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Crop remains from Schwanfeld, Ldkr. Schweinfurt, Germany, a site occupied by, successively, Earliest Linearbandkeramik, Grossgartach and Bernburg farmers

Bakels, C.C.; Lüning Jens

Citation

Bakels, C. C. (2011). Crop remains from Schwanfeld, Ldkr. Schweinfurt, Germany, a site occupied by, successively, Earliest Linearbandkeramik, Grossgartach and Bernburg farmers. *Schwanfeldstudien Zur Ältesten Bandkeramik, 196*, 223-231. Retrieved from <https://hdl.handle.net/1887/48154>

Version: Not Applicable (or Unknown)
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Note: To cite this publication please use the final published version (if applicable).

UNIVERSITÄTSFORSCHUNGEN ZUR PRÄHISTORISCHEN ARCHÄOLOGIE

Aus dem Institut für Archäologische Wissenschaften der Universität Frankfurt/M.
Abteilung Vor- und Frühgeschichte

Band 196

Schwanfeldstudien
zur Ältesten Bandkeramik

herausgegeben

von

Jens Lüning

2011

VERLAG DR. RUDOLF HABELT GMBH, BONN

Universitätsforschungen zur prähistorischen Archäologie

Band 196

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der Universität Frankfurt/M.
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Verlag Dr. Rudolf Habelt GmbH, Bonn

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ISBN 978-3-7749-3683-6

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie.
Detailliertere bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

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Zur Eröffnung

Bandkeramik Museum Schwanfeld

Steinzeitbauern vor 7500 Jahren in Franken

Vorwort

Die Ausgrabungen der Jahre 1979-1985 in der ältestbandkeramischen Siedlung Schwanfeld, Ldkr. Schweinfurt, Unterfranken (Bayern) sind durch drei Dissertationen in den Grundzügen publiziert und in anschließenden Arbeiten weiter ausgewertet worden¹. Beides ist natürlich untrennbar und wird in diesem Band fortgesetzt. Als letzte große Materialgruppen legt Corrie Bakels die pflanzlichen Großreste und Britta Ramming die Felsgesteinfunde vor. Drei ausführliche Studien von Jens Lüning, Stefan Flohr und Michael Schulz sowie Corina Knipper und T. Douglas Price sind den beiden in Schwanfeld entdeckten Siedlungsbestattungen gewidmet. Maria Cladders ergänzt ihre früheren Keramikuntersuchungen. Allen Autoren sei für ihre Mitarbeit herzlich gedankt, ebenso für ihre teils jahrelange Geduld mit der Drucklegung, und umgekehrt für ihre spontane Bereitschaft, unter Zeitdruck manches auf den neuesten Stand zu bringen.

Jens Lüning, Köln im Juli 2010

¹ Vgl. die Literaturangaben im Beitrag J. Lüning, Gründergrab und Opfergrab Abschnitt 1. Einführung Anm. 8 sowie ebda. Gronenborn 2003; Lüning 2005a; ders. 2006; ders. 2007 .

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Crop remains from Schwanfeld, Ldkr. Schweinfurt, Germany, a site occupied by, successively, Earliest Linearbandkeramik, Großgartach and Bernburg farmers

Corrie Bakels

Summary

The Earliest Linearbandkeramik settlement at Schwanfeld revealed only three crop plants: emmer wheat, barley and lentil, and it is questionable whether barley should be regarded as truly cultivated. Barley may have been growing as a weed in emmer fields. If it was a weed, it was one of the few weeds present, as weeds were scarce, both in number of species and in number of seeds. Emmer wheat seems to have been the main crop. Surpluses of its chaff were burnt and discarded in a specific area in the farmers' yards.

Plant remains retrieved from the pits and postholes left by the Großgartach settlement are considered unreliable as to their true age. The Bernburg house revealed einkorn wheat.

