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The prehistoric pottery from Melsele Hof ten Damme (East Flanders, BE)

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1. Introduction

The prehistoric site of Melsele Hof ten Damme is located in the lower Scheldt river basin, about 700 m west of the current left bank of the Scheldt (Fig. 1). It used to be situated, however, on a Pleistocene coversand ridge bordering a fossil channel of this river. The site was excavated over an area of 100 m², first by ADW (= Archeologische Dienst Waasland, currently Erfpunt) in 1984-86 and later in 1990 by the University of Illinois, ADW and RBINS (= Royal Belgian Institute of Natural Sciences) (Van Roeyen & van Berg, 1989; van Berg *et al.*, 1991, 1992; Van Roeyen *et al.*, 1992). The excavations yielded thousands of lithic artefacts, potsherds, botanical and faunal remains, belonging to several Mesolithic and Neolithic occupations on top of the ridge. Apart from brief discussions in post-excavation publications (*ibidem*), the lithic and ceramic artefacts have never been fully studied or reported.

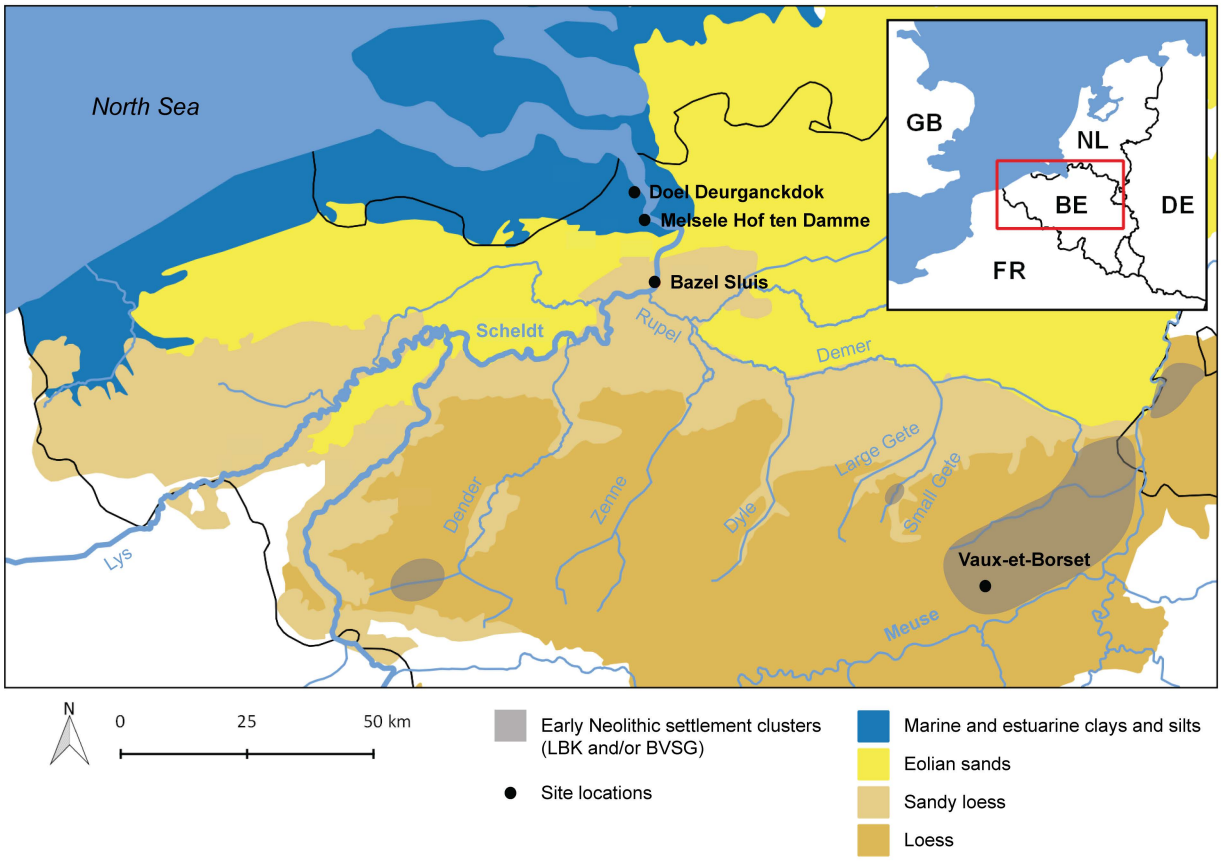

Fig. 1 – Map of the current Scheldt river basin, with the locations of Melsele Hof ten Damme (51°15'01" N, 4°17'40" E) and other sites mentioned in the text.

Melsele Hof ten Damme is located between and at short distance from the prehistoric sites of Doel Deurganckdok (6 km) and Bazel Sluis (13 km). The four sites at Doel represent spatially separated Swifterbant Culture and Middle Neolithic occupations situated on top of Late Glacial coversand dunes in the Scheldt floodplain (e.g. Crombé, 2005; Crombé *et al.*, 2009). Although remains of Final Palaeolithic and Early Mesolithic occupations were found as well, there is little intermixing between artefacts from different periods (Messiaen, 2020). The sites of Bazel and Melsele, on the other hand, are palimpsest sites with mixed remains of several Mesolithic and Neolithic occupations. The latter mainly seem to date to the 5th to early 4th millennium cal BC (Van Strydonck *et al.*, 1995; Crombé *et al.*, 2015a; Meylemans *et al.*, 2016). These transitional sites are key to understanding the neolithisation process in the Scheldt river basin. Recently, all pottery from Doel, Bazel and Melsele was studied within the framework of doctoral research at Ghent University (Teetaert, 2020). The current paper discusses the results of typo-technological and petrographic analyses of the pottery from Melsele Hof ten Damme.

2. The site of Melsele Hof ten Damme

2.1. Stratigraphy and features

The prehistoric site is situated on top of a Pleistocene sand ridge. In the upper *ca.* 30 cm of the Pleistocene sand, a humiferous horizon developed, which was completely homogenised as a result of bioturbation (Fig. 2:3). To the north, the coversand ridge steeply slopes towards a former channel. Against this slope, a complex of peaty, sandy and clayey alluvial sediments were deposited (Fig. 2:5-6). This occurred between *ca.* 5300 and 5000 uncal BP, during a period of increased fluvial activity in the lower Scheldt river basin (Van Strydonck *et al.*, 1995; also see Crombé *et al.*, 2015b; Storme *et al.*, 2020). Eventually, the sand ridge and prehistoric site became completely covered by peat and clayey sediments deposited by the Scheldt river (Fig. 2:7-10). Peat growth started from *ca.* 4300 uncal BP onwards in the lower-lying area and from *ca.* 4000 uncal BP onwards on top of the sand ridge (Van Strydonck *et al.*, 1995).

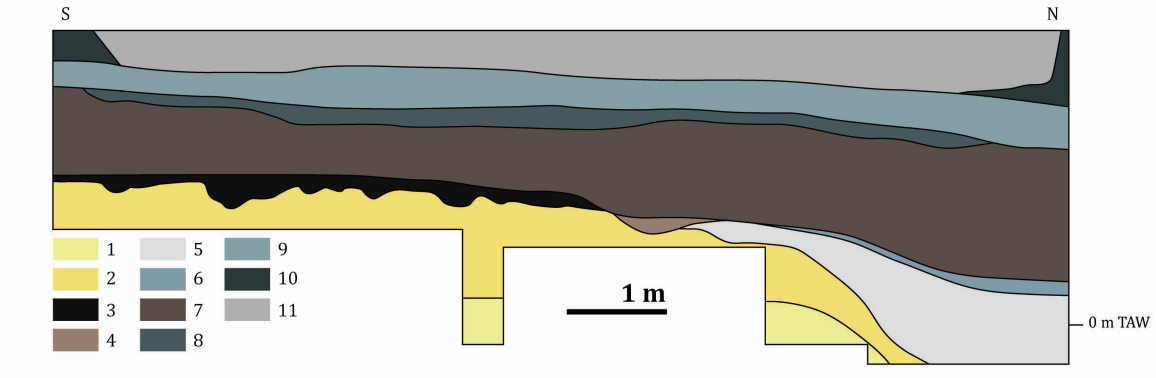

Fig. 2 – Schematic representation of the stratigraphy at Melsele Hof ten Damme. 1. Tertiary substratum; 2. Pleistocene sand; 3. Humiferous, bioturbated soil; 4. Sandy colluvium; 5. Complex of peaty, sandy and clayey strata; 6. Heavy compacted clay; 7. Peat; 8. Organic clay; 9. Slightly organic, sandy clay; 10. Sandy clay; 11. Anthropogenically disturbed clay (adjusted after Van Strydonck *et al.*, 1995: Fig. 2). TAW = mean lower water tide level in Ostend, West Flanders, Belgium.

