

METAALTIJDEN 13

BIJDRAGEN IN DE STUDIE VAN DE METAALTIJDEN



REDACTIE:

S. ARNOLDUSSEN, R. DE LEEUWE, E. NORDE & N. DE VRIES

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Deze 13e metaaltijdenbundel wordt opgedragen aan Hannie Steegstra, die in juni 2026 overleed. Al sinds de jaren '90 werkte zij – eerst samen met Jay Butler, later met Stijn Arnoldussen – aan het publiceren van de bronstijdvoorwerpen van de Lage Landen. Zij had een grote kennis van de artefacten en was een virtuoos tekenaar ervan. Ze heeft vele publicaties over de Nederlandse bronstijd mogelijk gemaakt.

This 13th volume of 'Metaaltijden' is dedicated to the memory of Hannie Steegstra, who passed away in June 2026. Since the 1990s, she worked – first with Jay Butler, later with Stijn Arnoldussen – on publishing the Bronze Age bronzes of the Low Countries. She possessed extensive knowledge of the artefacts and could draw them brilliantly. She made many publications on the Dutch Bronze Age possible.

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Inhoudsopgave

Verbindingen leggen. Van object tot cultuurlandschap in de metaaltijden	7
<i>Stijn Arnoldussen, Roosje de Leeuwe, Eric Norde & Nynke de Vries</i>	
Making connections. From object to cultural landscape in the Bronze Age and Iron Age	11
<i>Stijn Arnoldussen, Roosje de Leeuwe, Eric Norde & Nynke de Vries</i>	
Graanopslag in door brand verwoeste gebouwen uit de vroege/midden-ijzertijd te Weert-Laarveld	17
<i>Corrie Bakels & Damiën Duivenvoorden</i>	
Where do they come from? Provenance of sods used in burial mounds at the Lommel-Blekerheide urnfield (Belgium)	23
<i>Miel Schurmans, Hardy Rutten, Oda Nuij, Ferdi Geerts & Koen Hebinck</i>	
Wreaths of <i>Juniperus communis</i> in the coastal areas of the Netherlands	37
<i>Rik Semeijn</i>	
Keramische armbanden uit de ijzertijd in Nederland. De schaarse imitaties van stenen armbanden	49
<i>Peter W. van den Broeke</i>	
De gouden armbanden van Hijkersmilde (Dr.) en hun context	65
<i>Wijnand van der Sanden</i>	
Late Iron Age split cotter pins of Kessel type. Distribution and interpretation	79
<i>Stijn Arnoldussen, Margot Daleman & Tim Zijlstra</i>	
Een brandgraf met een scheermes en een speld te Echt-Kelvinweg (Echt-Susteren, prov. Limburg)	93
<i>Francies M.J. Delporte & Eugène Warmenbol</i>	
Getting to the core of it. Minimally destructive sampling of Dutch Bronze Age artefacts	105
<i>Stijn Arnoldussen, Liesbeth Theunissen, Bertil van Os, Stephen W. Merkel, Judith van der Leije, Joris J. Brattinga, Luc W.S.W. Amkreutz, Bibi Beekman, Irini Biezeveld & R. Alan Williams</i>	

Variatie als norm. Het grafritueel in West- en een deel van Oost-Vlaanderen. Resultaten van het syntheseonderzoek naar de vroeg La Tène occupatie ten westen van Leie en Schelde	139
<i>Tina Dyselinck, Ron Bakx, Bert Mestdag, Peter Hazen & Guy De Mulder</i>	
Een verdeelde bronstijdmens. Over een herontdekte bronstijdurn uit Bergeijk-Bergerheide	149
<i>Liesbeth Theunissen</i>	
Een op de kop begraven 'Hilversum-pot' uit Bennekom-Panoramaweg/Mosweg (gemeente Ede)	167
<i>Ivo Hermesen & Gerben Zielman</i>	
Verbrandingssporen op ijzertijdaardewerk. Tussen ritueel en afval	179
<i>Paul van den Helm & Dean Mepschen</i>	
Not as dull as ditchwater. Dating and function of two Iron Age rectangular ditch systems in Veldhoven-Oerle	193
<i>Anne van Hilst, Joris Aarts & Menno Dijkstra</i>	
De waarde van NAP. Hoogteligging als sleutel tot bewoning op het veen in Zeeland?	205
<i>Juanita Kiburg</i>	
Auteursgegevens	217
Lezercommité 2026	221

Where do they come from?