Zusammenfassung

In der ältestbandkeramischen Siedlung von Schwanfeld gab es nur drei Kulturpflanzen: Emmerweizen, Gerste und Linse. Dabei ist der Anbau von Gerste fraglich, könnte sie wegen ihres geringen Vorkommens doch auch als Unkraut in den Emmerfeldern gewachsen sein. Wenn letzteres zuträfe, wäre die Gerste eines der wenigen Unkräuter überhaupt, denn echte Unkräuter waren selten, sowohl hinsichtlich der Artenzahl als auch

der Anzahl gefundener Samen. Der Emmer scheint die Hauptanbaufucht gewesen zu sein. Seine überzähligen Spelzen wurden verbrannt und in einem besonderen Bereich der Hofplätze entsorgt. Pflanzenreste aus Gruben und Pfostenlöchern der Großgartacher Kultur könnten auch mit bandkeramischen Funden vermischt sein und werden als unsicher datiert betrachtet. Verlässlich ist dagegen das Inventar des Bernburger Grubenhauses, aus dem nur Einkornweizen stammt.

Résumé

Les installations du Rubané le plus Ancien du site de Schwanfeld n'ont livré que trois plantes cultivées, le blé amidonnier, l'orge et la lentille. Et encore, la culture de l'orge peut être questionnée, parce que cette céréale n'apparaît pas assez fréquemment. C'est bien possible qu'elle appartient au cortège d'adventices, qui est néanmoins marginal. Le 'pilier' de l'alimentation végétale est le blé amidonnier. Sa balle superflue fut brûlée et jetée, non aléatoirement, mais dans certains endroits du terrain appartenant à la maison.

Les carporesses extraits des structures Großgartach peuvent être contaminés avec des restes rubanés, mais le matériel fourni par la maison Bernburg est considéré digne de confiance. Cette maison a livré du blé engrain.

1. Introduction

Schwanfeld is at present a key site of the Earliest Linearbandkeramik culture in Central-Western Europe where it represents the beginning of crop cultivation. Its remains are dated to 5500 - 5350 years cal BC (Lüning 2005). The site is situated on a loess-covered terrain at c. 300 m from the rivulet Kembach, a classic setting where Linearbandkeramik settlements are concerned.

Excavations started in 1979 and continued until 1985. Traces of the earliest Linearbandkeramik were not the only ones present. The terrain also revealed remains of dwellings belonging to the Neolithic Großgartach and Bernburg cultures, dated to respectively 4800 - 4600 and 3200 - 2800 cal BC.

2. Aims of the botanical research

The Linearbandkeramik farmers owed their crop plants to the Near Eastern Centre of Domestication. From this region, also known as the Fertile Crescent, the newly evolved crops expanded over vast territories, including temperate Europe, where the Linearbandkeramik culture is one of the first representatives of the new lifestyle of food-producing.

Agriculture in the Fertile Crescent initiated eight so-called founder crops. These are all plants with an annual life cycle and comprise emmer and einkorn wheats (*Triticum dicoccum* Schübl and *Triticum monococcum* L.), barley (*Hordeum vulgare* L.), lentil (*Lens culinaris* Medik.), pea (*Pisum sativum* L.), chickpea (*Cicer arietinum* L.), bitter vetch (*Vicia ervilia* [L.] Willd.), and flax (*Linum usitatissimum* L.) (Zohary and Hopf 2000). One

of the aims of the research was to assess which of these eight plants had reached the Schwanfeld region.

The second question was whether information on the production and handling of the crops could be obtained.

3. Material and Method

What remains of settlements such as Schwanfeld are postholes and pits, in which the debris of the occupation are preserved in a matrix of washed-in or deliberately backfilled sediment. In the case of Schwanfeld this sediment is a sticky loam derived from the original loess cover of the area. The water table is, and always has been, low which implies that only carbonised matter will be preserved. Any non-carbonised items must have been brought in recently by the soil fauna in which the area abounds. The sticky matrix was the reason why a simple flotation was not successful. All material had to be sieved by hand under gently running water.

Sampling followed the excavation strategy. The plans of the Earliest Linearbandkeramik houses were flanked by oblong pits, which were excavated following a chess-board pattern. More rounded pits were quartered and postholes were halved. Every-other compartment was sampled for plant remains. If the fill of the pits showed

The third arose from the discovery of farming societies from later dates. Did the botanical remains belonging to those occupations differ from those of the earliest occupation? And if so, what do the differences infer?

layering, then every layer was sampled, if not, artificial layers of 10 cm depth were sampled.