Below the bioturbated layer, several features were observed. These include about 15 bowl-shaped pits with a homogeneous, organic-rich fill. Although part of these were first interpreted as possible hearths (van Berg *et al.*, 1992), they likely represent tree throws (Van Strydonck *et al.*, 1995; Crombé *et al.*, 1999). An anthropogenic feature was however discovered beneath the bioturbated soil during the excavations of 1990. It concerns a minimum 70 cm deep pit, the base of which was lined with bark (van Berg *et al.*, 1992: Fig. 3). It was interpreted as a possible food storage pit, that could have had a secondary use as a waste pit (*ibidem*).

Most of the artefacts were found on top of the sand ridge, where bioturbation had caused a vertical migration and mixing of artefacts and datable organic materials up to 30 cm of depth. Some materials were found in the tidal deposits against the slope and could have eroded from the top of the sand ridge (Van Roeyen & van Berg, 1989; Van Strydonck *et al.*, 1995). Finally, part of the cultural remains and ecofacts were collected from the infilling of the anthropogenic and natural features.

2.2. Material finds

Apart from charcoal, the botanical remains found at Melsele consist almost entirely of charred hazelnut shells. Although the excavated sediments were sieved, cereal grains have not been found. Thousands of burnt bone fragments were collected. The bones that could be identified belong to wild (red deer, roe deer, wild boar, beaver) and domesticated animals (cattle, sheep or goat, possibly pig) (van Berg *et al.*, 1991, 1992; Van Roeyen *et al.*, 1992).

The lithic material consists of *ca.* 14,000 artefacts. For a general overview of the lithic remains, we refer to van Berg *et al.* (1992). However, we note that these artefacts have never been fully studied. The raw materials include flint of diverse origins and quality, transported to the site in the form of pebbles or small cobbles, as well as Wommersom quartzite (5 %). In addition, a few artefacts in phtanite were recovered from the site. Most of this material fits with the Late/Final Mesolithic lithic industries in Belgium and the Netherlands (*ibidem*). The debitage was oriented towards the production of regular micro-blades and the armatures are dominated by trapezes. However, several *feuilles de gui* indicate a Middle Mesolithic component among the remains, and the presence of some Early Mesolithic material should not be excluded (pers. comm., L. Messiaen). In addition, the 1990 excavations yielded five tools that can be assigned to the Middle Neolithic. These include leafshaped points, a side scraper and a marginally retouched blade, all produced in flint from the Formation of Gulpen, which was mined during the Middle Neolithic *e.g.* at Rijckholt in Dutch Limburg (van Berg *et al.*, 1992; Vanmontfort, 2004: 275).

In addition, a number of macrolithic stone artefacts were found at the site. These have recently been studied by Messiaen *et al.* (2018). Several types of rocks are represented among these artefacts: arkosic sandstone, phyllite, quartz porphyry, granite and lyddite breccia. The first two have a primary origin in southern Belgium, but the latter three originate from the Vosges region in France. They were likely transported by the Meuse river system and collected as pebbles or cobbles in the gravel deposits of this river. The excavators also mention fragments of gabbro, a volcanic rock with an origin in the Eifel region in Germany (van Berg *et al.*, 1992). It must be noted that these artefacts cannot be assigned with certainty to a specific Mesolithic or Neolithic occupation at the site.

About 1500 potsherds were collected. The excavators originally suggested that the pottery and lithic remains from Melsele are contemporaneous, based on their similar vertical and horizontal distribution in the Pleistocene sand and their co-occurrence in the infilling of the bark-lined pit (van Berg *et al.*, 1992). However, it is clear that the site of Melsele represents a palimpsest of mixed artefacts from successive occupations and that the pottery remains do not belong to just a single Mesolithic or Neolithic group. Several researchers have since pointed to the presence of Swifterbant Culture elements among the pottery from Melsele (Vanmontfort, 2004; Crombé, 2010; Amkreutz, 2013). According to Raemaekers (1999), part of the pottery can be attributed to the Early Neolithic *Groupe de Blicquy* and Middle Neolithic Michelsberg Culture. Amkreutz (2013), finally, does not exclude a presence of Hazendonk Group, Vlaardingen Culture or Stein Group pottery at the site of Melsele Hof ten Damme.

2.3. Radiocarbon dating

A total of 15 archaeological samples have been dated by 14C dating (Tab. 1). Not all of these samples are equally reliable when it comes to dating the human occupations at

Melsele. The charcoal is retrieved from the Pleistocene sand or the transition between the sand and the covering peat (n = 5), from the tidal sediments against the levee slope (n = 1) and from windblows/tree throws (n = 4). As such, probably all of this charcoal comes from secondary positions – the materials in the Pleistocene sand were mixed and displaced by bioturbation – and cannot be related with certainty to the human activities. Moreover, an old wood effect can never be excluded for dates on charcoal. For the same reason, two dates of wood fragments should be treated with caution. Although the dated charred hazelnut shell is likely to be collected in secondary position, there is little doubt about its relation to the human activities. The bark is the only material that was certainly still *in situ*. Therefore, the three dates obtained from bark and hazelnut shell are the most reliable ones to date the human occupations at Melsele. The hazelnut shell dates between *ca.* 4700 - 4370 cal BC (2σ). The two dates of bark, when combined, allow to securely date the anthropogenic pit between *ca.* 3950 - 3650 cal BC (2σ).

Sample material	*Lab code*	*BP date*	*cal BC (2σ)*
Charcoal from windblow α	IRPA-933	9030 ± 70	8425 - 7957
Charcoal from windblow β	UtC-1351	7730 ± 110	7031 - 6392
Carbonized hazelnut from coversand	UtC-3191	5700 ± 60	4701 - 4370
Wet wood from coversand	IRPA-945	5690 ± 55	4683 - 4370
Bark from storage pit	OxA-3087	5130 ± 80	4224 - 3663
Charcoal from coversand	UtC-1352	5090 ± 80	4047 - 3656
Bark from storage pit	OxA-3092	4950 ± 80	3953 - 3541
Charcoal from windblow β	IRPA-937	4850 ± 50	3764 - 3521
Charcoal from coversand	UtC-1444	4660 ± 60	3632 - 3199
Charcoal from coversand	IRPA-934	4610 ± 60	3528 - 3102
Charcoal from gully	UtC-1430	4520 ± 100	3512 - 2919
Charcoal from transition peat/coversand	IRPA-988	4460 ± 35	3342 - 3013
Charcoal from peat base	IRPA-1040	4370 ± 65	3331 - 2885
Wood from gully	UtC-1445	4180 ± 50	2896 - 2586
Charcoal from windblow α	IRPA-938	3210 ± 60	1620 - 1311

Tab. 1 – List of AMS ^{14}C determinations of archaeological samples from Melsele Hof ten Damme (based on Van Strydonck *et al.*, 1995: tab. 2). ^{14}C calibrations are performed in OxCal v.4.4 (Bronk Ramsey, 2009) using the IntCal20 calibration curve (Reimer *et al.*, 2020).

Van Berg *et al.* (1992) indicated that pottery and lithic artefacts were found together in several of the infilling layers of the pit with bark lining. They argued that the artefacts in the infilling are contemporaneous and were dumped in the pit after its primary use as a possible food storage pit. It is not specified which pottery was found in the infilling, but the lithic artefacts are clearly of Mesolithic age and include several tools such as a *feuille de gui* (van Berg *et al.*, 1991: 38). However, the radiocarbon dates of the bark lining indicate that the pit relates to activities at the site in the early 4th millennium cal BC. Therefore, it is more likely that the pit was left open after its use and gradually filled up with sediment and (residual) material lingering on top of the sand ridge.

Overall, the excavation archive provides limited information about the distribution of the pottery remains at this site. It is not clear which pottery remains were found in the upper 30 cm of the Pleistocene sand or in the natural and anthropogenic features observed below the bioturbated soil.