Provenance of sods used in burial mounds at the Lommel-Blekerheide urnfield (Belgium)

Miel Schurmans, Hardy Rutten, Oda Nuij,
Ferdi Geerts & Koen Hebinck

Keywords: urnfield, burial mounds, sods, grain size, pollen

Introduction

During the Late Bronze Age and the Early Iron Age, the urnfields in the Meuse-Demer-Scheldt region, as part of the Lower-Rhine-Basin, consisted primarily of burial mounds over cremation graves, complemented to a lesser extent by flat graves (Roymans & Kortlang 1999, 42-43; Gerritsen 2003, 125). When preserved, it can be observed that these mounds were constructed either from sand extracted from the surrounding ditches or from (heather) sods (Louwen 2021, 11). Such sods and the old surfaces of the palaeosols below the barrows have been analysed for their pollen content to investigate the natural environment in which the burial mounds were constructed and the sods were cut from (Doorenbosch & van Mourik 2016, 313; e.g. Van Zeist 1967, Doorenbosch 2013, Meylemans *et al.* 2017, 15-16), although in the Low Countries their provenance has only rarely been a subject of research (e.g. Doorenbosch 2013, 35). Mostly it has been assumed that they were cut close to or in the surroundings of the burial mounds themselves (Doorenbosch 2013, 77), as their construction is presumed to have required considerable labour investment (Hissel 2012, 113). In several Danish studies, the local provenance of the sods has been demonstrated by grain size analyses (e.g. Breuning-Madsen & Holst 1995, 83-84; Holst, Breuning-Madsen & Olsson 1998, 50; Breuning-Madsen & Dalsgaard 2013, 229).

In this article, we aim to assess the provenance of sods in three burial mounds from the urnfield Lommel-Blekerheide, drawing primarily on grain size analysis, complemented by pollen analysis and pedogenetic features.

The urnfield Lommel-Blekerheide

Location and landscape

The urnfield Blekerheide is situated in the north of the municipality of Lommel (Belgium), close to the border of the Netherlands (fig. 1), in the Campine area, the southern part of the Meuse-Demer-Scheldt region, a region rich in burial sites of the Late Bronze Age and the Early Iron Age (Gerritsen 2003, 118). The site lies on a small (250 m wide), Late Pleniglacial/Late Glacial coversand ridge (45 – 47 m TAW, Belgian reference level), near the stream valley of the Klachtloop, an anthropogenic watercourse excavated in a landscape originally presumed to have constituted a flow-through-fen (Schurmans & Geerts in prep.). As a transitional zone between these geomorphological units lie undulations in terrace deposits mantled by aeolian cover sand (hereafter referred to as the flank) and associated slopes (fig. 2). The southern and western sections of the coversand ridge are consistently overlain by a Late Glacial dune complex, clearly visible in a section of the Digital Elevation Model of Flanders (DHM II) (fig. 3 and 4), with dune summits reaching elevations of approximately 52 m and 49 m TAW, respectively. The identified burial mounds are situated on the coversand ridge near the edges of the dunes, as well as on the slopes of the dunes themselves (fig. 2 and 3).

From at least the late Middle Ages onward, the area can be characterised as heathland, until gradual afforestation with pine began at the end of the 18th century, eventually resulting in a pine forest of approximately 72 ha by the early 20th century. At the end of the 18th century and the beginning of the 19th century loam was extracted for brick production, which resulted in an elongated depression (fig. 2). Cart tracks – dating from the period before the afforestation – run from southeast to northwest through the urnfield (fig. 3).

Discovery, robbery and initial research

The site was discovered during deforestation and subsequent ploughing in 1972. Afterwards, the urnfield was plundered using probing rods and shovels. The local heritage society acted swiftly, and through police intervention, the robbed objects (pottery, metal and cremated remains) were (partially?) retrieved. However, it was not possible to assign them to specific mounds or graves. The local heritage society conducted a field survey and a series of small-scale excavations in 1972 and 1973. During the survey, some pottery sherds and flint were found in the central and northern parts of the coversand ridge, indicating the possible presence of an Iron Age settlement as well as earlier occupation (fig. 2). In the surroundings, some flint tools (Mesolithic and Neolithic) were found (fig. 2). Subsequently, the site received no further attention. Today, the area is covered by a pine forest, intersected by (largely neglected) firebreaks.