All in all c. 1000 samples were obtained of which in the end 483 were examined. As mentioned before, sieving was difficult and therefore most sieved samples had a volume of only 1 dm³, but occasionally volumes up to 20 dm³ were treated. The stack of sieves had meshes of 1.0, 0.5 and 0.25 mm. Plant remains were retrieved from the residues by hand-picking under a Wild M5 microscope with magnifications of 6 - 50x. As the remains were far from plentiful, this was a very tedious work. For identifications the same kind of microscope was used. If there was doubt concerning the carbonised state, which mostly arose with black or dark-coloured seeds, seeds were dissected. Thus all specimens of Caryophyllaceae, *Veronica hederifolia* and *Atriplex* sp. and quite a number of *Che-nopodium album* seeds had to be discarded.

4. Results

4.1 The Earliest Linearbandkeramik, the crops

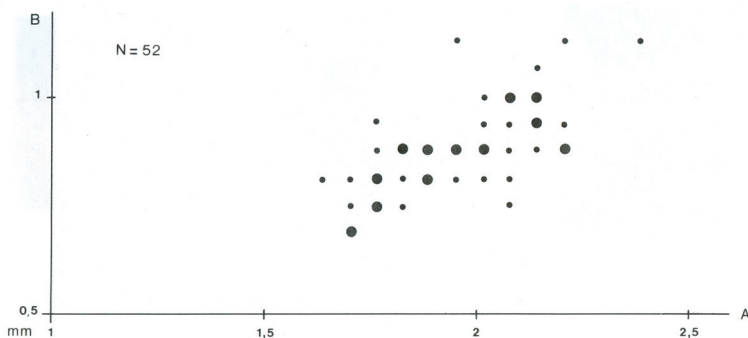


Fig. 1: Width of spikelet (A) and glume bases (B) of undamaged spikelet bases retrieved from pit 127, layer 5. Small dot = one specimen, large dot = several specimens.

The only crop plants found are emmer wheat (*Triticum dicoccum* Schübl.), barley (*Hordeum* sp.) and lentil (*Lens culinaris* Medik.). The wheat is mainly represented by its chaff remains. A few complete grains are preserved, but most of them are fragmented. The fragments are preserved as such in the sediment and are, therefore, not due to rough handling during the excavation or in the laboratory. Originally they may have been whole though. It is known that even carbonised seeds do not withstand long burial. They fall apart after a certain number of mill-

ennia, depending on the kind of seed and the nature of the sediment (Braadbaart et al. 2009). Fragmented grain does not necessarily represent grain coarsely ground by the ancient farmers. The more numerous chaff remains, consisting of spikelet forks and glume bases, made it possible to look for the second wheat species belonging to the founder crops, i.e. einkorn wheat. Measurements of the width of the spikelet forks (Helbaek's dimension A) and the width at the base of the glumes (Helbaek's dimension B) revealed that convincing remains of ein-

Crop plants	English name	German name	LBK	GG	BB
<i>Hordeum</i> sp.	barley	Gerste	+	-	-
<i>Triticum dicoccum</i>	emmer wheat	Emmer	+	+	-
<i>Triticum monococcum</i>	einkorn wheat	Einkorn	-	-	+
<i>Lens culinaris</i>	lentil	Linse	+	-	-
Gathered plants					
<i>Corylus avellana</i>	hazelnut	Haselnuß	+	-	+
Weeds					
<i>Avena</i> sp.	oats	Hafer	+	-	-
<i>Bromus</i> sp.	brome grass	Trespe	+	+	-
<i>Chenopodium album</i>	fat hen	Weißer Gänsefuß	+	+	+
<i>Galium aparine</i>	cleavers	Klebkraut	-	-	+
<i>Galium spurium</i>	false cleavers	Saat-Labkraut	+	-	-
Poaceae species	grasses	Gräser	+	-	-
<i>Fallopia convolvulus</i>	black bindweed	Winden-Knöterich	+	+	+
<i>Persicaria lapathifolia</i>	pale persicaria	Ampfer-Knöterich	+	-	-
<i>Setaris viridis/verticillata</i>	green/rough bristle-grass	Grüne/Quirlige Borstenhirse	+	-	+
<i>Vicia hirsuta/tetrasperma</i>	gray hairy/smooth tare	Rauhhaarige/Viersamige Wicke	+	+	-

Tab. 1: Plants found in Schwanfeld. LBK = Linearbandkeramik, GG = Großgartach, BB = Bernburg.

korn wheat are absent (Helbaek 1952). The results of one lot, retrieved from pit 127 layer 5, is depicted in Fig. 1. Narrow spikelet bases, with widths below 0.7 mm are missing. According to K.-H. Knörzer (1977), einkorn is characterised by values between 0.5 and 0.7 mm and emmer by values between 0.8 and 1.0 mm. Therefore the conclusion must be that the crop plant einkorn was not cultivated at Schwanfeld. A re-examination using the criteria set by Jacomet et al. (2006) has confirmed this.