3. Pottery analysis

3.1. Samples and methods

All pottery from the 1984-'86 and '90 excavations is included in this study. The pottery is highly fragmented and weathered. A few sherds could be refitted but large vessel profiles are lacking. All information with regard to the vessel shapes and pottery technology therefore is based on the often small potsherds.

Typological characteristics registered for each sherd include the type of fragment, its thickness, weight and the presence, type and organisation of decoration. For rims and bases, diameters were measured when possible. To reconstruct the pottery forming techniques, the pottery was macroscopically examined under low-angle light, to study variations in the surface topography (*i.e.* variations in thickness and texture; fracture patterns), as well as the orientation of the clay mass, pores and non-plastic inclusions visible in radial section. The interpretation of these *macrotraces* and *macrostructures* in terms of pottery forming techniques and methods is based on several ethnographic, (ethno-)archaeological and experimental reference studies (*e.g.* Rye, 1981; Livingstone Smith, 2001; Gelbert, 2003; Bosquet *et al.*, 2005; Gomart, 2014; Roux, 2016; Gomart *et al.*, 2017).

The pottery fabrics were studied in two phases. For a basic description of the fabrics, all sherds were analysed using a stereo microscope. This allowed to distinguish large fabric groups. From these groups, a total of 16 sherds were selected for petrographic analysis. The primary aim of this analysis was to identify the mineral and rock inclusions present in the pottery clays, which may provide information about the possible clay source(s) and pottery provenance (*e.g.* Quinn, 2013; Degryse & Braekmans, 2016). For this purpose, thin sections (30 µm thick) of the pottery were analysed at x40-200 magnification under plane-polarized (PPL) and cross-polarized light (XPL) using a polarizing microscope. Finally, coarse iron-rich inclusions visible in part of the Melsele pottery were analysed at the RBINS using Scanning Electron Microscopy (SEM) linked to an Energy-Dispersive Spectroscopy system (EDS).

As the pottery from Melsele has never been fully published, the current paper mainly focusses on a description of the typological and technological characteristics of the pottery, with respect to its cultural attribution. For the petrographic analysis, the most relevant results are mentioned. However, for a more detailed discussion of the applied methodology for petrographic analysis, and for the descriptions and illustrations of the pottery thin sections and petrographic groups, we refer to Teetaert (2020).

3.2. Pottery groups

The prehistoric pottery from Melsele consists of 1065 sherds (*ca.* 10 kg), including 39 rim and 1021 body fragments, four bases and a fragment of a fired clay coil. This number deviates from the almost 1500 sherds originally mentioned by van Berg *et al.* (1992), because in the current study all sherds smaller than 1 cm^2 (*ca.* 1.25 kg) were registered as pottery gravel. Such small fragments hold little information about the vessel shapes or technology and were therefore not included for further analysis.

Mesoscopic analysis allowed to identify large fabric groups in terms of temper materials. Most of the pottery is tempered with grog (75 %), followed by burnt bone (14 %) or burnt and crushed flint (11 %), both of which can be combined with grog (Tab. 2). While previous studies mention the presence of possible plant temper in part of the Melsele pottery (van Berg *et al.*, 1992; Van Roeyen *et al.*, 1992; Vanmontfort, 2004), this could not be confirmed. Plant temper was also not observed in thin section. Sporadically, however, dark voids are seen at the vessel surfaces, which probably relate to the disappearance of organic material during firing of the vessels. But in our opinion, this reflects a natural presence of plant matter in the extracted clays rather than the addition of plant temper. For eight sherds, no temper could be observed (Tab. 2: Undet.).

Temper material	*N*	%
Grog	796	74.7 %
Bone	134	12.6 %
Bone + grog	11	1.0 %
Flint	14	1.3 %
Flint + grog	102	9.6 %
Undet.	8	0.8 %

Tab. 2 – Temper materials observed in the pottery from Melsele Hof ten Damme based on macroscopic, mesoscopic and petrographic analysis. N = number of sherds.

Based on typological and technological characteristics, the pottery from Melsele can largely be attributed to the Swifterbant Culture of the Scheldt river basin (*cf. infra*). In addition, there is a small number of both Early and Middle Neolithic pottery. Following, the pottery is discussed according to these different groups.

3.3. Swifterbant Culture pottery

The pottery with (only) grog temper can largely be attributed to the Swifterbant Culture, based on strong similarities with the pottery from nearby sites in the lower Scheldt river basin (Fig. 1). It includes 26 rim and 761 body sherds, all four bases and a fragment of a clay coil. The sherd thickness varies from 5 to 16 mm, with 71 % between 7 and 9 mm. The rim sherds represent a minimum of six vessels.

At least two vessels are characterized by silty/sandy fabrics with relatively abundant iron oxides and grog temper (Fig. 3). Some of the iron oxides are quite coarse and well visible at the vessel surfaces. They have previously been referred to as haematite inclusions, that could have been naturally present in the pottery clays or were added as temper to these clays (van Berg *et al.*, 1992; Vanmontfort, 2004; Amkreutz, 2013). SEM/EDS analysis confirms that these are natural inclusions in the clays, *i. e.* pyrite that transformed into iron oxides (incl. haematite) during firing of the vessels. The first vessel has a closed shape (rim diameter < largest body diameter) with a short everted neck and is decorated with a row of fingertip impressions on top of the rim (Fig. 3:1). There is no information about the shape of the vessel body. The second vessel seems to be a closed beaker with a little pronounced S-shaped profile (Fig. 3:2-3). It has an everted neck and its lip is turned over to the outside. The vessel is not decorated. A single perforation in the neck of this vessel can likely be interpreted as a repair hole, as it was applied after the vessel was fired. Finally, we mention a small body sherd that is decorated with a row of fingertip impressions (Fig. 3:4). Among the Swifterbant pottery from the nearby sites at Doel and Bazel, this type of body decoration is only observed at the neck or neck/shoulder transition (Teetaert, 2020). If this sherd has a similar position, it probably represents a third vessel within this fabric group. One of these vessels had a conical to (weakly) pointed base, with a maximum thickness of 18 mm (Fig. 3:5). A body and two rim sherds of this fabric group were included in the petrographic analysis.

The remaining sherds with grog temper belong to minimum four vessels. Information about the vessel shapes is even more limited. It includes closed vessel shapes with insloping rims/necks (Fig. 4:1-2) and closed or open vessel shapes with everted (Fig. 4:4) or straight rims/necks (Fig. 4:3). Decoration seems to be limited to the rim top and either consists of notched rims or so-called *Randkerbung* (Fig. 4:1) or a row of fingertip impressions on top of the rim (Fig. 4:3). Other than that, four body sherds have round knobs (Fig. 4:5-8). We do not know their exact position on the vessel, but they were probably situated at or around the largest body diameter (*e. g.* Fig. 4:6). Three bases with grog temper probably belong to this group of vessels. These are a weakly rounded base (Fig. 5:1), a round base (Fig. 5:2) and a weakly pointed base (Fig. 5:3), with a thickness of respectively 12 mm, 18 mm and 18 mm. Three body sherds of these vessels were included in the petrographic analysis. This analysis indicates that the vessels are made from variants of the same clays used to produce the pottery with coarse iron oxides (Fig. 3). In fact, they are equally rich in iron oxides, but these are generally finer and less visible at the vessel surfaces.