Research 2017-2024

The municipal archaeological service of Lommel (Erfgoed Lommel) conducted small-scale field research at the site, primarily to identify the burial mounds and to assess their state of preservation through coring and limited trial trenching, with the aim of establishing a protection programme. Three mounds (H1, H2 and H4) – lying on the presumed edge of the urnfield – were documented through trenching, six (H7, H8, H10, H13, H15 and H16) were identified (recognisable sod stratification) by coring and another two (H5 and H17) are

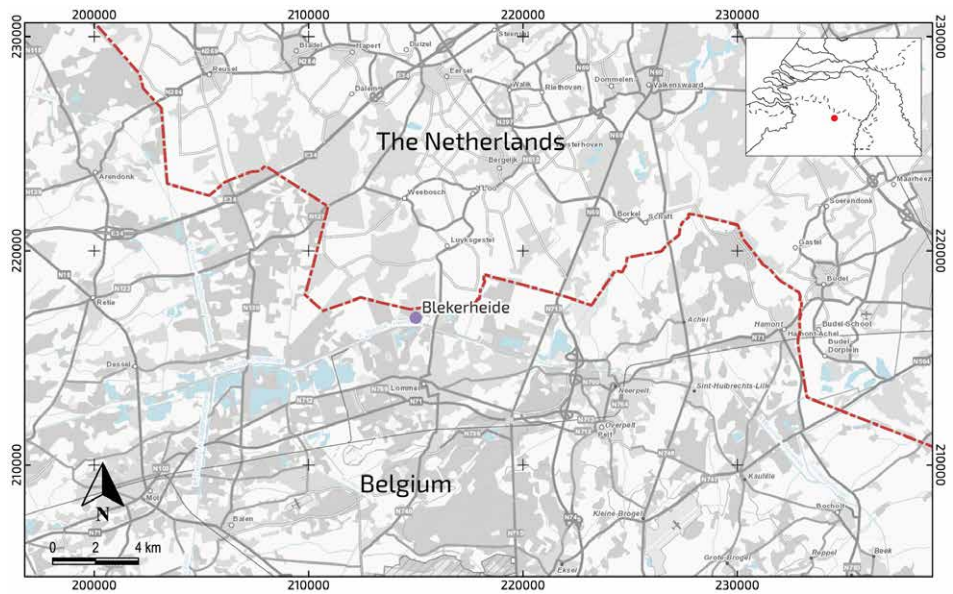


Figure 1. Overview map showing Lommel in the Belgium-Netherlands border region and the location of the Blekerheide urnfield (reference system: EPSG: 31370). Source: NGI.

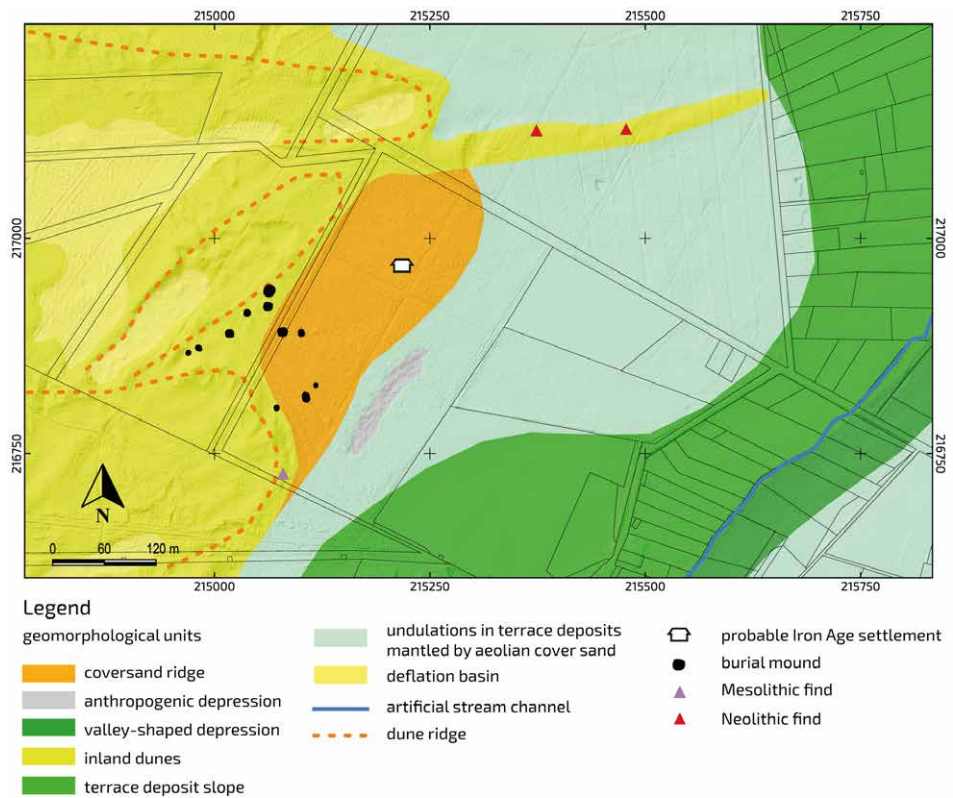


Figure 2. Geomorphological map with DHM II overlay, indicating burial mounds, the probable location of an Iron Age settlement, and the locations of Mesolithic and Neolithic finds (source DHM II: Geopunt; reference system: EPSG: 31370).

