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Archaeometric Analysis of Pottery Technology in the Funnel Beaker Culture

A Case Study: Tannenhausen, East Frisia (Germany)

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Zusammenfassung

Die Analyse von Keramik führt zu neuen Erkenntnissen über die in den verschiedenen Regionen der Trichterbecherkultur verwendeten Keramiktechnologien. Damit kann ein wichtiger Beitrag zur Rekonstruktion von Kommunikationsstrukturen geleistet werden. In dem hier vorgestellten Projekt werden verschiedene naturwissenschaftliche Analyseverfahren angewendet, um technologische Aspekte, wie Rohmaterial und Magerung, zu untersuchen. Die Studie zeigt, dass überwiegend zerstoßener Granit als Magerungsmittel eingesetzt worden ist. Dünnschliffanalysen von Scherben aus dem Megalithgrab von Tannenhausen, Ldkr. Aurich (Ostfriesland, Deutschland), weisen darauf hin, dass die Gefäße des Grabes lokal, in derselben Töpfertradition hergestellt worden sind.

Abstract

The analysis of pottery fragments reveals detailed information about the technology used in the different regions of the Funnel Beaker Culture. This will make an important contribution to the reconstruction of communication networks. In the project presented here, various analytical methods were used to investigate technological aspects such as the raw material and temper. These investigations showed that crushed granite was the predominant tempering agent. The analysis of thin sections of sherds from the megalithic tomb at Tannenhausen, in the District of Aurich (East Frisia, Germany), indicated that the vessels found in the tomb were all locally produced in the same pottery tradition.

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Introduction

In archaeological research, much attention has been traditionally paid to vessel forms and decorations while the technology associated with pottery has usually been considered only cursorily, despite the fact that an analysis of technological aspects often yields important information about communication patterns and the boundaries between different settlements. Furthermore, ethnographic sources show that the potter's craft is usually subject to very strict traditions, promoting patterns of continuity. For example, the introduction of a new source of clay entails the modification of other technological elements, such as the temper or the firing technique, so that the interdependence of the different processes impedes the emergence of innovations (Stilborg 1997, 24; 29; 219 f.). Time-consuming experimentation needed to change existing technology occurs only in the case of specialized pottery (Stilborg 1997, 33). Thus, the strict traditions upheld in this craft make it possible to identify different areas using the same technology and to reconstruct the distribution of the pottery. Moreover, the technological features of pottery production are not easily copied and are thus less affected by external influences than vessel forms and decorations (Stilborg 1997, 112).

This investigation, the first results of which are presented here, is part of the DFG Priority Program 'Early Monumentality and Social Differentiation'. The study is expected to complement the results of the module dealing with communication structures. The identification of different and/or similar pottery traditions makes it possible to reconstruct contacts on local, regional, and supra-regional levels. Comparative scientific analyses of pottery fragments are being carried out to obtain information about the pottery techniques used by different regional groups. The sherds being analysed originate from various sites in Northern Germany and the Northern Netherlands. Further analyses of pottery from adjacent areas of the Funnel Beaker Culture are planned in the course of the project (Nösler et al. 2012).

Methods

Various analytical methods are employed to obtain detailed information on the pottery technology of the Funnel Beaker Culture. A large quantity of sherds of different vessel types, in particular funnel beakers and bowls, were chosen for analysis. Initially, a vertical edge on each sherd is flattened using a cutting-wheel. Then the sherds are wet-ground and polished so that the texture and temper can be seen very clearly. With a reflected-light microscope it is possible to identify the individual components of the temper and to measure the grain size and the total amount of temper added to the raw clay. In a further step, thin sections are made from samples of the sherds and these are then examined under a polarizing microscope. In this way, it is possible to identify the raw clay by determining its mineralogical composition and to distinguish the original clay from the temper.