Barley is only represented by one grain and one rachis fragment. According to A. Kreuz (1990; 2007 p. 270), a comparable scarcity is common in not only the Earliest but also in Early Linearbandkeramik sites. Barley may not have been grown intentionally as a crop, but may have grown as a weed in an emmer wheat field.

Lentil, too, is scarce in the Schwanfeld features. Only two specimens were found together in one and the same pit (592, square c, layer e). Because lentils are more regularly found in early Bandkeramik sites than barley, this pulse is considered to have been truly grown as a crop.

In addition to the cultivated plants, at least one gathered food plant was discovered, hazelnut (*Corylus avellana* L.), present in 2 samples. Other wild plants may have been consumed as well, such as fat hen (*Chenopodium album* L.), but as their remains are scarce this cannot be proven.

Emmer wheat can be either autumn- or spring-sown, lentil only spring-sown (Körber-Grohne 1988). Weeds, brought into the settlement together with the harvest, may throw light on the way of cultivation. But unfortu-

nately, the weed content of the samples was too low to allow conclusions. The question is whether weed seeds, even when carbonised, have vanished or whether they have never been present. Because many of them are as robust as chaff, the latter is more credible. An analysis of Linearbandkeramik seed and fruit concentrations in the German Rhineland, the Netherlands and Belgium showed that newly founded settlements reveal much less weeds in their crops than settlements which had been inhabited for generations (Bakels 1991). An explanation may be that the fields of the first generation were better weeded or that initially crops were harvested by hand-picking to avoid weed seeds in the product, but this is hardly credible. A better explanation is that fields, laid out in newly felled primeval forest, are apt to be less infested by weeds than fields which are already in use for some time. The seed bank of a forest (the reservoir of seeds dormant in the soil) does not contain many seeds of herbs which could develop into weeds. The only source of weeds is then the sowing grain. In the course of time the seed bank has a chance to build up. As it is fairly well established that Linearbandkeramik settlements were permanently inhabited for at least some generations, it is no wonder that the farmers of the founding phase of a site encountered fewer problems with weeds than their successors. Seen in that light it is not surprising that Schwanfeld has not yielded large numbers of weeds. The species encountered are mentioned in Tab. 1.

A samples with both emmer grains and chaff**House 12****pit along western wall 562**

	a-a	e-d	e-e	f-d	f-e	f-f	k-e
Triticum dicoccum	-	-	1	-	2	2	2
Cereal fragments	11	20	19	21	35	30	25
Triticum chaff	8	15	9	10	18	10	11
Chenopodium album	1	-	-	-	-	-	-

pit along western wall 563

	v-a
Triticum dicoccum	1
Cereal fragments	10
Triticum chaff	4

external ditch 564

	g-o	z-d
Triticum dicoccum	-	5
Cereal fragments	15	30
Triticum chaff	5	9
Galium spurium	1	-

pit along eastern wall 591

	t-d
Triticum dicoccum	1
Cereal fragments	15
Triticum chaff	2

pit along eastern wall 592**(= southern end of 591)**

	b-a	b-b	b-c	c-a	c-b	c-c
Cereal fragments	30	35	18	40	12	30
Triticum chaff	100	85	36	145	20	40
Galium spurium	-	-	-	1	-	-