The petrographic analysis further shows that this pottery was all made from sedimentary clays with similar mineralogical compositions. The mineralogical composition of these pottery clays consists of: predominant (> 70 %) monocrystalline quartz; few to common (10 - 20 %) muscovite mica; rare (0.5 - 2 %) inclusions of polycrystalline quartz, plagioclase and alkali feldspar, natural chert and glauconite; very rare (< 0.5 %) biotite mica and chlorite (Teetaert, 2020). It is a typical composition for the Paleogene/Neogene ("Tertiary") and

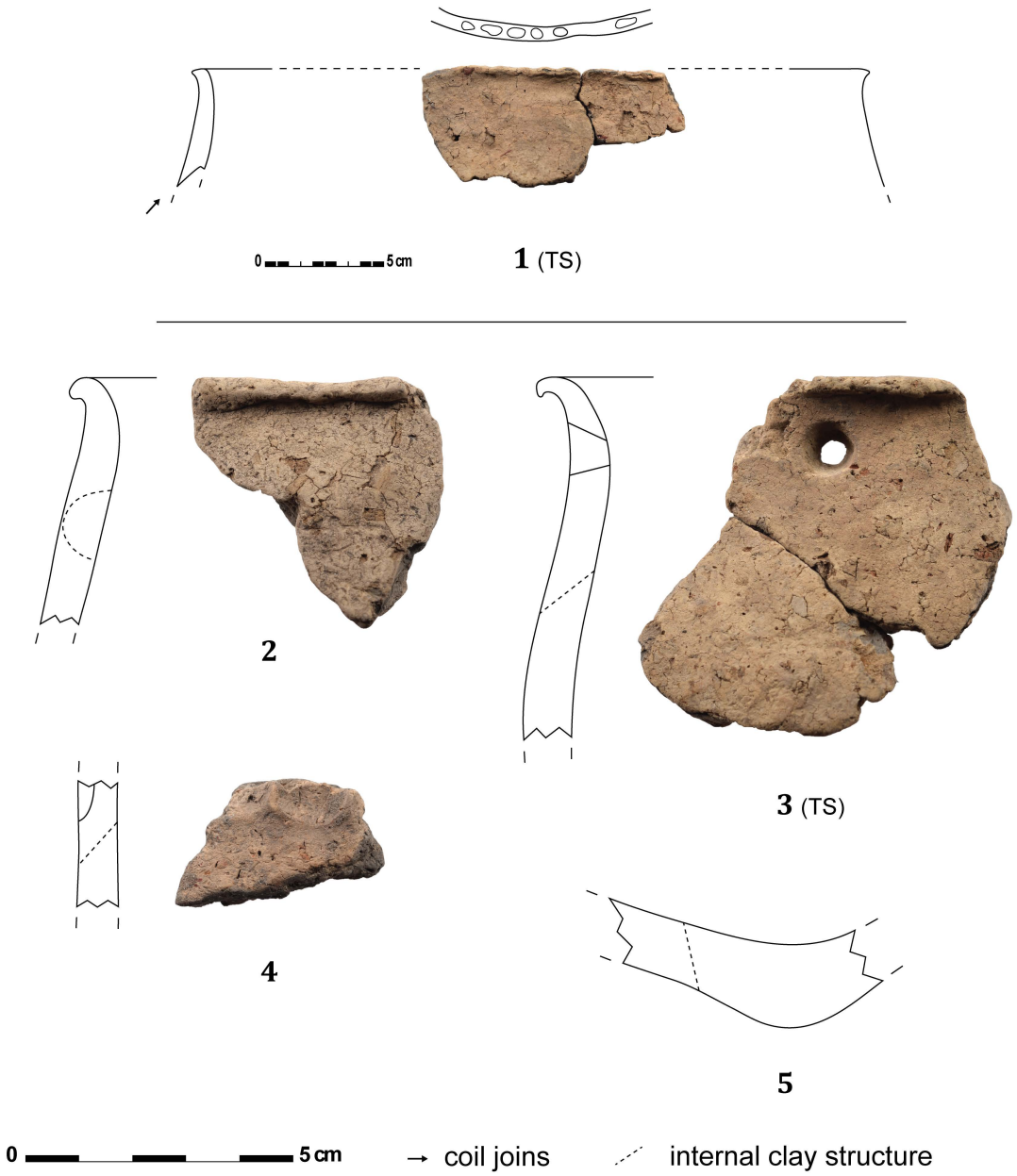

Fig. 3 – Swifterbant Culture pottery from Melsele Hof ten Damme (1). TS = thin section.

reworked Tertiary (*i.e.* alluvial) clays that can be found in northern Belgium and the Scheldt river basin. In other words, this pottery was made from local clays. In addition, the fragment of a coil found at the site (Fig. 5:4) has also been studied in thin section. It contains grog temper and has the same mineralogical composition – including fine iron oxides – as the vessels mentioned above. Therefore, it may be assumed that this pottery was produced at the site or in direct vicinity of the site, using locally available Tertiary or alluvial clays.

The vessels were entirely built with the coiling technique. For the vessel bodies, the use of this technique is apparent from the frequent occurrence of quadrangular fractures among the body and rim sherds (*e.g.* Fig. 4:3). This type of fracture pattern is often associated with coiling, as the latitudinal junctures between the assembled coils are weak lines, along which the vessels tend to break (Livingstone Smith, 2001; van Doosselaere, 2014). Several of the body and rim sherds show externally oriented, oblique ("Z") configurations in their internal clay structure, as visible in radial section (*e.g.* Fig. 4:1). It indicates that these vessel bodies were formed by the external overlap of strongly deformed or elongated coils (Livingstone Smith, 2001; Gomart *et al.*, 2017). The external overlap of coils is also

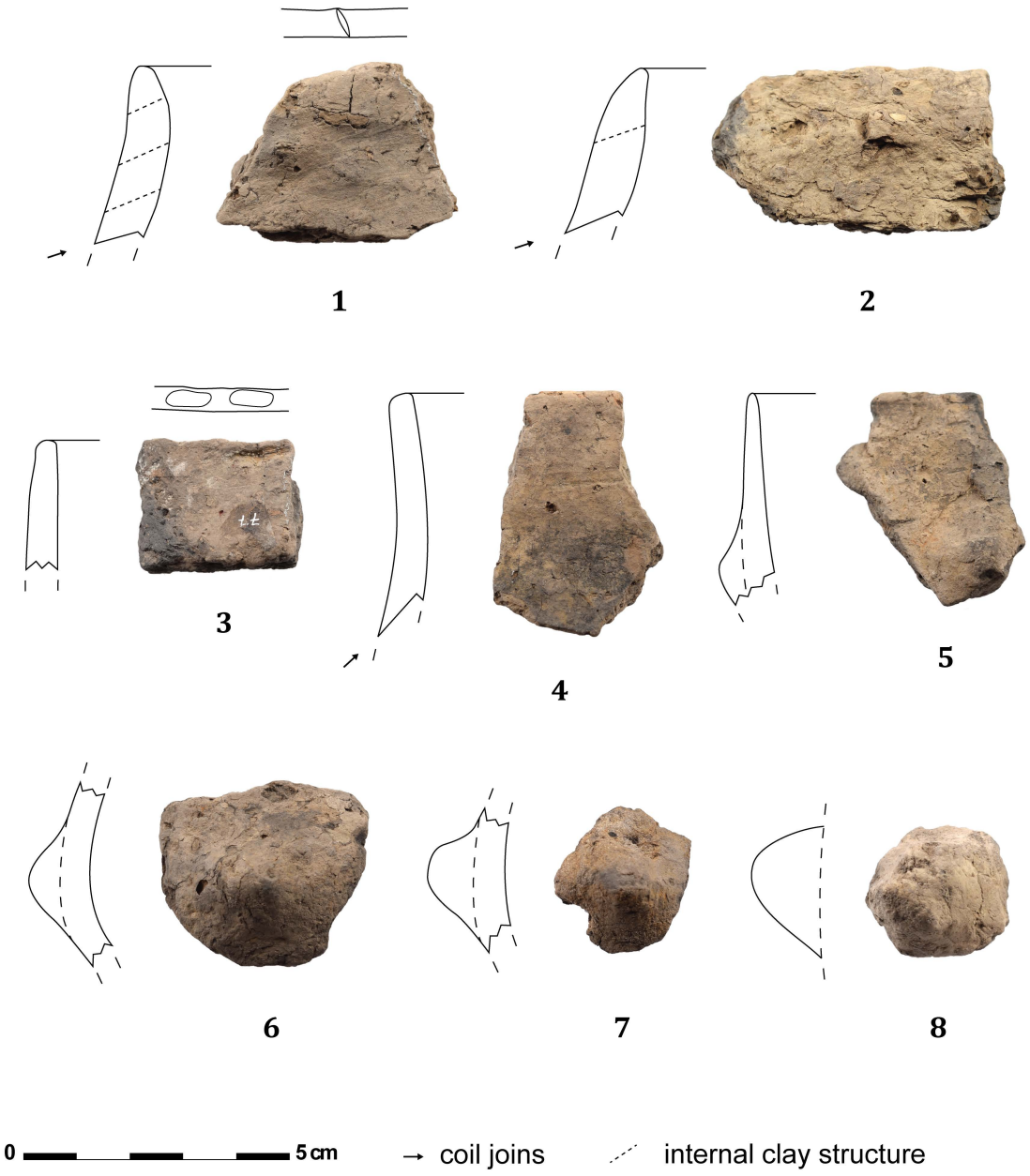

Fig. 4 – Swifterbant Culture pottery from Melsele Hof ten Damme (2).

visible in the presence and direction of so-called defective joins, *i.e.* fractures located at the juncture between two coils. Several of the rim/neck sherds have externally oriented N- or Z-joins (*e.g.* Fig. 4:1, 4:2 and 4:4), indicating that the coils were attached to one another with external overlap. N- or Z-joins have also been observed for the body sherds, but these are more difficult to orientate so the direction of the overlap is less clear. Occasionally, "C" configurations have been observed in the internal clay structure of rim or body sherds (*e.g.* Fig. 3:2). These are indicative for the superposition of non- or only slightly deformed coils. It shows that different coiling procedures could have been used by the potters who made these vessels. However, it is clear that the vessel bodies and rims were most often formed by systematic external overlap of strongly deformed coils.