Thermal Colour Tests (TCT) are carried out to reconstruct the temperature at which the pottery was originally fired. This method is based on temperature-dependent colour changes in the clay as it was fired (Hulthén 1976; Stilborg 1997, 101 f.; Brorsson 2010, 79). When the pottery is re-fired, the colour only changes after the original firing temperature has been reached. Chemical analyses with ICP (Inductively Coupled Plasma) are also carried out. These analyses focus on natural differences in the composition of clay and, based on the trace elements present, may prove to be a good guide to deter-

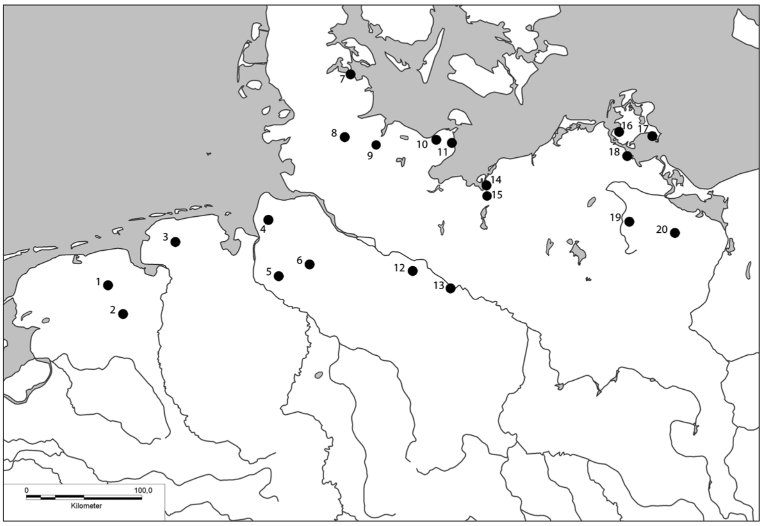

Fig. 1. Location of the sites. 1 Haren-Schimmeres, Prov. Groningen; 2 Drouwen, Prov. Drenthe; 3 Tannenhausen, Ldkr. Aurich; 4 Flögeln, Ldkr. Cuxhaven; 5 Pennigbüttel, Ldkr. Osterholz; 6 Lavenstedt, Ldkr. Rotenburg (Wümme); 7 Quern-Bostholm, Kr. Schleswig-Flensburg; 8 Büdelsdorf, Kr. Rendsburg-Eckernförde; 9 Flintbek, Kr. Rendsburg-Eckernförde; 10 Oldenburg-Dannau, Kr. Ostholstein; 11 Süssau, Kr. Ostholstein; 12 Rullstorf, Ldkr. Lüneburg; 13 Hitzacker, Ldkr. Lüchow-Dannenberg; 14 Hof Redentin, Lkr. Nordwestmecklenburg; 15 Triwalk, Lkr. Nordwestmecklenburg; 16 Drammendorf, Lkr. Vorpommern-Rügen; 17 Alt Reddevitz, Lkr. Vorpommern-Rügen; 18 Gristow, Lkr. Vorpommern-Greifswald; 19 Brunn, Lkr. Mecklenburgische Seenplatte; 20 Jatznick, Lkr. Vorpommern-Greifswald.

Abb. 1. Lage der Untersuchungsorte.

mine the provenance of the pottery. Finally, the results of the various analyses will be considered in a regional and chronological context. Supra-regional comparisons are also possible by using quantitative statistical analyses to evaluate the data and reveal the differences and similarities between the pottery traditions.

Analyses and Results

Pottery samples from 20 Funnel Beaker sites have been analysed so far from the various research areas covered by the DFG Priority Program 'Early Monumentality and Social Differentiation' (Fig. 1), including Lower Saxony, Schleswig-Holstein, Mecklenburg-West Pomerania, and the Northern Netherlands. A total of 342 sherds from settlements, graves, and one enclosure were examined. Further pottery complexes are being studied within the framework of the project so that it will be possible to come to statistically relevant conclusions and confirm these first results.

