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Grinding Stone Deposits of the Linear Pottery Culture in Central Germany☆

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A B S T R A C T

In recent years, three deposits of grinding stones have been discovered in Central Germany, resembling a phenomenon known from the Paris Basin and Belgium. These deposits were more than simple disposals; they likely held ritual or symbolic significance, reflecting the values and beliefs of the community. Their symbolism is diverse, shaped by both the tools themselves and their locations. The condition of the tools—ranging from new to nearly worn-out—adds layers of meaning, suggesting cycles of creation, use, and obsolescence. These symbols, such as fertility, life cycles, and territorial markers, mirror the daily and yearly rhythms of agrarian life. Additionally, they represent human biographies and social relationships, often emphasizing transitional moments such as birth, marriage, and death. A techno-functional analysis of the grinding tools highlights time as a central theme, symbolized through daily routines, seasonal cycles, and human lifespans. Overall, these interpretations reveal the complex and multifaceted nature of the grinding stone deposits, offering valuable insights into the worldviews and practices of past societies.

1. Introduction

The structural deposition of objects relatedto the agricultural way of life is a widespread phenomenon in the Linear Pottery culture (LBK) and the Stroke-ornamented ware culture (SBK) of the Central European Early Neolithic (ca. 5500–4600 cal BCE), extending across all artifact categories from ceramics and bones to flint and polished stone tools (Hoffman 2020, 118). Grinding stones are part of this deposition practice, often in combination with other objects. An example of this is the site of Eilsleben, in the Börde district (Saxony-Anhalt, Germany): One grinding slab was found in a female burial and associated with the skull of an aurochs (*Bos primigenius),* while another appeared in a deposit with various ceramics and polished stone tools (Kaufmann 2001, 128–132). A similar case is found in Dortmund-Oespel/Marten (North Rhine Westphalia, Germany) where a grinding stone was found with ceramic sherds and human ashes (Brink-Kloke/Althoff, 1994, 89). More of these combined deposits in Germany have been presented by Graefe et al. (2009), Graefe (2009 50–53;164–165). Another case was discovered in the settlement of Hrdlovka, district Teplice (Czech Republic), where a pit with two layers was found along the northeast wall of a longhouse. The upper layer contained almost exclusively grinding stones and grinding stone fragments (n = 35). In the lower layer, a large number of animal bones and ceramics were found along with small amounts of charcoal (Beneš et al. 2015, 162). However, most known Early Neolithic deposits consisting exclusively of grinding stones and possibly associated items, such as pecking stones, originate from the Paris Basin and Belgium (Fig. 1) (Hamon 2020). Further east, the deposit from Deiringsen/Ruploh (North Rhine Westphalia, Germany) included two grinding slabs and one pecking stone. This deposit has been adscribed to the Rössen Culture (Günter 1976, 17), which can be dated to 4700-4500/4400 BCE. The deposit from Motzenstein bei Wattendorf (Bavaria, Germany) contained four grinding stones, and shows a similarity to those from the Paris basin, Belgium, and Central Germany but does not date to the same timeframe. Even though the area has produced LBK and SBK finds, the deposit was dated to the Corded Ware period (ca. 2800–2200 cal BCE) (Graefe et al., 2009; Graefe, 2009, 165; Seregély 2004, 315). While this type of deposition was not previously recognized in Central Germany, three of such contexts have been excavated since 2007 (Fig. 1, Table 1). Two of them were found close to the circular ditched enclosure of Goseck, in the south of Saxony-Anhalt (Bertemes/Northe, 2012;

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Zamzow, 2023; Knoll/Zamzow 2025), and another one near Sömmerda, in Thuringia (Zamzow et al. 2024) (Fig. 1).

Two of these deposits from central Germany (Sömmerda and Goseck 2013/13) exhibit remarkable parallels with those found in the Paris Basin and Belgium, like the arrangement of tools and the fact that they are just composed of macrolithic tools (Hamon 2008a, 21-22; Hamon 2020, 37-39). The particular way in which they are assembled offers direct insight into the symbolic nature of the deposited tools, the contexts themselves, and their location, all of which, we propose, have a close relationship with the concept of time. The present study showcases a method to disentangle the meaning of such deposits by paying close attention to the placement of the tools as well as their morpho-technical features.

2. Method

The morpho-technical description of the artifacts has been carried out following a standard recording system developed for the economic investigation of macrolithic tools (Risch 1995, 2002; Delgado-Raack, 2008, 2013; Delgado-Raack/Risch, 2016; Eguíluz Valentini et al., 2023; Risch et al., 2021; Vučković/Risch, 2021; Zamzow et al., 2024; Ache, 2019; Vučković, 2019; Eguíluz/Risch, 2024). Initially, the objects are positioned in front of the observer based on strict object-oriented rules and divided into six sides (front, back, top, bottom, right, and left), which can be described morphologically, metrically, and functionally. The type and, if possible, the sub-type of each artifact in its final function is determined based on the detailed observation of manufacture and use-wear traces in combination with size, shape, and geology of the tool. Working surfaces are, if possible, oriented towards the front, top, or right side. Previous uses are described to the extent possible. The degree of preservation and the number of fragments belonging to the same artifact are recorded, as well as changes that occurred after deposition.