The weakly rounded base (Fig. 5:1) was probably formed by spiral coiling, based on the presence of a semi-circular crack on its internal surface. It is likely that the other round base was formed in the same way. However, another possibility is that these round bases were formed by adding clay coils around a pinched or flattened lump of clay (*e.g.* the

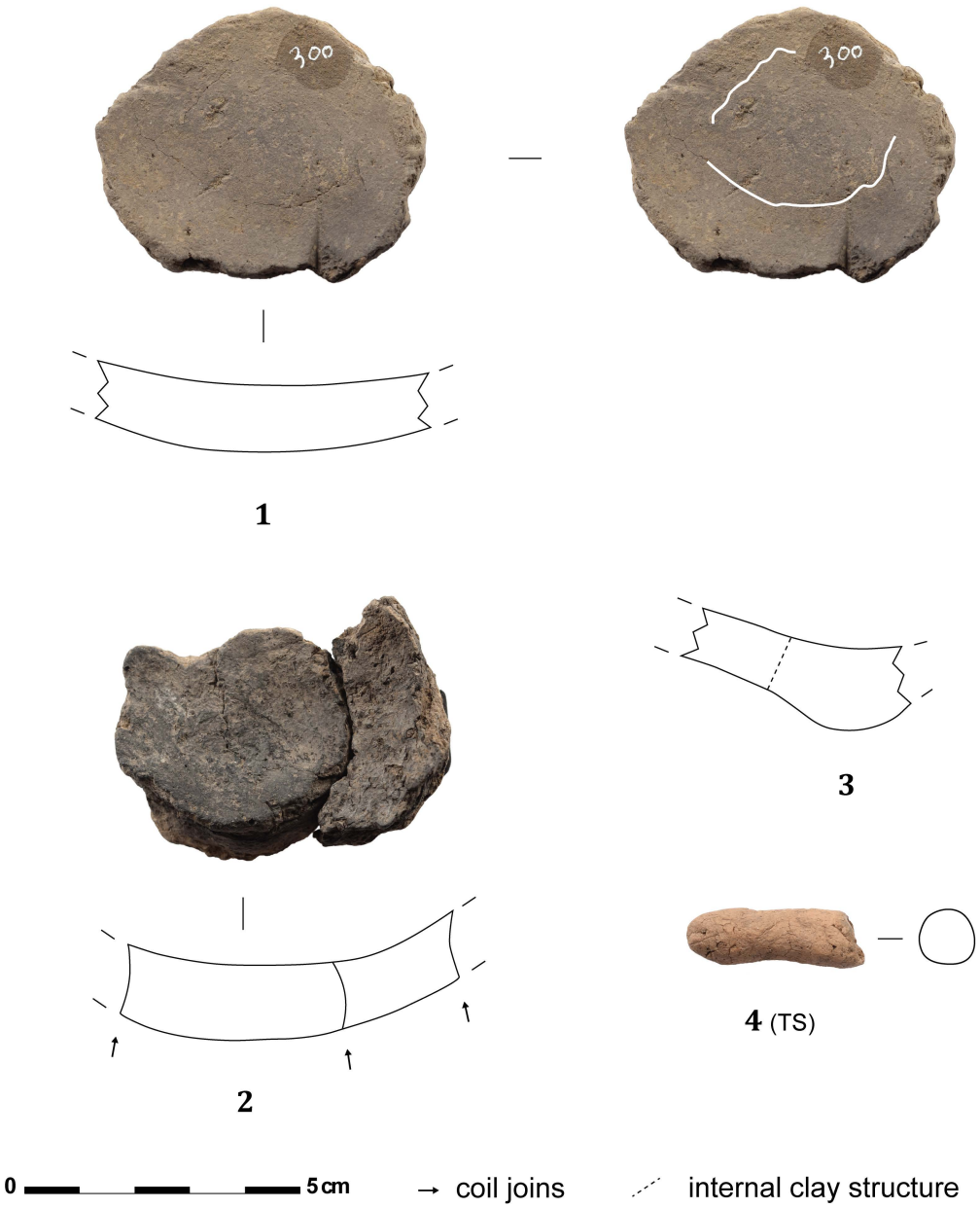

Fig. 5 – Swifterbant Culture pottery from Melsele Hof ten Damme (3). TS = thin section. 1 (above): round base likely made by spiral coiling; a semi-circular crack on the inner surface indicates the juncture between two rolls of clay.

central part in Fig. 5:2). For the pointed bases, it seems more likely that the point was shaped or pinched from a lump of clay, after which coils were attached to it to form the lower vessel body, or, vice versa, the base was attached to the lower body.

Information about the secondary forming techniques is limited. Eight body sherds have shallow depressions on their outer surface, indicating the use of the beating technique. This technique involves the use of a paddle to shape the vessel wall by pounding on it from the outside. Such beating operations leave specific traces on the vessel surfaces, referred to as "beating facets" (Rye, 1981; Martineau, 2005; van Doosselaere, 2014). The eight body sherds with these traces belong to different vessels, but their exact position in the vessel (lower/upper body) cannot be determined. In any case, they show that at least part of the vessels have been shaped by use of the beating technique. Finally, part of the sherds have lustrous surfaces with clear burnishing facets, which shows that the vessels were finished by burnishing the inner and outer surfaces. On most of the sherds, however, any traces related to the finishing techniques have weathered away.

To conclude, *ca.* 75 % of the pottery remains from Melsele belong to a minimum of six vessels with grog temper. They were produced at or in vicinity of the site using locally available Tertiary or alluvial clays. Although information about the vessel shapes is limited, most of these seem to be closed vessel shapes with slightly everted, straight or insloping necks and (weakly) round or pointed bases. Some vessels have round knobs, probably situated around the largest body diameter. Decoration is largely restricted to the rim top (notches; row of fingertip impressions), and on one occasion a row of fingertip impressions was observed on a vessel body. The vessel bodies were entirely built by coiling. Different coiling procedures might have been used, but in most cases this seems to have been done by a systematic external overlap of coils. The bases were made by spiral coiling or by pinching a lump of clay to which coils were attached to form the lower vessel body. At least part of the vessels were further shaped by beating on the outer surface, and at least for part of the vessels the inner and outer surfaces were burnished. Both typologically and technologically, this strongly resembles the Swifterbant Culture pottery from the nearby sites of Doel Deurganckdok and Bazel Sluis (Crombé, 2010; Crombé *et al.*, 2015; Teetaert, 2020).

3.4. Early Neolithic pottery

The pottery with bone temper almost certainly represents one or several Early Neolithic pottery traditions (*cf. infra*). It concerns 145 sherds, including seven rim and 138 body fragments. Four of these sherds have decoration (3 %). Despite the low number of sherds, the mesoscopic and petrographic analyses point to a large heterogeneity in pottery fabrics. Based on the available rims, decorated sherds and distinctive fabrics, these 145 sherds represent a minimum of eight vessels.

The vessels were made from silty clays (92 %), with a limited amount of sand-sized grains, or sandy clays (8 %), rich in sand-sized grains. Based on macro- and mesoscopic fabric analysis, these clays were either tempered with bone (92.5 %) or with bone and grog (7.5 %). However, the petrographic analysis points out that grog is more common, as it was observed in the thin sections of four sherds that seemed to contain no grog based on the macro- and mesoscopic analysis. The temper materials in these vessels are often finely crushed, which makes it harder to distinguish grog from the clay matrix with the naked eye. The bone temper in these vessels usually consists of a mix of calcined (white) and only slightly charred (brown) bone fragments.