An analysis of the sample sherds revealed that crushed granite was the predominant tempering agent. Its sharp-edged particles adhered better to the clay than rounded grains of sand. The resulting physical properties allowed the pottery to be used as cooking vessels (Rye 1988; Hulthén 1994, 134; Rice 2005, 407 ff.). Moreover, granite is easy to crush if the rock is pre-heated. The minerals feldspar, quartz, and mica, which are components of granite, could be identified in the polished sections of the sherds (Fig. 2). Feldspar is mostly reddish (*orthoclase*), but can also be pale grey or white (*plagioclase*). Quartz is often colourless and transparent, while mica is black.

A quarter of the sherds had additional tempering agents other than granite, i.e. organic material, sand, grog, and flint (Fig. 2 c–f). The organic temper had generally been destroyed by fire, so that only rounded or longish cavities in the clay indicate the use of plant material such as grass, straw, or husks (Fig. 2 c). These cavities increased the resistance of the pottery to temperature changes. This was especially useful in the case of cooking vessels, which were often exposed to thermal shocks. Grog, in the form of crushed pottery, was easily available. It increased the resistance of the vessels to thermal shock and gave them greater stability (Rice 2005, 229). The identification of grog is difficult because its colour is often very similar to that of the sherds being examined. Therefore, the fragments were identified according to shape and quality. Grog fragments are mostly angular and hard; sometimes there are cracks at the edge of the fragments. Moreover, granite was often obser-