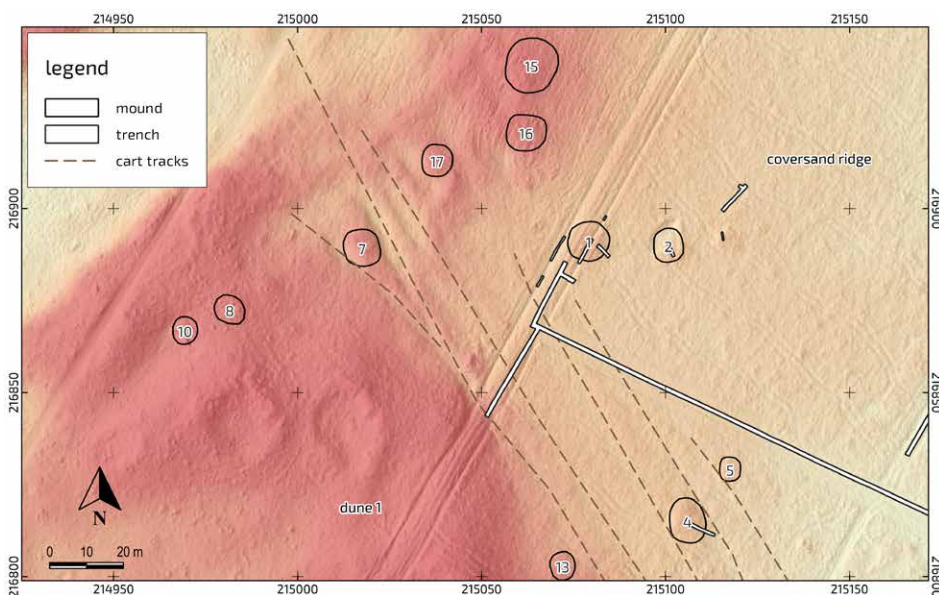


Figure 3. Burial mounds and trial trenches on a section of the DHM II (source DHM II: Geopunt; reference system: EPSG: 31370).

considered probable burial mounds based on coring data (fig. 3). Thus, a total of nine – and possibly eleven – burial mounds have been identified, which is presumed to represent a minimum number. In this area, numerous elevations occur, of both natural (sand drifts) and anthropogenic origin, and it was not feasible to investigate all of them.

The trenches (width: 1 m) were excavated (mechanically and manually) from outside the mounds toward near the estimated centre. Mound H1 is intersected by a ditch flanking a firebreak through the forest. The ditch was used as a trench, but because initially this didn't produce a clear profile, a second trench perpendicular to the first was excavated.

The (estimated) diameter of the mounds ranges from 6 m to 11 m, but one mound (H15) appears to be significantly larger, with a diameter of approximately 15 m. The measured remaining heights of mounds H1, H2, and H4 range from 50 to 56 cm; however, the preserved (intact) height of these features is limited to only 12 to 26 cm. The upper layers have been disturbed by forestry activities, notably the ploughing of the area in 1972 after tree felling. An intact podzol underlies each of the three burial mounds (H1, H2 and H4). The relatively good preservation of two (H1 and H4) of the three investigated mounds made it possible to identify different pedogenetic layers in (most of) the sods indicating podzol origins. The third mound (H2) not only had been robbed, a substantial part of it was removed during the research conducted by the local heritage society in 1972/1973, leaving only a small section with a maximum height of 12 cm undisturbed. In total, a limited number of 29 sods could be distinguished.

The urnfield can be dated to the end of the Late Bronze Age (9th century BCE) and the Early Iron Age, based on ceramics from the graves and on radiocarbon dates (RICH-36577: 2702 ± 29 BP and RICH-36579: 2656 ± 29 BP) obtained from cremated remains (Schurmans & Geerts in prep.). Recently performed pollen analyses date the mounds H1, H2 and H4 and sods to the transition from the late Subboreal to the early Subatlantic, which coincides with