The sherd thickness varies from 5 to 12 mm, but most sherds (72 %) are 7-9 mm thick. Again, the pottery is highly fragmented and information about the vessel shapes is limited. We discuss the different vessels based on their most diagnostic sherds. The first vessel (10 mm thick) has a slightly insloping rim with a rounded lip (Fig. 6:1). As far as can be observed, it was built by an external overlap of coils, as indicated by the external N-join and oblique ("Z") configurations in radial section. The second vessel (7 mm thick) has an insloping rim with tapered lip (Fig. 6:2). It was built by coiling, and it seems that the final rim coil was folded to the outside to create a hemmed rim. The third vessel (7 mm thick) has a straight rim/neck and a rounded lip (Fig. 6:3). Again, based on what we can see of the vessel, it was built by the external overlap of coils. An everted neck fragment (Fig. 6:5) and a body sherd with a horizontal, elongated knob (Fig. 6:4) could both belong to a fourth vessel. It is a thick-walled vessel (9 mm) with coarse bone inclusions. The fifth vessel (5 mm thick) is only represented by a single small body sherd (Fig. 6:6). It has a decoration of three parallel, fine lines, delineated by two perpendicular fine lines. These lines or grooves were either applied with a comb with multiple teeth or were applied with a fine-pointed spatula according to the *pointillé-sillonné* technique. It is hard to tell from such a small sherd. Three more decorated sherds (Fig. 6:7-9) belong to a sixth vessel (9 mm thick) with multiple rows of bidentate spatula impressions. On one of the body sherds it can be seen that these impressions are delineated by a groove (Fig. 6:8). Based on their similar decoration, thickness and fabric, it is certain that these sherds belong to the same vessel. The variation in surface colours between the rim and body sherds is probably related to the firing process or to weathering of the sherds over time. At

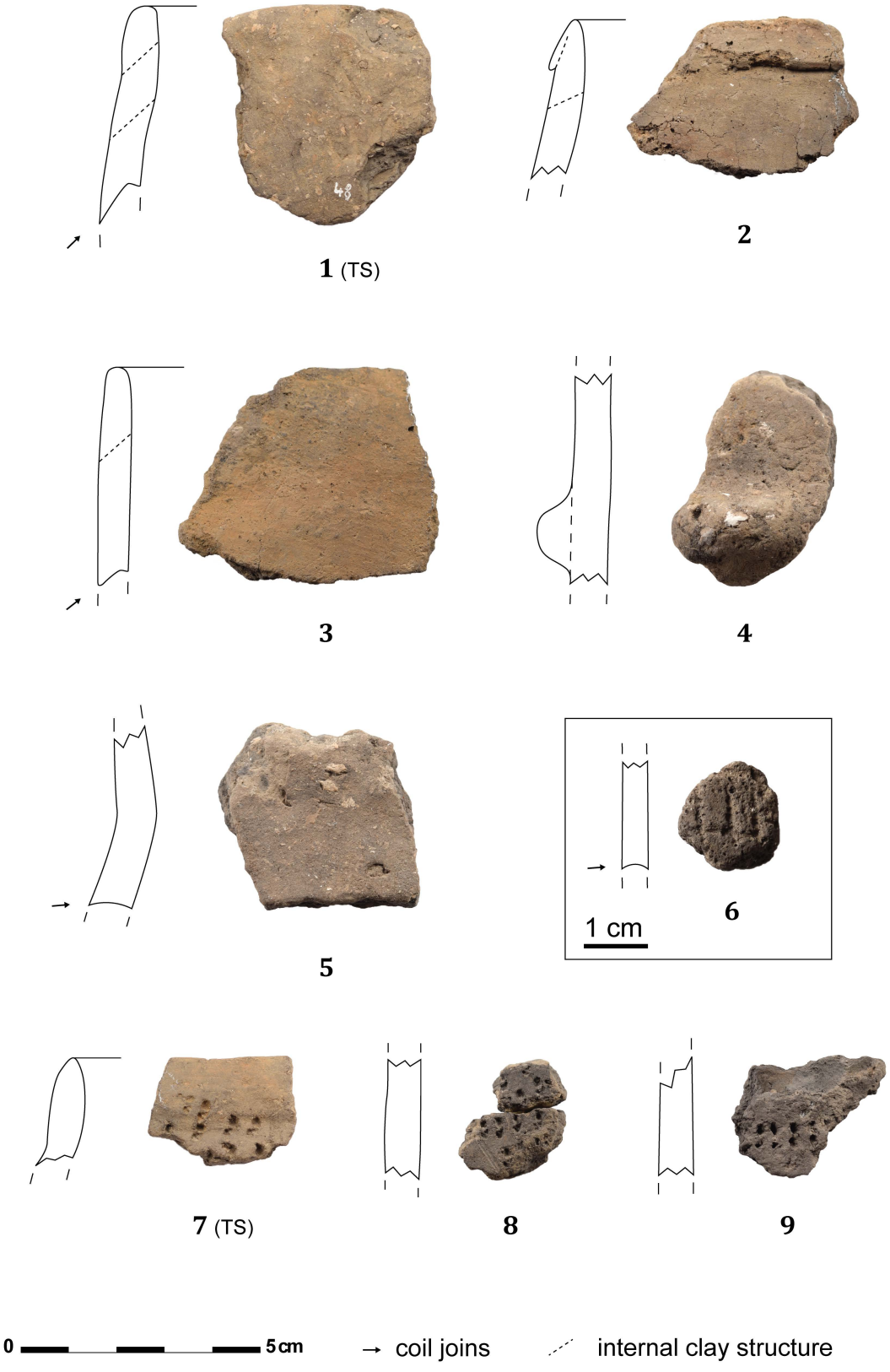

Fig. 6 – Early Neolithic pottery from Melsele Hof ten Damme. TS = thin section.

least two, possibly three more vessels are represented by the remaining, undecorated body sherds. These sherds are too small to provide information about the vessel shapes. Finally, it is noted that at least 10 % of the vessel surfaces have been burnished. Other than that, information about the secondary forming and finishing operations is lacking.

Six sherds with bone temper were included in the petrographic analysis. As mentioned above, there is a large variety in fabrics. For the six sampled sherds, five different fabrics were noted. For a detailed discussion of the thin sections, we refer to Teetaert (2020). The most important result is that four of these fabrics have a mineralogical composition close to that of the Tertiary clays in northern Belgium, but with higher amounts of polycrystalline quartz than observed for clays of the Swifterbant Culture pottery from Doel, Bazel and Melsele. First of all, this indicates that the bone-tempered pottery from Melsele is probably quite homogeneous in its provenance. Second, it is likely that the vessels do not originate from the lower Scheldt river basin. Although it remains uncertain, this pottery probably comes from the central Belgian loess region, where several Early Neolithic settlement clusters are known (Fig. 1).

The use of bone as temper is typical for several Early Neolithic pottery traditions of the central Belgian loess and adjacent loess regions (*e.g.* Constantin, 1985; Jadin, 2003; Burnez-Lanotte *et al.*, 2010). The observed decoration on part of the pottery from Melsele, applied with a bi- or multi-dented spatula and delineated by grooves, has close parallels in Blicquy/Villeneuve-Saint-Germain Culture (BVSG) pottery found at the Swifterbant Culture site of Hardinxveld-Giessendam De Bruin, located in the Rhine-Meuse river delta in the Netherlands (Raemaekers, 2001: fig. 5.4). Likely, the two decorated vessels from Melsele can be attributed to the BVSG Culture as well (also see Raemaekers, 1999: 138). Whether this is also the case for the undecorated vessels with bone temper is less clear. Quite a lot of the BVSG pottery from the Belgian sites bears little or no decoration (Constantin, 1985; Jadin *et al.*, 1989; Jadin, 2003). Most of the bone-tempered pottery from Melsele could indeed fit in the BVSG tradition. This is certainly the case for the insloping to almost vertical rims, that could belong to closed bowl shapes or more open vessel forms of BVSG pottery (*cf.* Hauzeur & Constantin, 1993: 174). The everted neck fragment (Fig. 6:5), on the other hand, could well represent a BVSG bottle (*cf.* Hauzeur & Constantin, 1993: 177). However, the elongated knob is less typical, as most BVSG appendages are oval-shaped with a horizontal perforation.