The weight, length, width, and thickness of the artifacts are recorded distinguishing between complete and incomplete maximum and, where relevant, minimum values. This is followed by the morphological description of all six sides of the object in both the longitudinal and transverse axes. Six basic forms are distinguished: sharp edges, convex shapes, concave shapes, straight shapes, irregular shapes, and the absence of the original surface due to breakage. Following this scheme, the working traces visible on each side are recorded with specific codes. A distinction is made between anthropogenically altered and natural surfaces, and, at the next analytical level, between surfaces that are manufactured by polishing, pecking, sawing, perforating, and flaking, and surfaces formed by the use as through percussion or abrasion. In the case of grinding slabs and handstones special attention needs to be paid to the front and back surfaces, which are altered by use, while the top, bottom, left, and right sides mostly show traces of the shaping of the artifact. Of course, all traces can occur in combination on the same sides of the artifacts. Furthermore, the functional analysis can be supplemented by additional observations, like microscopic descriptions of use-wear traces and mineral and organic residues that are crucial in any attempt to interpret the use of these tools (Ache et al., 2017; Delgado-Raack et al., 2016).

Where possible, the sizes of the working surfaces in the longitudinal and transversal axes are measured, as well as their convexity or concavity along these two axes. The concavity of the working surfaces of grinding slabs is a crucial indicator of their use-life. If working surfaces are not regularized periodically, the concavity, especially of its longitudinal axis, will increase more or less proportionally to the grinding time. Instead, the convexity of grinding slabs and grinders is a critical feature in order to identify the technological adjustment between both tools (Delgado-Raack/Risch, 2016). Features such as small depressions, perforations, working grooves, or drillings are described separately. Finally, documentation and sampling processes are noted, and additional observations can be recorded.

The identification of the raw materials is usually done through macro- or microscopic identification of the minerals and the geological structure visible to the naked eye or low magnification. If this approach

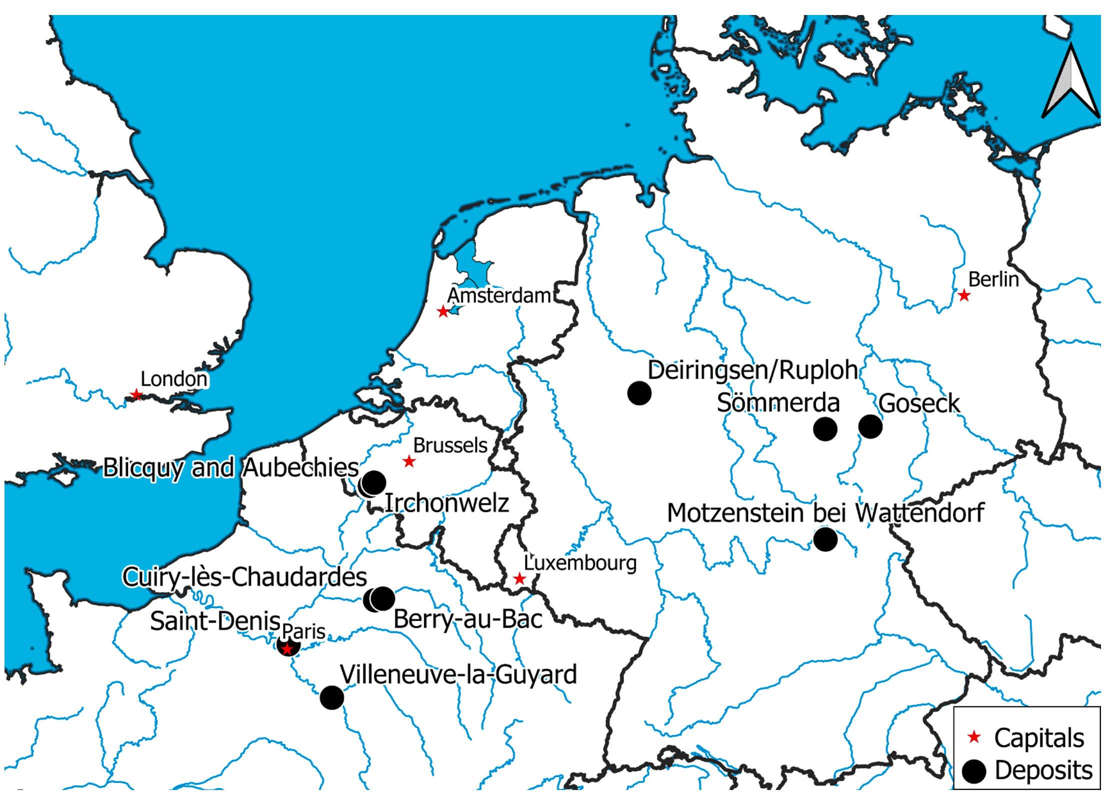

Fig. 1. Early Neolithic deposits containing grinding stones placed as structured assemblages (based on Günter 1976, 17; Sergély 2004, 315; Hamon 2008a, 20; Graefe et al., 2009; Graefe, 2009, 165; © EuroGeographics for the administrative boundaries, © WISE Large rivers and large lakes F1v0 modified by E. Zamzow).

Table 1
Geologic, metric, and functional information of the ground stone tools from the deposits of Goseck and Sömmerda (RT = Straight; CV = Concave; CX = Convex; ARC = Carbonated sandstone; ARS = Silicified sandstone, CGL = Silicified micro-conglomerate).