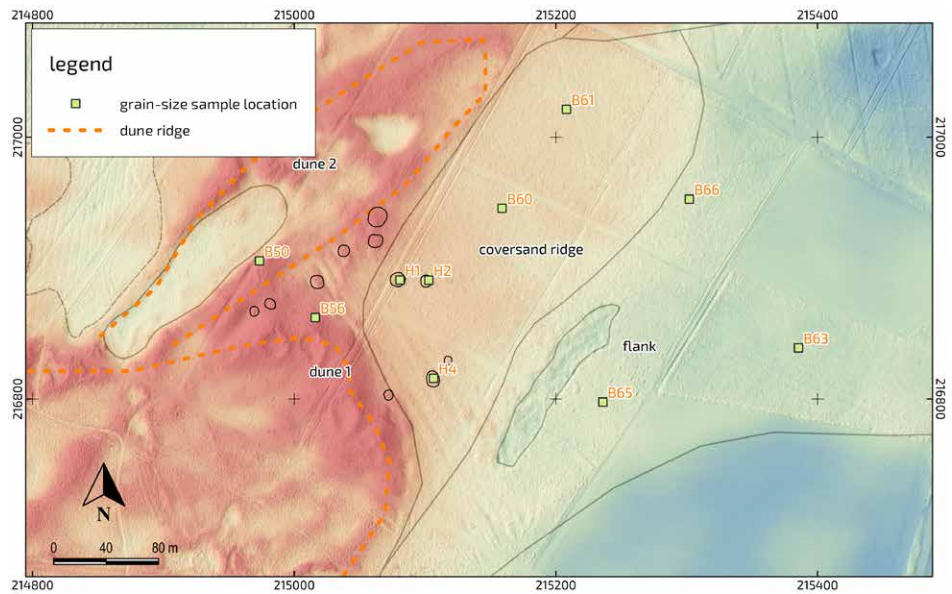


Figure 4. Locations of the grain size samples on a section of the DHM II (source DHM II: Geopunt; reference system: EPSG: 31370).

the Late Bronze Age to Early Iron Age and thus corresponds well with the archaeological evidence (Nuij 2026).

Material and methods

During field work, samples for pollen analysis and grain size determination were collected from the pedogenetic layers of the sods and from the underlying palaeosol, classified as a (humus)podzol, beneath the mounds (fig. 5). To establish a reference framework for the grain size analysis, additional samples were taken from the surrounding geomorphological zones of the study area in profile pits, including the coversand ridge, Late Glacial dunes and the flank of the ridge (fig. 3). In total, 40 grain size samples were analysed, of which seventeen are included in this study (appendix 1). To allow a meaningful comparison, only samples from the C horizon of both the palaeosol and the sods were selected. An exception occurs in mound H2, where the C horizon of the sods could not be sampled: here, the comparison relies on the A horizons of the sod and the palaeosol. Excluded from this study are samples from deeper terrace deposits, other pedogenetic horizons (A, E, B and BC) of the palaeosol and of the sods from the burial mounds H1, H2 and H4, and the filling of the ring ditch of mound H4.

The sand samples are assigned a unique laboratory identification number and subsequently dried. The initial step involves quantifying the clay content, defined as the mass percentage of the <25 µm fraction. Approximately 100 g of the sand sample is then transferred into a solution of Na₄P₂O₇ (sodium pyrophosphate) to disperse the clay particles. Dispersion is done by heating the suspension while continuously stirring. Following the heating phase, the suspension containing the dispersed clay particles is removed by wet sieving through a 25 µm mesh. After drying the remaining coarse fraction, the difference between the initial dry mass and the final mass yields the clay content. Grain size analysis of the residual fraction is performed using a shaking tower. The dried sample is placed in a sieve tower (sieve stack) composed of sieves



Figure 5. Sections of burial mounds H1 (a) and H4 (b).

Sod type	Mound					
	H1		H2		H4	
	n	%	n	%	n	%
A-C	11	61.1	1	50	6	66.7
A-AE-BC	-	-	-	-	1	11.1
A-AE-C	1	5.6	-	-	-	-
A-E	2	11.1	1	50	1	11.1
A-E-B	1	5.6	-	-	-	-
A-EB	-	-	-	-	1	11.1
A-AE	2	11.1	-	-	-	-
A	1	5.6	-	-	-	-
Total	18		2		9	

Table 1. Pedogenic horizons in the recognisable sods.

arranged in order of decreasing mesh size from top to bottom, with a collecting pan at the base. Particle separation is achieved by means of a mechanical shaker that imparts vertical and multidirectional vibration, analogous to manual sieving. The shaking time and amplitude are set according to standardised laboratory protocols.¹ Upon completion of the sieving cycle, the mass retained on each sieve is determined. The grain size distribution is then expressed as the percentage mass fraction corresponding to each sieve aperture.