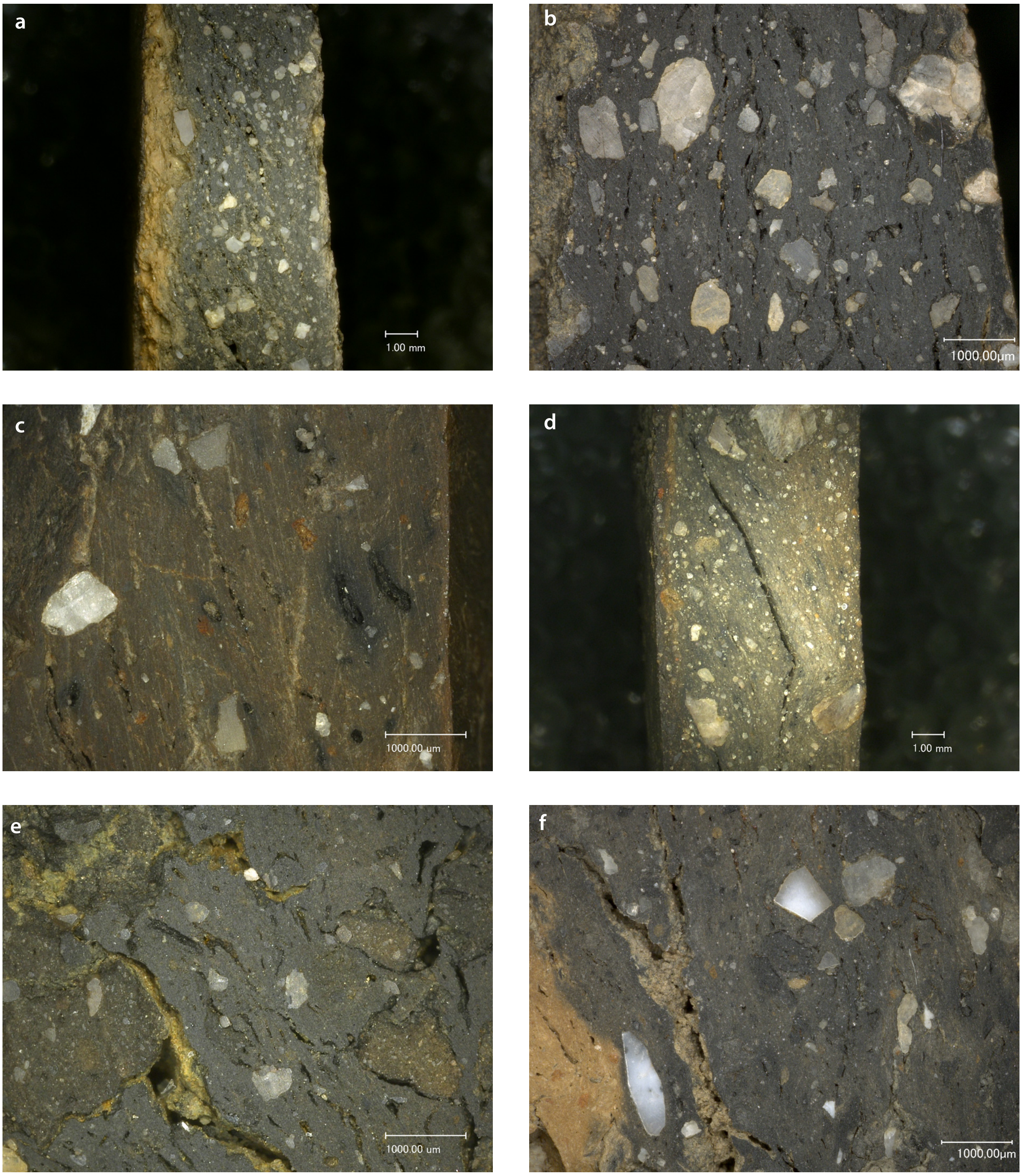

Fig. 2. Pottery with different tempering agents. a-b: granite, c: granite and organic material, d: granite and sand, e: granite and grog, f: granite and flint.

Abb. 2. Keramik mit unterschiedlichen Magerungen. a–b: Granitgrus, c: Granitgrus und organisches Material, d: Granitgrus und Sand, e: Granitgrus und Schamotte, f: Granitgrus und Flint.

ved inside the fragments, which can be interpreted as the former temper of the crushed pottery (Fig. 2e). Sharp-edged flint particles occurred only in very small quantities as a tempering agent (Fig. 2f).

A frequency distribution diagram of the observed tempering agents shows that 74.1 % of the analysed pottery was exclusively tempered with granite (Fig. 3). Additional temper added to the clay in a smaller quantity alongside the granite could be identified in 26 % of the sherds. Among these additional tempering agents, organic materials (15.9 %), sand (5.5 %), grog (2.9 %) and flint (1.7 %) were identified. Different tempering agents were probably selected to make the vessels particularly suitable for their intended purposes. So far, regional differences in the choice of the temper could not be detected.

The investigation of the pottery from the megalithic tomb at Tannenhausen in the district of Aurich (East-Frisia) is presented here as an example of micro-regional analysis. The tomb consisted of two chambers,

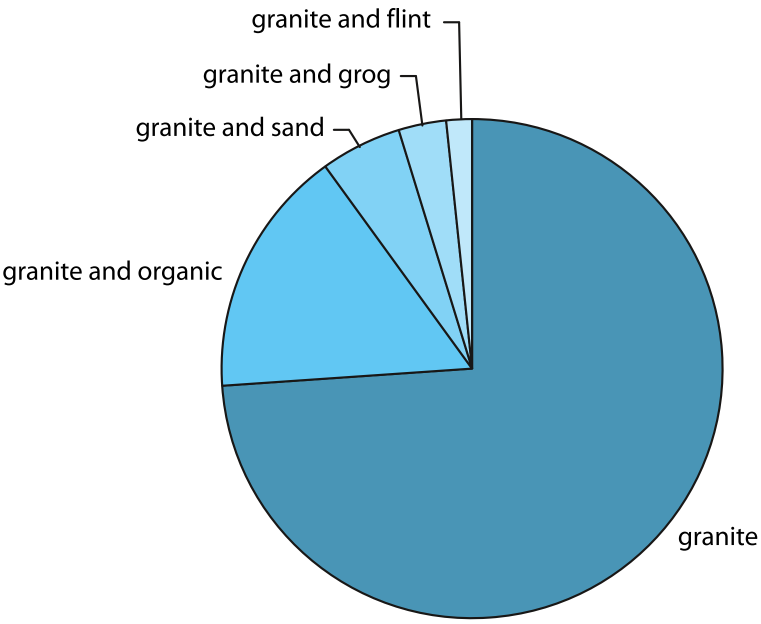

Fig. 3. Relative frequency of the tempering agents used.