Deposition		Goseck G3/G4-296/07		Goseck 2013/13					Sömmerda Feature 64							
ID Nr.		**12554:1000:296a**	**12554:1000:296b**	**12558:13:8**	**12558:13:9**	**12558:13:10**	**12558:13:11**	**12558:13:12**	**19/148–283-1**	**19/148–284-1**	**19/148–285-1**	**19/148–286-1**	**19/148–283-2**	**19/148–284-2**	**19/148–285-2**	**19/148–286-2**
Tool type		Slab	Slab	Slab	Slab	Slab	Grinder	Slab	Slab	Slab	Slab	Slab	Grinder	Grinder	Grinder	Undefined
Working surface	Convexity transversal axis (mm)	2	0	5	2	10	2	6	0	5	9	5	5	9	6	–
	Concavity longitudinal axis (mm)	58	22	17	56	47	7	10	0	22	78	24	8	18	10	–
	Form transversal axis	CX	RT	CX	CX	CX	CX	CX	RT	CX	CX	CX	CX	CX	CX	CX
	Form longitudinal axis	CV	CV	CV	CV	CV	CV	CV	RT	CV	CV	CV	CV	CV	CV	CV
	Width (mm)	240	257	200	235	212	137	158	232	255	230	245	164	156	151	–
	Length (mm)	405	425	400	440	440	245	235	410	425	425	400	260	250	243	–
Transformation index		0.8/1	1/1	0.8/1	0.8/1	1/1	0.8/1	0.8/1	0.6/1	1/1	1/1	1/1	0.6/1	1/1	0.6/1	0.75/1
Min. thickness (mm)		–	–	–	–	–	–	–	–	–	53	87	–	13	46	–
Max. thickness (mm)		122	123	120	145	113	67	63	82	119	140	145	59	36	80	113
Width (mm)		254	279	245	242	236	144	160	243	270	240	275	186	168	155	195
Length (mm)		504	470	462	501	471	269	254	505	515	535	480	311	281	262	420
Weight (g)		13,300	15,400	18,200	10,900	19,100	3072	3037	22,700	19,500	22,200	19,000	5400	3000	3000	7800
Geology		ARS	ARS	ARS	ARS	ARS	ARS	ARS	CGL	CGL	CGL	CGL	CGL	ARS	ARS	ARC

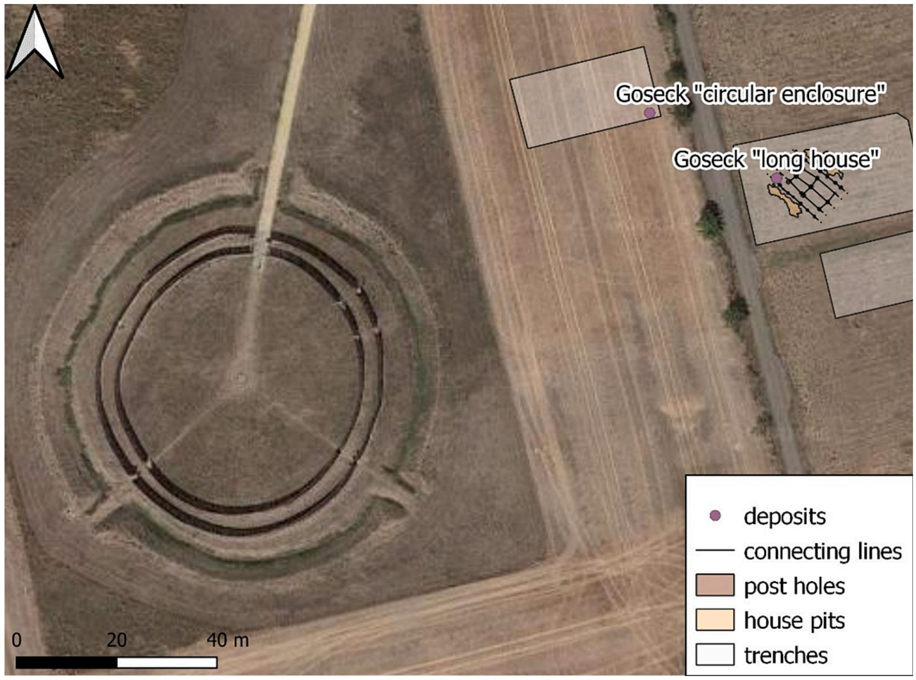

Fig. 2. Location of the grinding stone deposits close to the circular enclosure of Goseck. © 2023 Google; excavation documentation/MLU Halle-Wittenberg, modified by E. Zamzow.

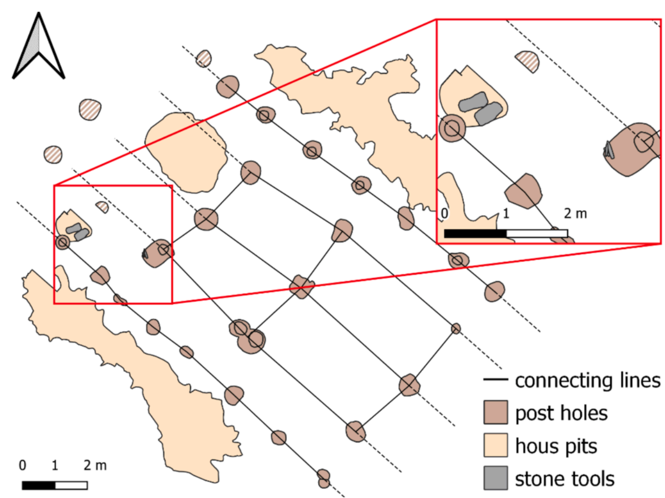

Fig. 3. Location of the ground stone tool deposits in the longhouse Goseck. E. Zamzow after Bertemes/Northe 2011 Abb. 17 and rectified digital photos and planum sketches.

Fig. 4. Grinding slabs of the deposit of Goseck in the longhouse pit. Excavation documentation/MLU Halle-Wittenberg.

proves insufficient to allow for secure identification, a thin section may be taken if this destructive sampling is possible on the object.

3. Archaeological contexts and tools

3.1. Goseck

The circular ditch enclosure of Goseck is located approximately 38 km southwest of Leipzig. The structure itself dates to the SBK and was discovered through aerial photographs (Bertemes/Northe, 2012, 12) and excavated from 2002 to 2004 by the State Office for Heritage Management and Archaeology Saxony-Anhalt and the Martin-Luther-University Halle-Wittenberg (MLU) as part of a research excavation (Henkel 2023). From 2005 to 2013, the surroundings of the circular ditch enclosure were investigated by the MLU through several research

Fig. 5. Planum 3 of the grinding stone deposit of Goseck circular ditch enclosure with human remains. Excavation documentation/MLU Halle-Wittenberg.