The pollen samples (eleven) were subsampled to 1 ml and prepared into permanent slides according to standard methods, with sieving over 200 µm, HCl and KOH treatment for the removal of calcium carbonate and humic acids, acetolysis and heavy liquid separation (Faegri & Iversen 1989). A known amount of exotic marker grains was added (Stockmar 1971). All microremains in the slides were counted under 400x magnification until the “barrow” pollen sum was reached (Doorenbosch 2013, 63-75).

Results

Characteristics of the sods

The recognisable sods, 29 in total, show minimal variation in pedogenetic layering (table 1). In the majority of these sods (62.1%), an A-C profile is visible, with the C horizon displaying incipient bleaching, indicating an early phase of podzolisation (van Breemen & Buurman 2002, 266 fig. 11.2). The palaeosol beneath the mounds H1, H2 and H4 exhibits a more advanced stage of podzol development, characterised by the formation of E-, B- and BC horizons. This demonstrates that the environmental conditions necessary for the development of a podzol were present at the time. The absence of such features in the A-C sods suggests that they were cut in an area from which the original sod layer had already previously been removed.

Grain size distributions of the geomorphological units

The grain size distributions for all sampled geomorphological units (dune, coversand ridge and flank) demonstrate that the dune and flank sediments form internally coherent groups.

1 NBN EN 933-1:2012: Tests for geometrical properties of aggregates – Part 1: Determination of particle size distribution – Sieving method.

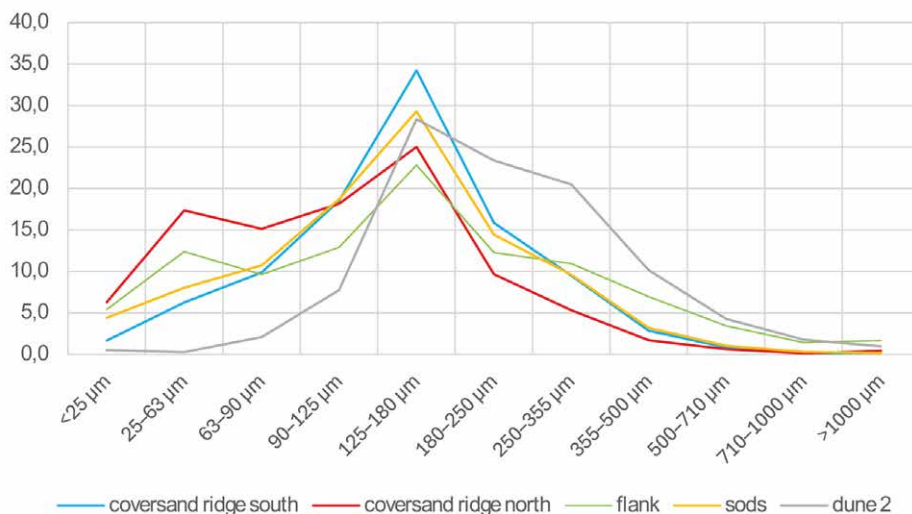


Figure 6. Mean grain size distribution for the different geomorphological units and the sods.

In contrast, the coversand ridge clearly separates into two distinct subunits, corresponding to a coarser, less silty southern part and a markedly finer, loam rich northern part (fig. 6). In general there is a fining in the sediment from the south to the north of the coversand ridge, with a rather abrupt change on the location of mound H2, a change that is solely reflected in the C horizon and not in the A horizon. The mean grain size curves reflect these differences (fig. 6). The dune sediments display a well-sorted, coarse, unimodal distribution with a pronounced maximum in the 180-250 µm fraction (fig. 6). The southern part of the coversand ridge shows a similarly sharp but slightly finer peak, whereas the northern part exhibits a substantially finer texture overall, characterised by elevated silt contents and a broader, less distinct modal maximum. The flank of the coversand ridge represents an intermediate sediment type: its finer fractions fall between those of the northern and southern parts of the coversand ridge, while its coarser fraction is enriched, probably reflecting reworked material from deeper terrace deposits.

Provenance of the sods

The pedogenetic characteristics of most sods (A-C profile) indicate that they were cut in an area that had previously been stripped of its sod cover. The purpose of the earlier sod removal remains uncertain, although mound construction is the most likely explanation. It must additionally be noted that an intact podzol underlies each of the three burial mounds (H1, H2 and H4). Since mounds H1, H2 and H4 are located at the edges of the urnfield, it is unlikely that sods were cut directly adjacent to the mounds for their construction; such a practice would have resulted in sod-stripped areas beneath later mounds, which seems not to be the case.

