Store Frigård on Bornholm

Provenance Determination using ICP-MA/ES Analysis of Pottery from an Early Iron Age Cemetery

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ABSTRACT

The Early Iron Age cemetery at Store Frigård, Bornholm, is currently under study in preparation for a forthcoming publication of the so far largely unpublished material. As part of this work, a series of ICP-MA/ES (Inductively Coupled Plasma-Mass Atomic Emission Spectrometry) analyses has been carried out to investigate the provenance of the pottery and to explore the wider potential of such analyses.

The results show that most vessels were locally produced, but a few indicate connections to other regions around the southern Baltic Sea. Notable examples include a vessel from western Scania dating to the Late Bronze Age, one from Schleswig-Holstein from the Early Roman Iron Age, and another from Blekinge from the Late Roman Iron Age. These finds provide evidence of contacts and exchanges extending beyond Bornholm.

The analyses also shed light on how some of the vessels were made and used. In several cases, it appears that pots were specifically produced for funerary purposes, or that newly made vessels were selected for deposition. This observation, combined with information on wear and use, highlights the importance of ICP-MA/ES analyses in addressing questions of production, choice of raw materials, and ritual practice. Such approaches contribute to a deeper understanding of social and cultural aspects surrounding burial customs and contact and exchange networks.

ARTICLE HISTORY
Received
19 August 2025;
Accepted
15 December 2025

KEYWORDS
ICP-MA/ES analyses; Bornholm; Ceramics; Provenance; Pre-Roman Iron Age; Roman Iron Age.

Introduction

This article provides an account of an investigation into the provenance of selected ceramic material from the cemetery at Store Frigård, located in the eastern part of Bornholm. The work is part of the project *"Bornholm – the island in the middle. Society, exchange and alliance systems in the Baltic area on the threshold of history."* Pottery is one of several find categories that will contribute to answering questions about contacts addressed by the project as a whole.

The authors' roles in the project are to present and analyse various aspects of the ceramics from Store Frigård. The work includes conducting a series of ICP-MA/ES (Inductively Coupled Plasma-Mass Atomic Emission Spectrometry) analyses to gain knowledge about the provenance of parts of the extensive pottery collection from the grave field. The ICP-MA/ES analyses offer interesting insight into contacts both within Bornholm and with other regions in the southern Baltic Sea area. The results regarding the provenance of the vessels constitute an important part of understanding where the people came from and what kinds of contacts they maintained.

Before presenting the results, we will first provide a brief background on the excavation and the ceramics at Store Frigård.

The investigation at Store Frigård

Under the leadership of Ole Klindt-Jensen, large parts of the Store Frigård cemetery were investigated between 1954 and 1963. Store Frigård is located in Østermarie parish, Øster district on Bornholm, Denmark (Figure 1). The cemetery is the second-largest investigated from the Early Iron Age on Bornholm, comparable in scale to the Slusegård burial ground on the southern side of the island (Klindt-Jensen 1978a; 1978b).

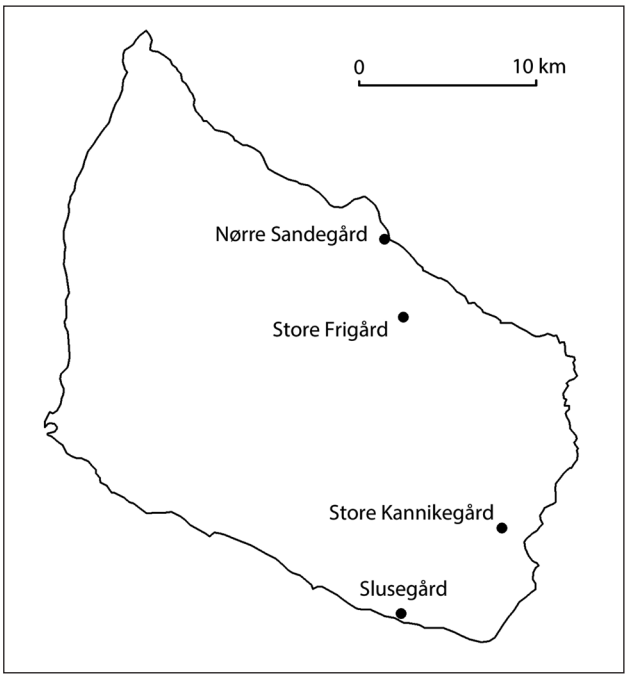

Figure 1. Bornholm with the locations of the cemeteries Store Frigård, Nørre Sandegård, Kannikegård and Slusegård marked.