Fig. 6. Planum 5 of the grinding stone deposit of Goseck circular enclosure with the tools. Excavation documentation/MLU Halle-Wittenberg.

excavations (Bertemes /Northe, 2012; Knoll/Zamzow 2025) (Fig. 2). The construction and use of the enclosure could be dated between 4900 and 4700/4650 cal BCE (Henkel 2023, 192).

3.1.1. Feature G3/G4-296/07

In 2006, a LBK house, older than the circular ditch enclosure as it was dated to approximately 5200–5000 cal BCE,[1] was uncovered and excavated in 2007 (Knoll/Zamzow, 2025). In this house, two deposits were found: the first one consisted of three edge-ground stone tools, which were deposited at one of the inner posts of the house, while the second was formed by two grinding slabs (Fig. 3).

The deposited grinding tools were placed side by side in a pit located 15–25 cm away from the last preserved post of the southwestern outer wall of the house. The less worn grinding slab was laid with its active surface facing downwards, protecting it (Hamon 2008a, 25f.), while the second was laid down with the active surface up. Though a direct stratigraphical connection between both deposits cannot be conclusively demonstrated, they do intersect (Fig. 4). The topsoil and the underlying gravel layer were cut during the excavation of the deposition pit, allowing the grinding slabs to rest on the underlying sandy loess (Knoll/Zamzow 2025).

Both tools are made of silicified sandstone, which is not locally available within a radius of 5 km. The most likely source area for the sandstone is assumed to be the outcrops along the Unstrut River, near Nebra, approximately 23 km from the site. However, conclusive geological evidence is still pending. In this case, both fluvial transport of the material via the Unstrut and the Saale rivers or transport over land would be possible.

The active surfaces of the grinding slabs bear the typical traces, resulting from the abrasion developing during food processing and the percussion marks for roughening (Delgado-Raack/Risch, 2016).

The backside of grinding slab 12554:1000:296a shows a natural eroded surface. The upper and bottom sides were shaped by pecking and flaking. The left and right sides were primarily shaped by flaking. Additionally, isolated pecking marks can be discerned around the edges between the use surface and the surrounding sides.

The backside of grinding slab 12554:1000:296b was shaped by

Fig. 7. Fitting pair of the grinding stone deposit of Goseck circular enclosure (grinding slab: 12558:13:9; handstone 12558:13:11) J. Soldevilla, LDA.

Fig. 8. Fitting pair of the grinding stone deposit of Goseck circular enclosure (grinding slab: 12558:13:10; handstone 12558:13:12) J. Soldevilla, LDA.

[1] MAMS 57,459 = 6148±28 BP; MAMS 57460 = 6138±28 BP.

natural erosion and by very coarse flaking. The top was worked by finer flaking, while the bottom was shaped by coarse flaking and pecking. The right and left sides were almost exclusively shaped through flaking.

Both grinding stones (tab. 1) show a very high index of transformation (Delgado-Raack, 2008, 307) as four out of five (index of 0.8) and all five (index of 1) passive sides respectively are worked in some way. This is typical for most grinding slabs in LBK and SBK contexts in which very rarely, more than one passive side of the grinding stones is left unworked. Only smooth surfaces that already fitted the intended shape and use of the tool were left in a natural state. Such natural surfaces are mostly found on the back side of grinding slabs where the shape is not so important as long as it gave a stable base for the tool.

Both grinding implements were buried in a usable condition and can be categorized as shape 1 (by surface shape) and shape 2 (by proportions) according to Zimmermann (1988, 724–727). Shape 1 describes a pair of grinding stones where the handstone is longer than the grinding slab, resulting in a bulge at the top and the bottom end of the handstone. In the shape 2 the length of the handstone and the width of the grinding slab are almost identical so that the wear of both surfaces is similar, and no bulges can form (Zimmermann 1988, 724–727; Delgado-Raack/Risch, 2016). Slab 12554:1000:296a is relatively worn, approaching the end of its use life. In contrast, 12554:1000:296b was much less used, as indicated by the lower concavity of the longitudinal axis of the working surface and the greater preserved tool thickness (tab.1). This tool likely surpassed half of its use life (cf. Knoll/Zamzow 2025). The unbroken state of the two slabs and their careful placement in a pit, together with the absence of the corresponding grinders allows the interpretation of feature G3/G4-296/07 as an intentional deposit, not as a tool storage for later reuse, comparable to other similar contexts of intentional deposits (Hamon 2008a, 25f.).

3.1.2. Feature 2013/13

Further excavations close to the circular ditch enclosure carried out in 2013 unearthed another deposit, also containing anthropological remains. It was located approximately 70 m northeast of the north-eastern opening in the palisade line of the enclosure. The deposit was recognized as a possible feature at the beginning of the excavation due to the absence of the documented surrounding gravel layer. The nearly circular pit was filled with brown, humus-rich material that did not contrast in colour with the topsoil, making this feature difficult to delineate. In plana 2–3, skeletal material could be documented in the centre of the approximately 1.70 x 2 m large pit (Fig. 5). The very poorly preserved and heavily fragmented bone material included remains of a skull, parts of the presumed left upper extremities, and some additional bone fragments. The skull was positioned with the calotte to the north and on the right side, facing southwest towards the opening in the palisade ring of the circular ditch enclosure through which the sun can be observed at sunrise on the day of the summer solstice.

The incomplete remains of the left arm were located only a few centimetres east of the skull in a slightly displaced position. The skull, together with the arm, was excavated as a block and examined after exposure. The individual's teeth exhibit significant abrasion, suggesting that the individual likely reached an age between 40 and 55 years. This assumption is supported by the joint wear of the jaw and finger joints. The sex determining characteristics of the skull are partially indistinct but suggest a predominantly biologically female interpretation.