Also from a technological point of view there are parallels with the BVSG pottery. Bone is the dominant temper material in this pottery tradition, and the combination of bone and grog temper is generally observed in 5-15 % of the vessels (Constantin, 1985; Hauzeur & Constantin, 1993; Jadin, 2003; Constantin *et al.*, 2010b). Further, detailed technological analysis of the BVSG pottery from the site of Vaux-et-Borset (Hesbaye) indicates that many of these vessels were entirely built by coiling with external overlap of coils (van Doosselaere *et al.*, 2013, 2016). This concurs with the observations for some of the bone-tempered pottery from Melsele, even though these observations are largely limited to the upper vessel parts.

As mentioned above, most of this pottery probably comes from central Belgium, where BVSG sites are known from the Hainaut and Hesbaye regions. However, Limburg pottery is found on LBK settlements in these same (geological) areas. It is mainly tempered with bone, sometimes in combination with grog (*e.g.* Constantin, 1985; Burnez-Lanotte *et al.*, 2010; Constantin *et al.*, 2010a). Moreover, recent studies indicate that coiling with external overlap of coils is also the dominant technique used to produce the Limburg pottery from several LBK sites in central Belgium and the Paris Basin (Gomart, 2014; Gomart *et al.*, 2017). The remains of about three to seven Limburg vessels have been found at the site of Bazel Sluis, situated 18 km upstream from the Scheldt river (Crombé *et al.*, 2015; Teetaert, 2020). So, it is not excluded that Limburg pottery is represented among the bone-tempered pottery from Melsele. Finally, bone temper, or the combination of bone/grog, has also been observed in a small proportion of the classical LBK pottery from the Hainaut region (*e.g.* Constantin *et al.*, 2010a), although this pottery is usually tempered with grog or has no visible temper. It is unlikely but possible that classical LBK pottery is represented among the undecorated bone- and/or grog-tempered pottery from Melsele.

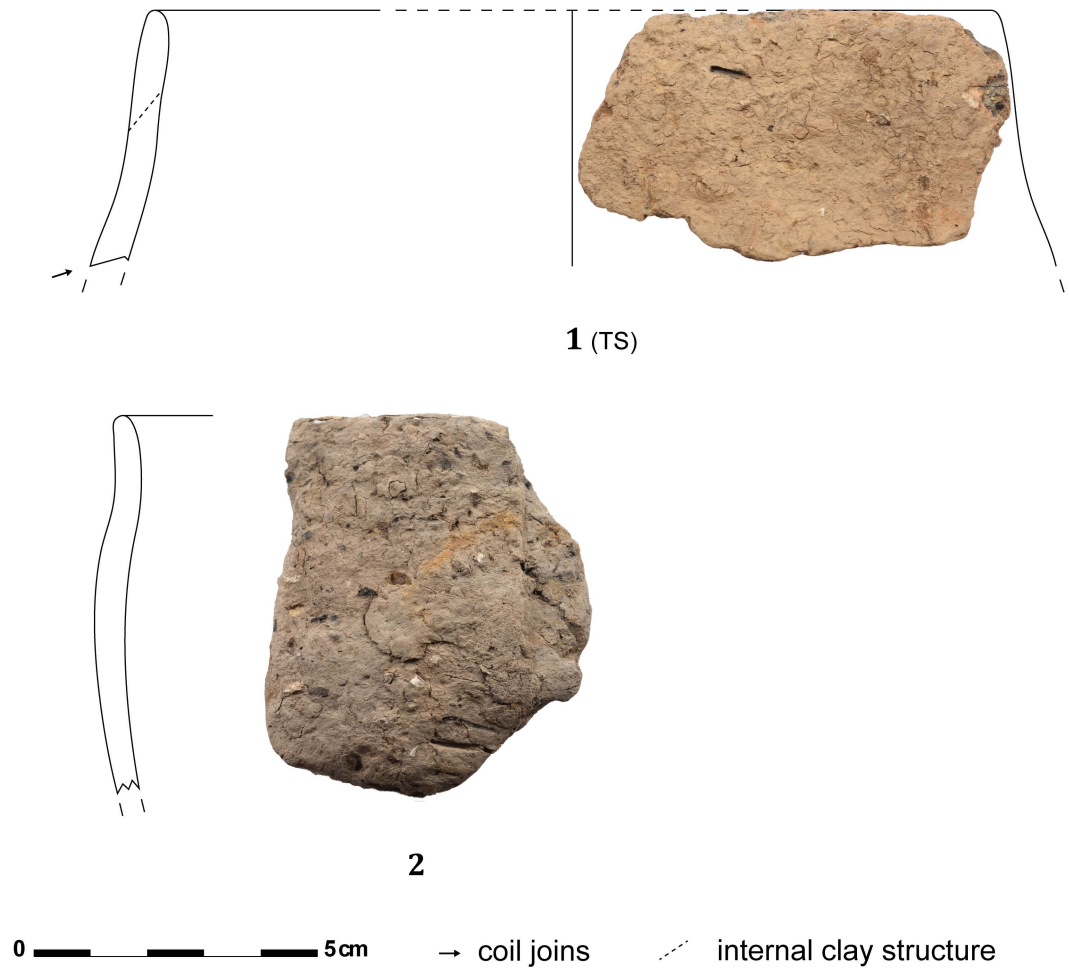

Fig. 7 – Middle Neolithic pottery from Melsele Hof ten Damme. TS = thin section.

3.5. Middle Neolithic pottery

The pottery with flint temper can be attributed to the Middle Neolithic traditions of the Scheldt river basin (also see Raemaekers, 1999; Vanmontfort, 2004). The five rim and 111 body sherds (5-10 mm thick) belong to at least two vessels.

The first vessel has a closed form with a rim diameter of 15 cm (Fig. 7:1). It could represent a bottle-shaped vessel or jar, but its shape below the neck cannot be reconstructed. The vessel was made from a fine clay, tempered with a limited amount of burnt and crushed flint and grog. In addition, some crushed quartz and small pebbles have been observed in the fabric through mesoscopic and petrographic analysis. These indicate that the grit temper was probably made by the crushing of pebbles that were collected from old gravel beds in the Scheldt river basin. This gravel mostly consists of flint pebbles and minor amounts of quartz and sandstone (Elsen, 1996). Two sherds of this vessel were included in the petrographic analysis. It shows that the pottery clay has a typical mineralogical composition for (reworked) Tertiary clays from northern Belgium and the Scheldt river basin. The second vessel probably represents a slightly closed beaker with a little pronounced body profile (Fig. 7:2). It was made from a silty clay, tempered with flint and grog. Another 14 body sherds could represent a third vessel, but this is uncertain.

Flint is a common temper material in Middle Neolithic pottery from the Scheldt river basin (*e.g.* Vanmontfort, 2001, 2004; Bostyn *et al.*, 2011; Teetaert, 2020). It often occurs in combination with fine plant temper, but this is not the case at Melsele. As far as they can be reconstructed, both vessel shapes from Melsele fit within the known repertoire of Middle Neolithic pottery from this area. Therefore, the flint-tempered pottery from

Melsele can almost certainly be attributed to the Middle Neolithic (Michelsberg Culture/Group of Spiere or MK/SP) traditions of the Scheldt river basin.

3.6. Undefined pottery

A few sherds with grog temper could not yet be attributed to a specific cultural group or period. This includes one rim/neck fragment with at least two rows of spatula impressions in the neck (Fig. 8:1). These impressions were applied using a tool with a flat point and curved extremities. One notch on top of the rim is either decorative or results from damage. The second fragment is a body sherd with a round knob, decorated with rows of rectangular spatula impressions on either side of the knob (Fig. 8:2). Based on their fabric, both sherds belong to different vessels.