Based on the grain size distribution (fig. 6), the dunes can be excluded as the origin of the sods, since their proportions in the finer and coarser fractions differ significantly. By the same token, the northern part of the coversand ridge and the flanks can be dismissed as possible extraction areas. Although containing a slightly higher proportion of the finest parts, the sods mostly resemble the southern part of the coversand ridge, indicating this area as the most probable location of origin, bounded by the dunes and the terrace-deposit undulations (flanks). The area measures c. 10,000 m², but it contains the major

part (c. 5,000 m²) of the urnfield's final extent. Based on observations of the local heritage society in 1972/1973, burial mounds and graves were present between mounds H4 and H1, eliminating almost half of the designated area for the provenance of the sods of mounds H1, H2 and H4, under the assumption that sods were not cut in open spaces within the urnfield. This appears to be confirmed when only the finest fractions (<25 µm) are considered. When focusing solely on these fractions, the sods are comparable with the flank and the northern part of the coversand ridge. When the AGS is taken into account, the sods align more closely with the values from the southern part of the coversand ridge and the flank.

Pollen samples from the palaeosol surfaces (four samples) below the mounds H1, H2 and H4, and of the old surfaces of sods (six samples) used to construct these mounds, contain mainly pollen from trees, heather and some grass and are similar to other barrow pollen spectra from the Campine area. There are small but notable differences between the samples from the palaeosols and the sods (Nuij 2026). The old surfaces have higher tree pollen percentages than the sods, indicating the heathland the barrows were built on, was smaller or located closer to the forest's edge than the heathlands the sods were cut from. Secondly, the pollen content of the sods reflects some human activity with very low percentages of cereals (barley or wheat) and the ruderals mugwort (alsen), corn spurry and nettle. These are completely absent from the palaeosol surfaces. This suggests the heaths the sods were cut from, were visited or used more intensively by humans. It goes too far, however, to interpret them as former, abandoned arable land turned into heathland. The concentration of microcharcoal is moderate to high in both the sods and the palaeosols, indicating both heathlands were managed by fire alongside sod cutting and probably grazing. Other local differences in environmental conditions possibly linked to grain size, like soil moisture, nutrient level or loam content could not be reconstructed by pollen analysis because the samples lack clear indicators for that.

Taken together, these observations (grain size, pollen and pedogenetic features) indicate that the sods were most likely sourced beyond the limits of the burial ground, within the southern part of the coversand ridge. Based on the current study, however, it cannot be established whether this represents a deliberately designated zone for sod-cutting.

Discussion

The grain size analyses, combined with pollen analyses and pedogenetic observations, provide insights into the provenance of the sods used in the construction of three burial mounds at Lommel-Blekerheide. Grain size analysis has been used in earlier studies, for example at Lejrskov and Tårup in Denmark, where similarity in grain size revealed that the soil used for the mounds was extracted in the immediate vicinity of the mounds (Breuning-Madsen & Holst 1995, 83-84; Holst, Breuning-Madsen & Olsson 1998, 50). For the Late Bronze Age burial mound at Seddin (Germany), similar analyses show that the soil was taken from the surrounding glaciofluvial deposits (Nykamp *et al.* 2021, 12). At Skelhøj (Denmark), a comparison was made between the mound itself and the palaeosol beneath, not only regarding grain size and chemical components (Breuning-Madsen & Dalsgaard 2013), but also plant macrofossil remains (Karg 2008). These analyses showed a provenance of the sods in the vicinity of the mound. Whereas the Danish and German studies mainly focussed on the texture (and chemical composition) of the soil, in the Netherlands comparisons between sods and palaeosol have been done primarily by pollen analysis. For several sites, this has led to the conclusion that the sods were harvested in the same vegetational environment as

the mounds (e.g. Doorenbosch 2013, 110; 194). Moreover, in the case of Apeldoorn-Echoput, pollen and textural composition were used. The presence of gravel within the sod sediments indicated a very local origin, as gravel only occurred on the ice-pushed ridge on which the mounds were constructed (Van der Linde & Fontijn 2011).

The present study incorporates a systematic reference set of grain size from the surrounding geomorphological units, which is absent in the above mentioned studies, allowing more precise exclusion of potential source areas.

Finally, repeated sod removal has also been identified at Skelhøj on the basis of sod features, where it is interpreted as the final phase of land use associated with mound construction (Karg 2008, 47; Lewis & Hart 2022, 227). A comparable function can be attributed to the extraction zone for the sods used in constructing mounds H1, H2 and H4 at Blekerheide.