A ^{14}C sample was taken, dating the individual to 4795–4696 cal BCE[2] (Zamzow 2023, 54-55). Thus, the deposit falls within the period of use of the circular ditch enclosure of Goseck, which ranges between 4900–4750/4650 BCE (Henkel 2023, 192).

Below this special burial, five grinding stones were found side by side and partially overlapping (Fig. 6). Items 12558:13:8, 12558:13:9, and 12558:13:10 are grinding slabs, while the other two 12558:13:11 and 12558:13:12 are handstones. Tools 12558:13:9 and 12558:13:11 (Fig. 7), as well as 12558:13:10 and 12558:13:12 (Fig. 8) belong together, forming two pairs of grinding equipment. The skeletal remains were located above tool 12558:13:10. All stones were aligned with their longitudinal axis placed east–west.

Fig. 9. Planum 2 of the grinding stone deposit of Sömmerda with the first layer of tools. S. Schneider, TLDA.

As the grinding stones overlapped each other, the sequence of deposition can be reconstructed (Zamzow 2023, 51-54). It started with the two handstones: tool 12558:13:12 was first deposited, followed by 12558:13:11, which was placed west of it in a slightly overlapping position. Next, the two corresponding grinding slabs were placed adjacent to the overlapping grinders (12558:13:10 north and 12558:13:9 to the south). Finally, grinding slab 12558:13:8 was placed centrally, to the left of handstone 12558:13:11. Except for 12558:13:9, all tools were placed with the working surface facing down, on the bottom of the pit. All tools are complete and in a usable condition, but with varying degrees of wear. While slab 12558:13:8 represents a nearly unused specimen, 12558:13:9 almost reached the end of its life span. An intermediate stage of use is illustrated by tool 12558:13:10. Both handstones where approximately in the middle of their use life.

All tools are made of the same silicified sandstone as the artifacts of feature G3/G4-296/07, and they also correspond to grinding tool shape 1 (by surface shape) and shape 2 (by proportions) (Zimmermann 1988, 724–727; Delgado-Raack/Risch, 2016). Accordingly, the transformation index of the grinding slabs is very high (tab. 1). Two of them reached an index of 0,8/1 and one of 1/1. This intense transformation of passive sides means a high investment of work not crucial for the usability of the tool.

Both the grinding slabs and the handstones exhibit the typical grinding working surfaces on the front side.

The grinding slab 12558:13:8 preserves its natural appearance on the back. The left and right sides are flaked. The upper and lower ends have been worked by pecking and flaking. In the case of grinding slab 12558:13:9 the back side was also not modified. The upper side was worked by flaking, and the left, right, and bottom sides show traces of pecking marks and flaking. The last grinding slab 12558:13:10, shows a partial natural smooth surface on the reverse while other parts are flaked. All other sides are shaped by pecking and flaking.

Similar traces are observed for the two handstones. The naturally even reverse surfaces were further smoothed through contact with the workers hands. All other passive sides of grinder 12558:13:11 were shaped by flaking. Handstone 12558:13:12 was further worked by pecking.

The grinding slabs exhibit various degrees of wear, as shown by the concavity of their use surface in combination with the preserved thickness of the stone, especially in the centre of the tool. Grinding slab 12558:13:8 can be considered a newly produced tool with an almost flat

[2] MAMS 44,662 = 5875 ± 24 cal. BP.

Fig. 10. Planum 3 of the grinding stone deposit of Sömmerda with the second layer of tools. S. Schneider, TLDA.

Fig. 11. Fitting pair of the grinding stone deposit of Sömmerda (grinding slab: 19/148-283-1; hand stone 19/148-283-2). J. Soldevilla, LDA.

surface, whereas 12558:13:10 represents an object that has been in use for some time but was far from being exhausted. Instead, slab 12558:13:9, with a pronounced concavity (tab. 1), represents an object that has nearly reached the end of its use life (Zamzow 2023, 55-56).

3.2. Sömmerda

The city of Sömmerda, is approximately 23 km north of the state capital of Thuringia, Erfurt. The Early Neolithic site and deposit were discovered during a rescue excavation on the north-eastern outskirts of the city of Sömmerda by the Thuringian State Office for Heritage Management and Archaeology (TLDA). The site is a multi-period settlement area, which has been intermittently inhabited from the Linear Pottery culture period to the Middle Ages. In addition to the deposition and settlement pits from various periods, a northwest-southeast-oriented house layout from the LBK period was found, along with accompanying pits in the north-eastern part of the excavation area (Zamzow et al. 2024, 5).

3.2.1. Feature 64

The deposition pit, dated as LBK,[3] is located a few meters west of the aforementioned longhouse and is intersected by another pit, used for raw material extraction of clay or loess. The deposit pit is oval (1.1 m x 0.6 m), with a shallow concave bottom where the ground stone tools were deposited in two layers. The upper layer was formed by a grinding slab and two grinders with their longitudinal axes placed in north–south direction and their active surfaces facing downwards. Additionally, an indeterminate large block (19/148–286-2) was documented. The lower layer consisted of three grinding slabs and one grinder, all placed facing upwards and towards the centre of the pit, with their axes in an east–west orientation. In this sense, all working surfaces of the upper and lower layers faced each other (Zamzow et al. 2024, 8-10).

The deposit was arranged as follows (Fig. 9): Only one grinding slab (19/148–285-1) was in the upper layer, placed above the three east–west oriented grinding slabs of the lower layer (19/148–283-1; 19/148–284-1; 19/148–286-1). Two overlapping handstones were placed approximately in the middle of the feature (19/148–285-2 found north, 19/148–284-2 found south), to the right of the upper grinding slab and covering two of the lower ones. The indeterminate tool appeared in the northern area of the pit. Finally, the handstone 19/148–283-2 was leaning in an upright tilted position against the eastern pit wall, with the active surface facing the inside of the deposition and the rest of the tools (Fig. 10).