Abb. 3. Verhältnis der genutzten Magerungsmittel.

each with a wooden passage on the southern long side (Gabriel 1964; 1966). Today, only three stones of the western chamber are still preserved. Twenty-seven sherds from the site were analysed by scientific methods: 17 funnel beaker fragments and 10 sherds from bowls.

The Tannenhausen vessels were tempered with granite. Five sherds were also tempered with organic material and one sherd had rounded sand grains in addition to granite. The question whether different tempering techniques were used for funnel beakers and bowls was then considered. For this purpose, the average grain size of the five largest temper particles observed on each polished section was determined. The average amount of temper was also calculated. The analyses indicated that the funnel beakers were predominantly tempered with smaller granite particles than the bowls (Fig. 4). The funnel beakers had an average maximum grain size of 1.3 mm while the bowls had an average maximum grain size of 1.6 mm. Furthermore, the average amount of temper in the funnel beakers was 12.2 %, i.e. lower than the 16.8 % in the bowls. Consequently, in spite of some overlapping, there was a difference between the two types of vessels as far as their temper was concerned. One reason for this difference probably lies in the varying thickness of the sherds of the two vessel types: the average maximum grain size of the temper is directly proportional to the thickness of the sherd (Fig. 5). The same applies to the relation between the thickness of the sherd and the average amount of temper (Fig. 6).

In addition, six thin sections were prepared to provide more information on the raw clay and the tempering agents (Table 1). Analyses of these thin sections identified three different clays (groups A, B, and C).

Table 1. Microscopy results: thin sections from Tannenhausen. Abbreviations: s = sorted, f = fine, m = medium-coarse, c = coarse, ++ = very large amount, + = large amount, * = presence, - = small amount, ° = none.

*Tabelle. 1. Ergebnisse der Dünnschliffanalysen von Tannenhausen. Abkürzungen: s = sortiert, f = fein, m = mittel-grob, c = grob, ++ = sehr große Menge, + = große Menge, * = vorhanden, - = geringe Menge, ° = nicht* vorhanden

Thin section	Find No.	Sorting	Coarseness	Silt	Sand	Iron	Mica	Diatoms	Organic material	Calcium-carbonate	Accessory minerals	Temper material	Average max. grain size (mm)	Temper amount (%)
1	289	s	f	-	-	-	+	°	°	°	°	Granite	1,4	14
2	284 A	s	f	+	-	-	*	°	°	°	°	Granite, Organic	1,6	14
3	285	s	f	+	-	°	*	°	°	°	°	Granite	1,3	17
4	290	s	f	-	°	°	-	°	°	°	°	Granite, Sand	1,0	23
5	288	s	m	++	*	+	*	°	°	°	°	Granite	1,7	16
6	280–027	s	c	+	++	°	-	°	°	°	°	Granite	1,0	14