Conclusion

The combined grain size, pollen and pedogenetic analyses provide a coherent picture of the provenance of the sods used in the construction of three burial mounds at the Blekerheide urnfield. The sods do not originate from the Late Glacial dunes or from the finer, loam-rich northern part of the coversand ridge, but instead most closely resemble the coarser sands of its southern portion. Pollen data confirm that all sods derive from a heather-dominated landscape, while subtle differences in arboreal pollen indicate that they were harvested slightly further away from trees than the mounds. The pedogenetic structure of the sods, particularly the dominance of simple A – C profiles, demonstrates that the extraction area had been stripped of its sod cover before. These analyses and observations (grain size, pollen and pedogenetic features) indicate that the sods were most likely sourced beyond the limits of the burial ground, within the southern part of the coversand ridge. On the basis of the present investigation, however, it is not possible to determine whether this concerns a zone that was especially (or exclusively?) chosen for cutting sods.

Taken together, the results show that provenance studies combining grain size, pollen and soil observations can meaningfully narrow down the origin of sods used in prehistoric mound construction, even if the exact extraction location cannot be determined. The Blekerheide case thus provides an important methodological and interpretive contribution, highlighting the complexity of sod-based barrow construction and the likelihood that such practices involved organised, spatially delimited management of heathland resources. Future research will be essential to determine whether the patterns observed at Blekerheide represent local practice or a broader tradition within the Meuse-Demer-Scheldt region.

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Appendix 1

sample location	sample nr.	layer	context
B50	M42	C horizon	dune 2
B56	M49	C horizon	dune 1
B60	M55	C horizon	coversand ridge
B61	M57	C horizon	coversand ridge
B63	M60	C horizon	undulations in terrace deposits mantled by aeolian cover sand
B65	M65	C1 horizon	undulations in terrace deposits mantled by aeolian cover sand
B66	M67	C1 horizon	undulations in terrace deposits mantled by aeolian cover sand
H1	M6	C horizon	coversand ridge
H1	M24	C horizon	sod
H1	M25	C horizon	sod
H1	M26	C horizon	sod
H2	M19	A horizon	coversand ridge
H2	M21	C horizon	coversand ridge
H2	M38	A horizon	sod
H4	M29	C1 horizon	coversand ridge
H4	M33	C horizon	sod
H4	M36	C horizon	sod

Context of the grain size samples. H = mound (trench); B = soil profile pit.

Appendix 2

Sample	<25	25-63	63-90	90-125	125-180	180-250	250-355	355-500	500-710	710-1000	>1000	AGS
M6	1,9	6,9	10,1	18,0	33,4	15,6	9,4	3,2	1,0	0,2	0,4	171
M19	2,5	8,9	10,2	17,9	27,7	15,8	10,8	4,3	1,5	0,4	0,0	174
M21	6,9	14,4	13,5	18,2	25,6	10,9	6,2	2,1	0,8	0,3	1,0	155
M24	5,1	8,1	10,6	17,7	29,8	15,2	9,4	2,9	1,0	0,3	0,1	167
M25	3,9	8,7	12,1	20,0	28,4	13,2	8,9	3,0	1,0	0,5	0,2	164
M26	4,2	6,2	9,5	16,9	31,2	16,4	10,5	3,7	1,2	0,3	0,0	175
M29	1,5	5,6	9,7	19,1	35,1	16,2	9,6	2,5	0,7	0,1	0,0	165
M33	4,1	7,3	10,3	19,7	28,9	14,4	10,1	3,4	1,2	0,4	0,5	174
M36	4,7	9,8	11,2	19,4	28,1	13,2	9,1	3,1	1,1	0,2	0,2	162
M38	5,1	10,3	12,0	17,4	28,2	13,7	8,2	3,1	1,1	0,1	0,9	168
M42	0,5	0,3	2,1	7,8	28,4	23,4	20,5	10,2	4,3	1,8	1,0	263
M55	5,6	18,2	16,2	18,1	25,4	9,0	5,0	1,5	0,6	0,1	0,2	131
M57	6,4	19,5	15,7	18,3	24,0	9,1	4,7	1,5	0,6	0,1	0,1	128
M60	4,5	8,3	7,9	12,7	23,0	14,7	13,9	8,5	4,2	1,3	1,0	226
M65	5,7	18,0	12,4	14,0	24,1	10,6	6,9	4,3	2,2	1,0	0,8	171
M67	6,1	10,9	8,5	12,1	21,3	11,6	12,1	8,1	3,9	2,0	3,3	247

Sample	<63	63-90	90-125	125-180	180-250	250-355	355-500	500-710	710-1000	>1000	AGS
M49	1,9	1,4	5,6	23,9	23,2	22,7	11,6	5,3	2,2	2,2	293

Grain size distribution of the sods, coversand ridge, dunes and flank. Results of the grainsize analyses in μm . The context (geomorphological unit or sod) is symbolised by the background colour. AGS = Average Grain Size.