All deposited tools are very well-preserved and were likely in use at the time of deposition. Only artifact 19/148–286-2 was found heavily damaged by erosion, making it impossible to conduct a reliable functional identification. All tools were covered by a thick calcite crust, which was removed to the extent possible with water and mechanical action before examination. All pieces were made of sedimentary rocks, specifically sandstone and microconglomerate, both silicified. Only the indeterminate artifact 19/148–286-2 was made of carbonated sandstone, which hastened its damage and the formation of calcite crust. All grinding slabs and two of the handstones exhibit traces of fluvial transport weathering on some of their surfaces, suggesting the exploitation of secondary deposits (Zamzow et al. 2024, 11).

The four lateral, passive sides of the grinding stones had been shaped by flaking. In the case of 19/148–283-2, these surfaces are additionally refined by pecking. In two instances (19/148–283-2; 19/148–285-2), the natural surfaces of the stones were left untouched on the top side. Additionally, grinding slab 19/148–283-1 has a naturally smooth surface on the left side. The same applies to 19/148–286-1, although this surface was also flaked. This process was also applied to the reverse side of the artifact, but the edge between the active and reverse surface broke, leaving a rough fractured facet that was not further worked. In general, the passive backsides of the grinding slabs were rather roughly hewn. While one slab (19/148–283-1) shows an irregular, rough surface that was barely worked, two slabs (19/148–285-1 and 19/148–286-1) were shaped by rough flaking, and only one (19/148–284-1) is worked by a finer, flat striking. The backsides of the handstones, like those from Goseck, are much smoother compared to the grinding slabs due to prolonged contact with the hands during use. The reverse of the grinder 19/148–283-2 presents a rough, irregular, natural surface that was probably not worked. Grinders 19/148–284-2 and 19/148–285-2 show developed traces of hand polishing, indicating intensive use over a long period. Prior to this hand polishing, the artifacts already had a smoothed surface due to natural weathering processes (19/148–285-2), and one was also worked by fine pecking (19/148–284-2) (Zamzow et al. 2024, 12-13).

All grinding stones' active front sides show the characteristic abrading and pecking traces. However, the active surfaces of the handstones present greater variability in macroscopic use-wear traces. All exhibit distinct scratches or grooves running parallel to the work direction, formed by wear processes during grinding. Handstone 19/148–283-2 also shows fresh pecking marks from surface preparation. In contrast, the working surfaces of the other two pieces are so worn down, especially at the top and bottom ends, that no remnants of the pecking are visible. Due to the high degree of wear generated by the contact between handstones and grinding slabs, these areas can be described as polished.

[3] Relative dating using ceramic morphotypes.

The transformation index of the grinding slabs is very high, similar to the tools from Goseck. One of them reaching an index of 0,6/1 and three of 1/1 showing evidencing a very high stage of working.

Among all the tools of the deposit, only one paired set of handstone and grinding slab could be identified. The active surfaces of grinding slab 19/148–284-1 and grinder 19/148–283-2 are perfectly adjusted to each other (Fig. 11).

The duration of the use life of the tools can also be addressed in the deposit of Sömmerda. Grinding slab 19/148–283-1 stood at the beginning of its use. The practically flat and freshly pecked working surface suggests that the tool had been manufactured shortly before deposition and had probably not been used. In comparison, 19/148–284-1 had been used for a longer period, based on the concavity of the longitudinal axis of the working surface. However, the remaining thickness of the artifact is still sufficient for the tool to have remained functional for a long time. The artifact may not have reached the middle of its potential use-life. Grinding slabs 19/148–286-1 and 19/148–285-1 show a more intensive wear, especially the former. For both, further use would have been possible for some time.

Based on the concavity on their longitudinal axis it can be concluded that the grinding slab 19/148–283-1 was hardly used or not at all. 19/148–286-1 and 19/148–284-1 were in the middle of their use life, while 19/148–285-1 was a notably older tool, as is also manifested in the very thin edges of the working surface in the transversal axis (tab. 1), indicating the tail end of its use.

The handstones have all reached the midpoint of their potential period of use, as evidenced by the working surface, and the remaining thickness (Zamzow et al., 2024, 12-13).

4. Previous views on grinding tool deposits

Similar deposits of grinding stones, like those found in Goseck and Sömmerda, are most numerous in the Paris Basin and Belgium. In total, 20 of such depositions are known, comprising 89 tools. They date to the LBK (11) and the Bilicquy/Villeneuve-Saint-Germain culture (9) and are attributed to 13 sites (Hamon 2020, 34-35). Ten of these deposits are associated with longhouses: eight come from pits in the vicinity of houses, while two are found in pits located at the rear of houses (Hamon 2020, 37). These two latter findings are also likely to be deposited at the end of the LBK (Hamon, 2005, 41; Hamon 2020, 37), providing a good comparison to the older deposit G3/G4-296/07 from Goseck. In these contexts, the tools were mostly arranged with the working surface facing downwards, either in piles or laid out in a circular fashion. They are rarely found in a working position (Hamon 2008a, 21-22; Hamon 2020, 39). Another type of arrangement was observed in the deposit of Saint-Denis, where the larger grinding slabs circularly surrounded the smaller tools, similar to the layout of the younger deposit from Goseck.

Even if there are apparently no strict rules that determine the configuration of these depositions, there are similarities that connect those of the Paris Basin and Belgium to the ones in Central Germany. These aspects are 1) that two or more tools were placed in the deposits, 2) grinding slabs are always present, usually in connection with associated tools like handstones, hammerstones, or other macrolithic tools, 3) the way the tools are laid down is planned even if not in a strict manner, and 4) the depositions have a clear connection to structures like houses, settlements, or landmarks.