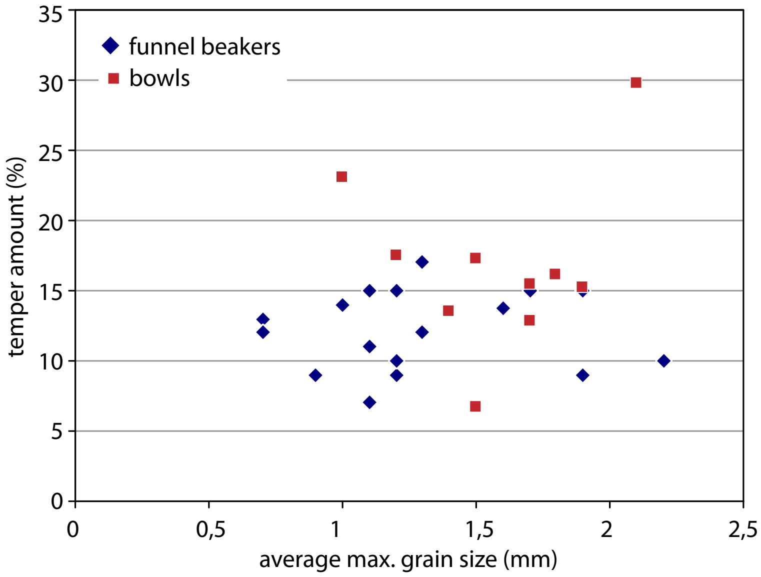

Fig. 4. Tannenhausen. Temper characteristics on the basis of average max. grain size and amount of temper.

Abb. 4. Tannenhausen. Charakteristika der Magerung auf Grundlage der mittleren maximalen Korngröße und der Magerungsmenge.

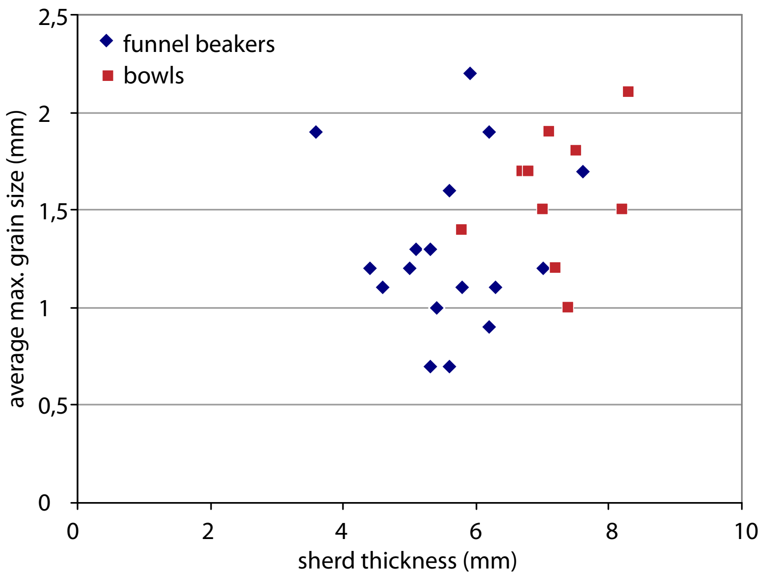

Fig. 5. Tannenhausen. Sherd thickness in relation to the average max. grain size of the temper.

Abb. 5. Tannenhausen. Wandstärke der Scherben im Verhältnis zur mittleren maximalen Korngröße der Magerung.

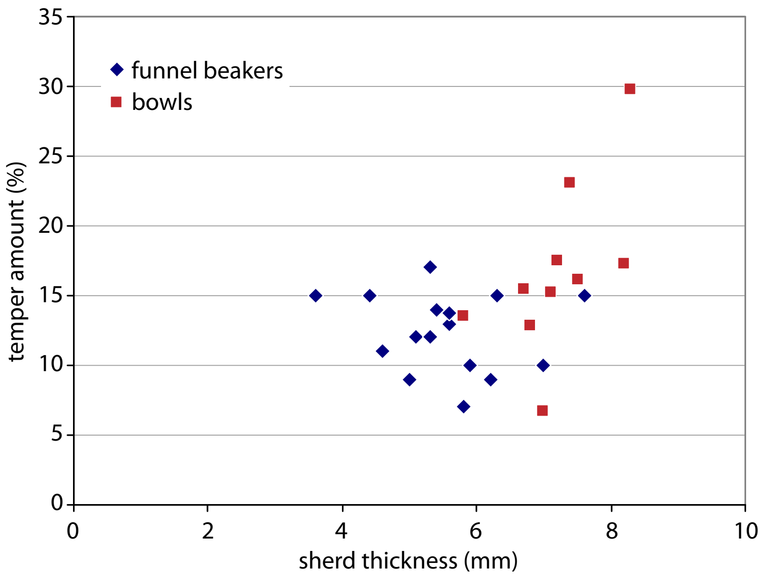

Fig. 6. Tannenhausen. Sherd thickness in relation to the amount of temper.