House 15**western pit 624 in yard**

	c-l	f-c
Cereal fragments	26	10
Triticum chaff	16	24

House 16**western pit along wall 704 north****(formerly 527)**

	c-b	c-c	d-a	f-b
Cereal fragments	-	4	21	2
Triticum chaff	52	43	68	24
Bromus sp.	-	-	1	-
Indeterminatae	-	7	1	-

western pit along wall 704 centre**(formerly 760)**

	d-a
Cereal fragments	28
Triticum chaff	3

western pit along wall 704 south**(formerly 762)**

	h-a	f-b	d-c
Cereal fragments	45	159	31
Triticum chaff	2	19	1
Avena sp. awn	1	-	-

postholes

	528	529	534
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Crop remains from Schwanfeld, a site occupied by, successively, Earliest Linearbandkeramik, Großgartach and Bernburg farmers

Triticum dicoccum	-	-	1				
Cereal fragments	10	5	16				
Triticum chaff	24	14	22				
Indeterminatae	-	-	2				
House 18							
western pit 665 in yard	b-b	b-j	c-j	b-1			
Cereal fragments	15	30	52	22			
Triticum chaff	8	3	-	1			
Chenopodium album	6	-	-	-			
B samples with mainly chaff							
House 11							
western pit 127	3	4	5	6	7	8	
Triticum dicoccum	-	-	1	-	-	-	
Cereal fragments	2	-	-	10	1	11	
Triticum chaff	156	461	684	915	57	272	
Fallopia convolvulus	-	-	-	-	-	1	
House 12							
western pit 353	c	g-o	g-a	g-b	g-c	g-d	g-g
Triticum dicoccum	-	1	-	3	7	-	1
Cereal fragments	41	13	36	105	194	20	99
Triticum chaff	929	184	348	683	977	285	933
Hordeum sp.	-	-	-	-	1	-	-
Hordeum sp. rachis internodium	-	-	-	-	1	-	-
Chenopodium album	1	-	-	1	3	-	2
Galium spurium	1	-	-	-	1	-	-
Fallopia convolvulus	-	1	-	1	-	-	-
Setaria viridis/verticillata	-	1	1	-	-	-	-
House 19							
western pit 857	e-f	d-b	d-e	d-g	d-c	a-c	
Triticum dicoccum	-	-	1	-	-	-	
Triticum chaff	17	282	121	19	182	381	
Poaceae sp.	-	-	1	-	-	-	
Persicaria lapathifolia	-	-	-	-	-	2	
Vicia hirsuta/tetrasperma	-	-	4	-	-	-	
Indeterminatae	-	-	1	-	-	-	

Tab. 2: The composition of Linearbandkeramik concentrations of plant remains. Each find is headed by its position as to square and layer. For instance, a-a means square a, layer a (in German Kasten a, Stratum a).

	number of posts examined	Average density	% of samples without remains	Maximal density present
Linearbandkeramik				
House 11	9	0,2	67	1.0
House 12	5	0,3	80	1,5
House 15	14	0,3	86	3.0
House 16 minus the three posts	24	0,7	50	3.0
House 16 including the three posts	29	4,1	45	39.0
Großgartach				
House 10	20	4,3	30	18.0
House 13	34	1,4	59	12.0
House 17	13	1.0	54	3.0

Tab. 3: The density (numbers per dm³) of the finds in postholes. As three posts of house 16 contain a concentration (see table 2), values are given with and without these posts.

4.3 The remains found in the Großgartach settlement

The fill of pits of Großgartach date was to such a large extent contaminated with remains of the Earliest Linearbandkeramik that these pits were not sampled. All samples were instead taken from postholes. The fill of these holes tend to display a higher density where plant remains are concerned (Tab. 3). This may imply that more waste was lying scattered around than in the earlier period and that the Großgartach settlement was 'filthier'. But it may also imply that part of the carbonised plant remains represents contamination. They may have been part of the sediment with which the holes were filled. Although this seems unlikely, because such remains are very friable and cannot stand much disturbance, the possibility remains.

Only one crop plant, emmer wheat, was discovered and no new weed species are present (Table 1). As this is rather unusual, the contents of the postholes are possibly not representative of the farmers' practices, and as some doubt is attached to the right age of the remains, no more will be said. Nevertheless, all species are known from Großgartach sites.