The intention behind the depositions themselves, the selection of objects, and their arrangement appears as a crucial question regarding the Early Neolithic economy and ideology. Regardless of the deposition context, various studies have explored the symbolism of grinding stones in recent decades (see Makkay, 1978; Fendin, 2000, 2006; Brück, 2001; Hamon 2008a/b; Lidström Holmberg, 2008; Ramminger, 2008; Watts, 2008, 2012, 2014). References are often made to interpersonal relationships (Lidström Holmberg, 2008, 133f.; Watts 2012, 91–94) or transitional life events such as adolescence, marriage, or death (Ramminger, 2008, 42; Watts 2012, 97). These events are often related to women, considered to be the primary users of grinding stones according to archaeological evidence and ethnological comparisons (Alonso 2019, 4320–4322; Graefe et al., 2009; Graefe, 2009 154–158; Graefe et al., 2009; Graefe, 2009; Gronenborn, 1995, 51; Lidström Holmberg, 2008, 127). The references to transitions are often linked to the transformation of the raw material or of the grinding stones themselves through simultaneous destruction and recreation (Fendin, 2000, 90; Watts 2012, 93–95). Likewise, there are temporal references to the day and the night or the course of the agricultural year with sowing and harvesting (Fendin, 2000, 88–91; Watts 2012, 93, 99). Watts (2012, 106) identifies symbolism in the depositions with interpersonal relationships, harvest and fertility, feasting, and wastefulness. Furthermore, it has been proposed that the tools were imbued with meaning through their use in a ritual context, rendering them unsuitable for everyday use (Makkay, 1978, 19–30). All these interpretations are highly context-dependent and can only serve as inspiration, even when ethnographic comparisons are used. C. Hamon (2008) proposes a total of six interpretation possibilities: 1. Foundation ritual, 2. Abandonment ritual, 3. Raw material reserve, 4. Symbolic transition from life to death, 5. Territorial sign, and 6. Expression of Neolithic agricultural identity (Hamon 2008a, 25).

5. Discussion

The deposits of Goseck and Sömmerda seem to support several of the above interpretative propositions. Their location near settlement contexts could be linked to the foundation of these spaces or an important achievement of these communities. Additionally, their placement in the landscape and within the settlements can be considered a territorial marker, especially in the case of Goseck 2013/13, with its connection to the circular enclosure. The participation of the grinding tools in food processing for feasting or gatherings could be linked to ritual events. The symbolic transition from life to death might have been expressed through the different stages of wear of the tools, representing the everyday tasks of the people who used them or their "previous life" before their deposition. Together with their location, this aspect can be a depiction of the Neolithic way of life, marked by sedentary domestic structures, technological specialisation, and the consumption of cultivated goods.

The hypothesis of a raw material or artifact storage can be excluded in the case of the contexts of Central Germany due to the heavy wear of many of the grinding slabs which would not withstand a refitting process with a new handstone or prolonged grinding.

Rather, the transformation and wear processes of the grinding stones seem to provide meaning to their ritual deposition and should be added to the interpretative models. The high degree of transformation and long use-life distinguishes grinding stones from other tools, such as pecking stones, which are mostly natural cobbles with minimal surface preparation before use. The substantial work investment on the passive surfaces of grinding slabs was not mandatory for the proper functioning of the tool. This is exemplified by the large Late Neolithic and Early Bronze Age grinding stones of Central Germany, which were manufactured out of glacial erratic boulders (Risch et al., 2021). In these cases, only the working surface is pecked, while all other sides are only flaked when the shape was markedly irregular. The high level of curation in the manufacturing and maintenance of the LBK and SBK grinding equipment provides a first indication of the attention paid to these tools by the Early Neolithic people beyond their simple function. On average, all the presented grinding slabs have a transformation index of 0,88/1.[4] Only axe heads, a tool category which has also been found in deposits, have a similar transformation index (almost 1/1), suggesting both artifact categories shared a similar social recognition in the Early Neolithic

[4] Features' average values: G3/G4-296/07 = 0,9/1; 2013/13 = 0,86/1; 64 = 0,9/1.