Abb. 6. Tannenhausen. Wandstärke der Scherben im Verhältnis zur Magerungsmenge.

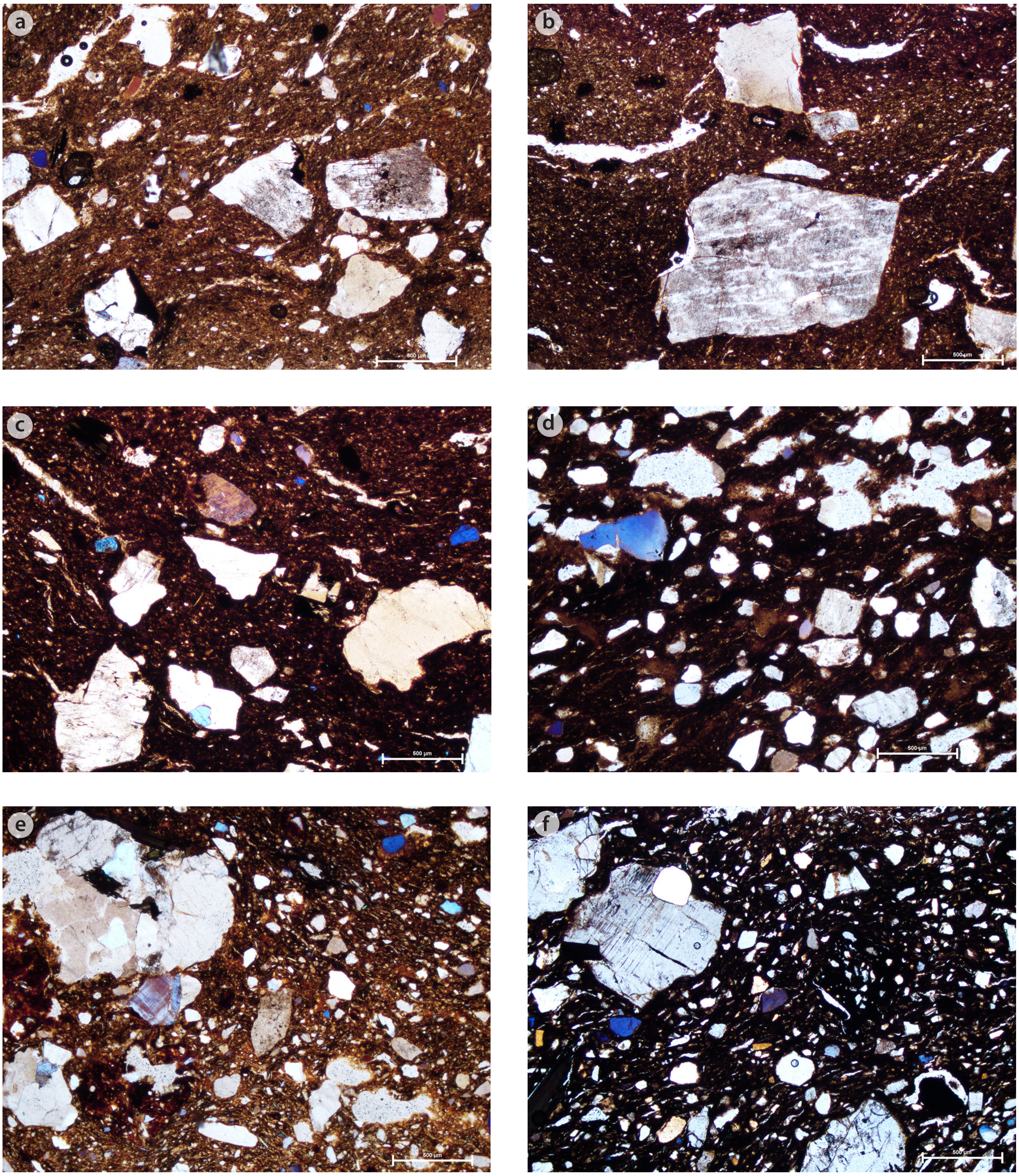

Fig. 7. Microscope photographs of thin sections from Tannenhausen. a–d: group A (thin sections Nos. 1–4), e: group B (thin section No. 5), f: group C (thin section No. 6).

Abb. 7. Fotos der Dünnschliffe von Tannenhausen. a–d: Gruppe A (Dünnschliffe Nr. 1–4), e: Gruppe B (Dünnschliff Nr. 5), f: Gruppe C (Dünnschliff Nr. 6).

1. Group A (thin sections Nos. 1-4; Fig. 7 a–d):

The sherds in group A, from both funnel beakers and bowls, were made of fine clay with a low or large amount of silt and a low amount of natural sand. No accessory minerals, such as amphiboles or pyroxenes, or organic material could be detected in the thin sections. The sherds were tempered with crushed granite. Only thin sections Nos. 2 and 4 contained additional tempering agents: organic material and sand. The analyses also included the determination of the average maximum grain size for each thin section. For the four sherds, the average maximum grain size measured between 1.0 and 1.6 mm. The average amount of temper was calculated between 14 and 17 %. Only when sand was used as a tempering agent, as is visible in thin section No. 4, was the amount higher, i.e. 23 %.

2. Group B (thin section No. 5; Fig. 7 e):

One sherd from a bowl was made of a medium-coarse clay with a large amount of silt. Moreover, iron was identified as a component of the clay. Again, there were no accessory minerals. Granite was used as a tempering agent with an average maximum grain size of 1.7 mm and the average amount of the temper amounted to 16 %.

3. Group C (thin section No. 6; Fig. 7 f):

A sherd from a funnel beaker made of coarse clay containing a large amount of silt and a very large amount of natural sand. No accessory minerals were identified. The clay was tempered with 14 % crushed granite and the average maximum grain size of the granite particles amounted to 1.0 mm.