These sherds do not fit with the known Swifterbant Culture pottery from the Scheldt river basin, for which body decoration is extremely scarce. Their decoration also does not seem to fit with one of the known Early or Middle Neolithic pottery traditions in northern Belgium or the adjacent areas. The specific shape of the spatula impressions on the rim fragment (Fig. 8:1), however, has parallels in the Hinkelstein, Grossgartach and Rössen pottery from the upper Rhine region (Denaire, 2009: fig. 75, variant 2.2.2). In these pottery traditions, the decoration is organized in horizontal bands that often consist of rows of impressions. The Hinkelstein and Grossgartach vessels have decoration below the rim. This becomes less frequent in the subsequent Rössen tradition but still occurs (Denaire, 2009). Apart from notched rims (*Randkerbung*), round knobs and rectangular or quadrangular spatula impressions (Fig. 8:2) are also known from these pottery traditions. The knobs or other types of appendages then usually interrupt the decoration of the horizontal bands. So, it is not to be excluded that some of the pottery from Melsele represents Neolithic pottery from the Rhineland.

The body sherd with knob was included in the petrographic analysis. Based on its mineralogical composition, the vessel does not seem to originate from the lower Scheldt river basin (Teetaert, 2020). On the other hand, in this particular thin section, no distinctive rock fragments or related minerals were observed that could indicate a provenance in the Rhineland area.

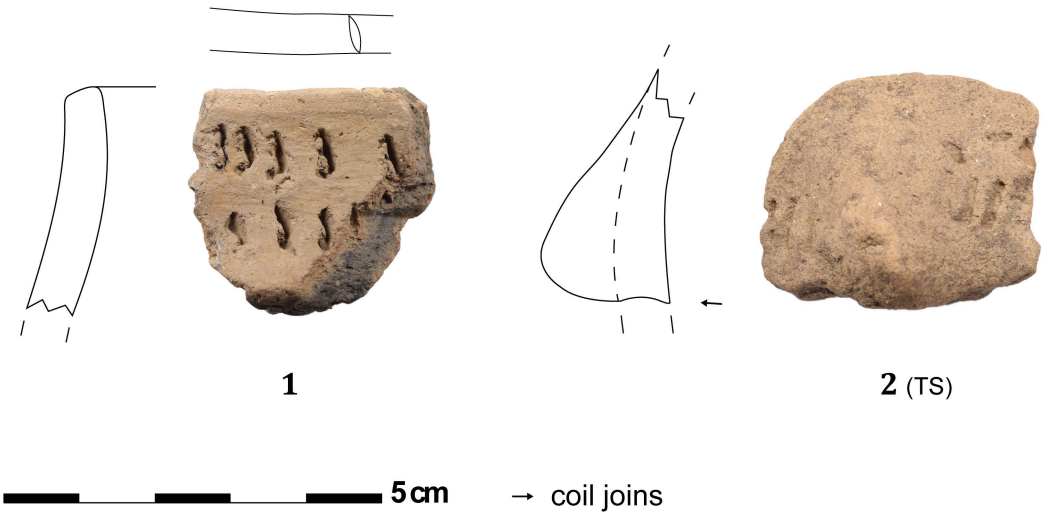

Fig. 8 – Undefined pottery from Melsele Hof ten Damme. TS = thin section.

4. Discussion and conclusions

The pottery from Melsele Hof ten Damme can be attributed to several cultural groups of the 5th to early 4th millennium cal BC. Most of it represents local Swifterbant Culture (75 %) and Middle Neolithic (11 %) pottery. The remains of minimum six vessels with grog temper can be assigned to the Swifterbant Culture of the Scheldt river basin *ca*. 5000/4600 - 4000 cal BC; see Boudin *et al*., 2009; Crombé *et al*., 2015b; Teetaert & Crombé, 2021; Messiaen *et al*., 2022). Probably all these vessels were produced at or in vicinity of the site using the locally available, Tertiary or alluvial clays. On a typological and technological level, it strongly resembles the Swifterbant pottery from the nearby sites at Doel and Bazel. This shows a homogeneous pottery production in the lower Scheldt river basin, which differs somewhat from the Swifterbant pottery production in the Netherlands (Raemaekers & De Roever, 2010; Teetaert *et al*., 2020). Due to the palimpsest situation at Melsele, with mixed cultural artefacts and datable organic materials, it is not possible to accurately date the Swifterbant occupation(s) at the site. We can only suggest a broad dating in the 5th millennium cal BC. Further, the remains of minimum two vessels with flint and grog temper can be attributed to the Middle Neolithic MK/SP traditions of the Scheldt river basin (*ca*. 4300/4250 - 3800 cal BC; see Vanmontfort, 2001, 2004; Bostyn *et al*., 2011; Teetaert *et al*., 2020). Together with the tools produced from mined flint, it points to Middle Neolithic occupation(s) at the site. Likely, the deep pit with bark lining, dated to the early 4th millennium cal BC, is a remnant of these occupations.

In addition, part of the pottery from Melsele represents non-local pottery traditions. The remains of minimum eight vessels with bone (and grog) temper (14 %) seem to belong to one or several Early Neolithic traditions of the central Belgian loess region. Two decorated vessels can likely be attributed to the BVSG Culture (*ca*. 5000/4950 – 4700/4650 cal BC; see Dubouloz, 2003; Denis, 2017; Praud *et al*., 2018). It is possible that the undecorated vessels with bone temper are also related to this cultural group, but the presence of other (e.g. Limburg) pottery traditions should not be excluded. Finally, two decorated sherds with grog temper could not be assigned to a specific cultural group/period. They do, however, present similarities in decoration with the pottery of the subsequent Hinkelstein, Grossgartach and Rössen Cultures of the Rhineland (*ca*. 4900/4850 – 4450 cal BC; see Denaire *et al*., 2017). It would be interesting to know whether any of these cultural groups are represented among the lithic remains found at Melsele. This requires more detailed analysis of these remains in the future.

The co-occurrence of indigenous Swifterbant and "exotic" Early Neolithic pottery at the sites of Melsele (BVSG and possibly Limburg pottery) and Bazel (LBK and Limburg pottery) indicates mobility of and contact between late hunter-gatherers of the lower Scheldt river basin and early farmers of the southern loess areas. These contacts likely started from the late LBK onwards, but intensified during the subsequent BVSG period. This is corroborated by strong similarities in pottery technology between the local Swifterbant and BVSG Cultures (Teetaert *et al*., 2020; Teetaert & Crombé, 2021), and is also visible in changes in the lithic industry (Messiaen *et al*., 2022; Halbrucker *et al*., 2022). It shows that contact during this period was not limited to the exchange of commodities, but also involved exchanges of technological know-how. The increased interactions between late foragers and early farmers from the BVSG period onwards is also exemplified by the presence of cereal grains (Meylemans *et al*., 2018) and domesticated animal bones (Crombé *et al*., 2020, 2022), in particular of sheep/goat, at the site of Bazel Sluis.

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Abstract

This paper presents a detailed study of the prehistoric pottery from the site of Melsele Hof ten Damme, located in the lower Scheldt river basin (Belgium) and excavated in the 1980s. The pottery remains can mainly be attributed to the local Swifterbant and Middle Neolithic (MK/SP) traditions of the Scheldt river basin. In addition, minimum eight vessels of Early Neolithic, BVSG Culture and possibly Limburg pottery from the central Belgian loess region are represented among these remains. The co-occurrence of both Swifterbant and BVSG pottery makes Melsele an important site for the study of farmer-forager contacts and the Neolithic transition in northern Belgium.

Keywords: Melsele "Hof ten Damme" (East Flanders, BE), Neolithic transition, Swifterbant Culture, BVSG Culture, pottery, Scheldt river basin.

Samenvatting

Dit artikel bespreekt de resultaten van een gedetailleerde analyse van het prehistorisch aardewerk van de site Melsele Hof ten Damme. De site is gelegen in het Beneden-Scheldebekken en werd opgegraven in de jaren 1980. Naast lokaal Swifterbant- en middenneolithisch aardewerk uit de Scheldevallei werden ook de resten van minstens acht vroegneolithische potten gevonden. Die laatste behoren vermoedelijk toe aan de BVSG-cultuur, al is het niet uitgesloten dat er ook Limburg-aardewerk vertegenwoordigd is. Melsele Hof ten Damme is bijgevolg een belangrijke site voor het onderzoek naar mogelijke contacten tussen jager-verzamelaars en vroege landbouwers en naar het neolithisatieproces in noordelijk België.

Trefwoorden: Melsele "Hof ten Damme" (Oost-Vlaanderen, BE), neolithisatie, Swifterbantcultuur, BVSG-cultuur, aardewerk, Scheldevallei.

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