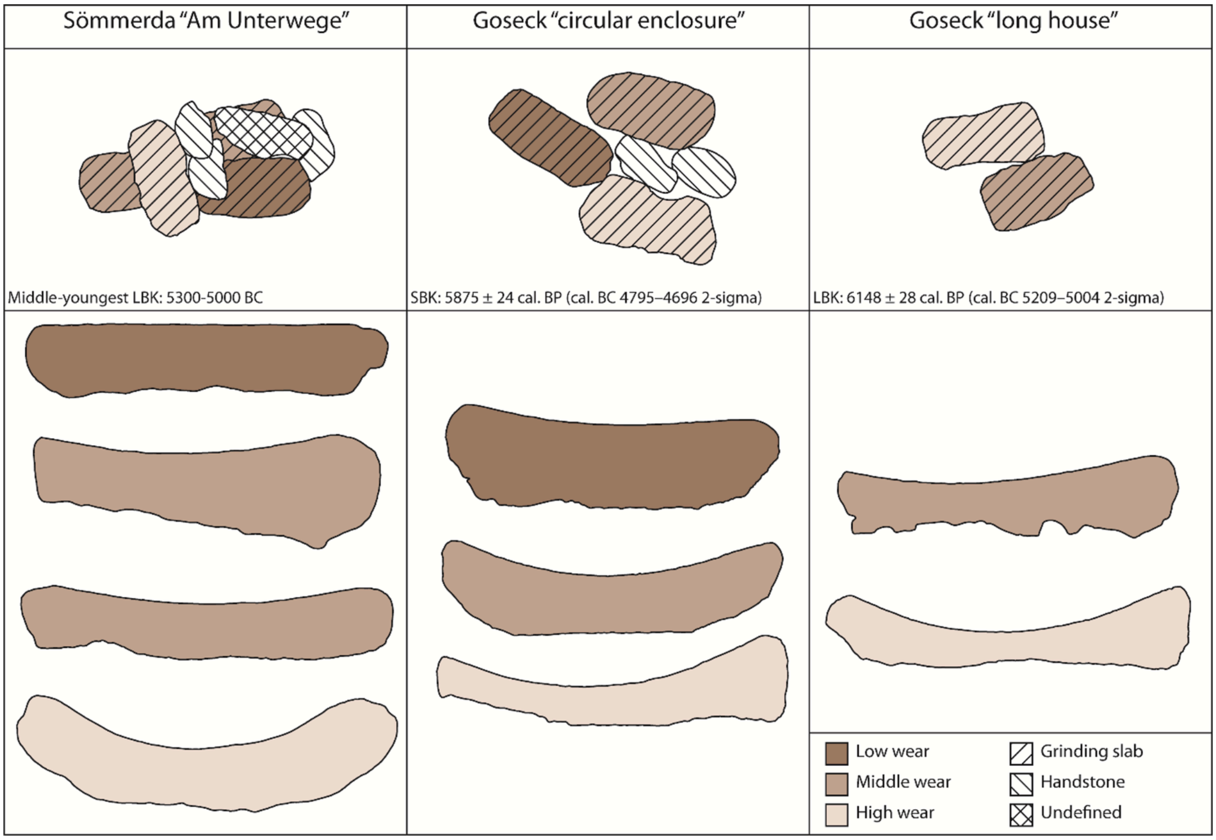

Fig. 12. Different states of wear of the grinding slabs in the deposits of Central Germany, as manifested in the transversal sections. E. Zamzow.

communities.

The varying degree of wear of the tools, which provides direct insight into their use-life, has also not been documented adequately or considered in the interpretation of the deposits. Noticeably, in Sömmerda and in the younger deposit from Goseck, some tools were almost new, some were withdrawn from the domestic context in the middle of their life-span, and others were almost completely worn out, nearing the end of their use life. Here, the biography of the objects is reflected, even in matching pairs (Fig. 12).

This techno-functional aspect encapsulates the time invested in the provision of the adequate raw materials, the manufacturing and curating the tools, and the grinding of food, and expresses the high value of these artifacts and the significance of their deposition. From this perspective, the object's biography, through its production, use, reworking, until its deposition, can be compared to the human life in terms of birth, life, and death. Symbols of fertility, regeneration and decline are also evident in the products processed by these grinding tools, most likely cereals, as they are tied to the agricultural cycles of sowing, growth, and harvest. Finally, their placement near landmarks or settlements connects them to rituals involving the founding, changing, or abandoning of these permanent structures, reflecting the Neolithic agrarian way of life. This has already been suggested based mostly on contextual rather than techno-functional evidence (Fendin 2000, 91–95, 2006, 161; Brück, 2001 63–66; Hamon 2008b, 47; Graefe et al., 2009, 93–94; Watts 2012, 19-21).

The reference to life cycles suggests that the underlying notion of the grinding stone deposits was time, in relation to the day, the year, the lifetime of human individuals, and the use-life of the tools themselves. The symbolic significance of these artifacts regarding the concept of time can be summarised as follows:

- Representation of the day: the use and maintenance of the grinding stones for grinding grain in the domestic context depicts the basic, daily tasks in the Linear Pottery culture longhouses and settlements.
- Representation of the year cycle: The three stages of wear observed on the grinding stones are understood in the form of the recurring rhythm of sowing, growth, and harvest. Moreover, the orientation and location of the tools supports their connection to the agrarian cycles: in the Goseck solar observatory, the deposit with human remains looks into the circular enclosure through the gate that marks the sunrise on the summer solstice.
- Reflection of human life cycles: The biographies of individuals are represented in the grinding tools through their degree of wear seen as an allegory of birth, life, and death. In addition, they can symbolize a group, as they are often closely associated with a person and then passed down from generation to generation, representing children, parents, and grandparents through the selection of new, in-use, and almost worn-out artifacts.
- Reflecting settlement cycles: The course of production of these tools, the total duration of their use-life, and their final deposition can also be transferred to houses and settlements, referring to their three stages from founding through occupation and final abandonment.

6. Conclusions

Through the techno-functional and contextual analyses of three grinding stone deposits discovered in Central Germany we have shown that the depositions of grinding tools were highly complex symbolic acts, probably closely reflecting the passage of time and a valuing of the tools, their users, and the processed materials. This is particularly evident in the deposits of Sömmerda and Goseck, where the arrangement of the tools and their varying stages of wear exhibit striking similarities. The significant value attributed to these tools is reflected in the considerable labor invested in their production, curation, and daily use in cereal processing. Depositions can vary in terms of the number of tools and their arrangement, yet they appear to be part of a shared practice among the earliest agricultural communities in Central and Western Europe concerning grinding stones and their significance. Although it is not possible to establish a final interpretation of the symbolic behaviour in past communities, the change of the objects as well as subjects in time emerges as the underlying principle behind grinding tools deposits. More detailed techno-functional analyses of grinding tools along the methodological lines proposed in the present study are required to confirm this interpretation.

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CRediT authorship contribution statement

Erik Zamzow: Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Marina Eguíluz Valentini:** Writing – review & editing, Visualization, Methodology, Investigation, Formal analysis, Data curation. **Mario Küßner:** Writing – review & editing, Resources, Investigation, Funding acquisition, Formal analysis, Data curation, Writing – review & editing. **Roberto Risch:** Writing – review & editing, Supervision, Resources, Methodology, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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