4.4 The Bernburg house

A large rectangular pit, measuring 5.20 m long by 5.00 m wide, could be attributed to the Bernburg culture. The flat-bottomed pit is the remnant of a house with a sunken floor. Its fill was hardly contaminated by older material, and five samples of 2 dm³ each were taken for botanical analysis. The results have already been published (Bakels in Lüning 1999), but are offered here again (Tab. 4). Needless to say that all remains are carbonised. Interestingly, all identifiable cereal remains belong to einkorn wheat (*Triticum monococcum* L.). The chaff remains are listed as *Triticum monococcum/dicoccum*, but this uncertainty is due to their fragmented state. It can safely be presumed that they concern einkorn wheat too. Other crop plants are absent. A fragment of a hazelnut shell (*Corylus avellana* L.) offers proof that plant food was not only cultivated but gathered as well. Four weed species complete the list. They belong to the commonest weeds of the Neolithic. Concentrations of fruits and seeds were not found. The scatter of einkorn chaff in the house suggests that einkorn wheat was the commonest crop. Interestingly M. Hopf (1957) found in the Bernburg settlement Burgdorf "auf dem Lietfeld" Kr. Goslar, Germany, also a dominance of einkorn wheat, although emmer wheat and barley were present too. However, W. Rothmaler (Rothmaler in Römmer 1962) found in Derenburg, Kr. Wernigerode, Germany, a dominance of emmer wheat. It is, therefore, too early to conclude that the Bernburg farmers grew largely einkorn wheat.

sample	81.15c	81.18d	81.23b	81.29a	81.30ab
Triticum monococcum	3	-	2	1	-
Tr. monococcum/dicoccum, chaff	2	2	1	1	-
Triticum grain damaged	-	1	-	-	1
Triticum fragments	-	3	12	10	10
Corylus avellana	-	-	-	1	-
Chenopodium album	-	-	-	2	-
Fallopia convolvulus	-	-	-	1	1
Galium aparine	-	-	-	1	-
Setaria viridis/verticillata	-	-	-	1	-

Tab. 4: Number of plant remains found in the samples from the Bernburg house.

5. Conclusions

One of the aims of the present research was to assess which of the eight founder crops had reached the earliest farmers' community in Schwanfeld. It turns out that only three of them were found of which one, barley, lacked perhaps the status of crop plant. The question is whether the other five were 'lost' during the process of expansion of the food-producing way of life from the Near East to Western-Central Europe.

According to A. Kreuz *et al.* (2005) the Linearbandkeramik crop assemblage of Central Europe, also in its later stages, comprises only five species: emmer and einkorn wheat, pea, lentil and flax, and perhaps barley. As mentioned before, A. Kreuz considers barley not having been valued as true crop plant yet. This implies that chickpea and bitter vetch were indeed lost on the way from the Near East to Central Europe. Einkorn wheat, pea and flax were not found in Schwanfeld, notwithstanding the large number of samples. Einkorn wheat and pea though are rather common in the Earliest and Early Linearbandkeramik. A. Kreuz (1990) found einkorn wheat in eight, and pea in six of the ten settlements she examined. Flax was present in only two of them. It is therefore possible that the absence of flax in the still earlier site of Schwanfeld is due to mere chance, but in the case of einkorn wheat and pea this is less credible. It is obvious that more research is needed.

The second question put forward was whether information on the cultivation and processing of the crops could be obtained. It has become clear that the weed content of the crop was very low, a fact that is attributed to the absence of a weed growth of any importance in the

cereal fields. The reason for this condition is sought in the absence of weed seeds in the soil of the forest cleared for the laying-out of the fields. What weeds there were came with the sowing seed.

Another observation is that a surplus of chaff was not disposed off at random, but was burnt in specified areas within the yard. In Schwanfeld this was west to north-west of the house.

The third question was whether differences could be observed between the Earliest Linearbandkeramik and the later occupants of the terrain. Unfortunately the Großgartach samples were quite unreliable due to the possibility of contamination. The remains of the Bernburg settlement consisted in essence of one single house and this may not be representative for the Bernburg culture. But as it is, it differs from the Earliest Linearbandkeramik in the fact that einkorn wheat was the main cereal, this in contrast with the emmer wheat of that much earlier culture.

Acknowledgments

I should like to thank the students from Cologne and Frankfurt for sieving the bulk of the samples. The tedious sorting out of residues was the far from enviable lot of the people in the Leiden laboratory: Johan Goudzwaard, Wim Kuijper and Caroline Vermeeren. They did their work cheerfully and with the utmost care. Kelly Fennema kindly corrected my English.

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