüringen Teil 4: Kleinsäugetiere. *Beiträge zur Geologie von Thüringen* N.F. 9: 187-205.

Meyrick, R. (2002). Bedeutende Fossilvorkommen des Quartärs in Thüringen Teil 2: Mollusken. *Beiträge zur Geologie von Thüringen* N.F. 9: 145-172.

Monnier, G.F. & Missal, K. (2014). Another Mousterian debate? Bordian facies, chaîne opératoire technocomplexes, and patterns of lithic variability in the western European Middle and Upper Palaeolithic. *Quaternary International* 350: 59-83.

Müller, W. & Pasda, C. (2011). Site formation and faunal remains of the Middle Pleistocene site Bilzingsleben. *Quartär* 58: 25-49.

Olsen, B. (2010). *In defense of things – Archaeology and the ontology of objects*. Altamira, Lanham.

Orschiedt, J. (1999). *Manipulationen an menschlichen Skelettresten. Taphonomische Prozesse, Sekundärbestattungen oder Kannibalismus?* Urgeschichtliche Materialhefte 13. Archaeologica Venatoria, Tübingen.

Pasda, C. (2012). A study of rock and flints from Bilzingsleben. *Quartär* 59: 7-46.

Pigeot, N. (1987). *Magdaléniens d´Étiolles*. 25e Supplément à Gallia Préhistoire. CNRS, Paris.

Pigeot, N. (1988). Apprendre à débiter des lames: un cas d´éducation technique chez les Magdalénien d´Étiolles. *Technologie préhistorique* 25: 63-70.

Pigeot, N. (2004). *Les derniers Magdaléniens d´Étiolles – Perspectives culturelles et paléohistoriques (l´unité d´habitation Q31)*. 37e Supplément à Gallia Préhistoire. CNRS, Paris.

Ploux, S. (1983). Étude de débitage expérimentaux: la marque du tailleur. *Prehistoire et technologie* 2: 111-179.

Ploux, S. (1991). Technologie, technicité, techniciens: méthode de détermination d´auteurs et comportement techniques individuels. *In*: Anon. (Ed.) *25 ans d´études technologiques en préhistoire*. APDCA, Juan-les-Pins, 201-214.

Pope, M. & Roberts, M. (2005). Observations on the relationship between Palaeolithic individuals and artefact scatters at the Middle Pleistocene site of Boxgrove, UK. *In*: C. Gamble & M. Porr (Eds.) *The hominid individual in context*. Routledge, London, 81-97.

Rocca, R. (2016a). First settlements in Central Europe: between originality and banality. *Quaternary International* 409: 213-221.

Rocca, R. (2016b). Depuis l´Est? Nouvelles perspectives sur les premières dynamiques de peuplement en Europe. *L´Anthropologie* 120: 209-236.

Rocca, R., Abruzzese, C. & Aureli, D. (2016). European Acheuleans: critical perspectives from the East. *Quaternary International* 411: 402-411.

Sanvitale, N. & Bowman, E.T. (2012). Internal imaging of saturated granular free-surface flows. *International Journal of Physical Modelling in Geotechnics* 12: 129-142.

Schick, K.D. (1986). *Stone age sites in the making*. British Archaeological Reports International Series 319. Archaeopress, Oxford.

Schick, K.D. & Toth, N. (1993). *Making silent stones speak*. Weidenfels & Nicholson, London.

Schlanger, N. (1996). Understanding Levallois: lithic technology and cognitive archaeology. *Cambridge Archaeological Journal* 6: 231-254.

Serangeli, J. & Conard, N.J. (2015). The behavioral and cultural stratigraphic contexts of the lithic assemblages from Schöningen. *Journal of Human Evolution* 89: 287-297.

Sinclair, A. & McNabb, J. (2005). All in a day´s work – Middle Pleistocene individuals, materiality and the lifespan at Makapansgat, South Africa. *In*: C. Gamble & M. Porr (Eds.) *The hominid individual in context*. Routledge, London, 176-196.

Stebich, M. & Schneider, H. (2002). Bedeutende Fossilvorkommen des Quartärs in Thüringen Teil 1: Mikro- und Makrofloren. *Beiträge zur Geologie von Thüringen* N.F. 9: 119-144.

Steguweit, L. (2003). *Gebrauchsspuren an Artefakten der Hominidenfundstellen Bilzingsleben (Thüringen)*. Tübinger Arbeiten zur Urgeschichte 3. Marie Leidorf, Rahden/Westfalen.

Stout, D., Semaw, S., Rogers, M.J. & Cauche, D. (2010). Technological variation in the earliest Oldowan from Gona, Afar, Ethiopia. *Journal of Human Evolution* 58: 474-491.

Street, M., Terberger, T. & Orschiedt, J. (2006). A critical review of the German Palaeolithic hominin record. *Journal of Human Evolution* 51: 551-579.

Turq, A., Roebroeks, W., Bourguigon, L. & Faivre, J.-P. (2013). The fragmented character of Middle Palaeolithic stone tool technology. *Journal of Human Evolution* 65: 641-655.

Unger, K.P. (1963). *Erläuterungen zur Geologischen Spezialkate der Deutschen Demokratischen Republik 1:25000 Blatt Weissensee 4732*. Zentrales Geologisches Institut, Jena.

Uthmeier, T (2013). More news from Neanderthal kids: formal teaching of flint knapping at Kabazi II, Crimea (Ukraine) and its implication for the demographic structure of Middle Palaeolithic intimate groups. *In*: S. Feldmann & T. Uthmeier (Eds.) *Gedankenschleifen – Gedenkschrift für Wolfgang Weißmüller*. Erlanger Studien zur Prähistorischen Archäologie 1. Dr. Faustus, Erlangen, 237-250.

van Peer, P. (2007). Refitting lithic reduction sequences, formal classification systems, and Middle Palaeolithic individuals at work. *In*: U. Schurmanns & M. de Bie. (Eds.) *Refitting rocks: lithic refitting examined*. British Archaeological Reports International Series 1596. Archaeopress, Oxford, 91-103.

Vlček, E., Mania D. & Mania, U. (2002). *Der fossile Mensch von Bilzingsleben*. Bilzingsleben V. Beiträge zur Ur- und Frühgeschichte Europas 35. Beier & Beran, Langenweissbach.

Vollbrecht, J. (2000). Die Geweihfunde von Bilzingsleben, Ausgrabungen 1969-1983. *Internet Archaeology* 8 (http://intarch.ac.uk/journal/issue8/vollde_doc.html).

Wadley, L. & Kempson, H. (2011). A review of rock studies for archaeologists, and an analysis of dolerite and hornfels from the Sibudu area, KwaZulu-Natal. *Southern African Humanities* 23: 87-107.

Weber, T. (1986). Die Steinartefakte des Homo erectus von Bilzingsleben. *In*: D. Mania & T. Weber (Eds.) *Bilzingsleben III*. VEB Deutscher Verlag der Wissenschaften, Berlin, 65-232.

Wenban-Smith, F. (2004). Bringing behaviour into focus: archaic landscapes and lithic technology: *In*: E.A. Walker, F. Wenban-Smith & F. Healy (Eds.) *Lithics in action*. Lithic Studies Society Occasional Paper 8. Archaeopress, Oxford,: 48-56.

Wiśniewski, A., Badura, J., Salamon, T. & Lewandowski, J. (2014). The alleged Early Paleolithic artefacts are in reality geofacts: a revision of the site of Kończyce Wielkie 4 in the Moravian Gate, South Poland. *Journal of Archaeological Science* 52: 189-203.