The described investigation of the sherds revealed that at least three different clay sources were used to make the pottery from Tannenhausen. It can be excluded that the different vessel forms, funnel beakers und bowls, were made of specific clay sources in regard to their intended purposes. Most of the vessels in group A were made of fine clay. While some of these sherds were only tempered with granite, others contained organic material or sand as an additional tempering agent. Given the same basic clay source in group A, it can be maintained that the pottery of this group that had an additional tempering agent did not come from another region with a different pottery tradition. The same applies to the sherds in groups B and C. Although the raw-material sources probably differ from group A, the features of the temper, e.g. grain size and the amount of the temper, are very similar. There is, therefore, no sign of imported pottery. Instead, the analyses indicate that the Tannenhausen vessels were locally produced in the vicinity of the megalithic tomb and shared the same pottery tradition. The different clay sources could be interpreted as an indication that the vessels came from several nearby settlements which used the same burial site.

Future investigations

In the further course of the project, more sites at the micro-regional level are to be included. Technological similarities in the production of pottery could point to connections between the different sites within a settlement area, so that it may be possible to reconstruct the interaction between neighbouring settlements and between the settlements and megalithic tombs. For example, it may be possible to identify the settlements where the pottery for burials was produced. Thus, analyses of pottery technology can make an important contribution to our understanding of local and regional communication networks of the Funnel Beaker Culture.

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