Unfortunately, Klindt-Jensen did not have time to complete a scientific study and publication of Store Frigård before he died in 1980. In 2018, an initiative was taken to finally complete a scientific publication on the cemetery. After the project's initial phase, it was largely dormant during the Covid years of 2020 and 2021, but work has now resumed to analyse the extensive finds.

During the excavation at Store Frigård, a total of 1,256 features were documented, the vast majority of which were graves. This is an exceptionally large burial site from a Scandinavian perspective, with an extensive inventory of objects including brooches, belt hooks, beads, clay vessels, fired clay, knives, leather knives, tweezers, needles, swords, spear and lance heads, shield bosses, spurs, among others. The graves consisted almost exclusively of cremations, and burnt bones were recovered from a large number of them. The material includes around 650 objects made of metal and glass, as well as ceramics from more than 500 graves. In total, there are at least 630 clay vessels. It is therefore a highly valuable assemblage with great scientific significance for our understanding of the pre-Roman and Roman Iron Age on Bornholm and in the southern Baltic Sea area (Trolle 2021; Trolle et al. 2025).

The ceramic material

This short presentation of the ceramic material from Store Frigård serves as a general introduction and background to the ICP-MA/ES analysis. The ceramics consist of vessels, and parts of vessels, spanning chronologically from the transition between the final Late Bronze Age and Early pre-Roman Iron Age to the Late Roman Iron Age (*c.*600 BC-AD 300). The emphasis lies on the pre-Roman and Early Roman Iron Age, and a number of different vessel types are represented in the material. The condition of the vessels varies greatly. In many cases, only a small number of fragments of individual vessels remain, and in numerous cases they have been secondarily burnt on the pyre (Figure 2). However, there are also a number of vessels where the shape and type can be determined (Figure 3).

The approximately 900-year-long use of the burial field is well reflected in the ceramics. There is a large variation in vessel shapes, types, and surface treatments. The vessels range from small drinking cups to very large storage containers. There is also considerable variation in the number of vessels placed in individual graves, which underlines the long duration of burials. During the cemetery's period of use, major changes occurred both in ceramic traditions and in burial customs, for example, in the preferences regarding what kinds of vessels and how many accompanied the dead. Generally speaking, there appears to be a tendency from relatively large vessels in the early pre-Roman Iron Age, to small drinking cups in the later pre-Roman period, and finally to an increase in both the number and variety of vessels in individual graves during the Early and Late Roman Iron Age, when, in some cases, almost complete sets of dishes were included.

The material from the Early and Late Roman Iron Age shows typological connections to southern and eastern Scania. At the same time, certain vessel shapes and the character of the earthenware suggest that most of it was made locally on Bornholm. The pottery from Store Frigård shares many features with contemporary materials from other burial grounds on Bornholm, such as Nørre Sandegård, Kannikegård, and Slusegård (Bech 1996; Becker 1990; Vedel 1886), but also, to some

Figure 2. In many cases, the vessels from Store Frigård consist of a few sherds from a single grave and in many cases, they are secondarily burnt, as the sherds from a large vessel in grave 49, left, and from a large vessel in grave 505, right (Photos: Tony Björk).

extent, with contemporary pottery from other parts of the southern Baltic Sea area, *e.g.* Scania and Blekinge in southern Sweden. An interesting fact, mentioned above, is that a large proportion of the pottery from the pre-Roman and parts of the Early Roman Iron Age is secondarily burnt (Figure 2). This means that it was placed on the funeral pyre, which corresponds with some of the material from Scania and, in particular, the site Tjärby in southern Halland (Strömberg 1982, 173-174; Brorsson 2019, 145-148).

It was established early on that the ceramic tradition during the Early Iron Age in southeastern Scania had a very clear connection to Bornholm (Stjernquist 1955, 99-101, 163). Bornholm's role as a transit point for people, goods, and ideas in the southern Baltic Sea during the Late Roman Iron Age has later been emphasised, and the material culture's connection with southeastern Scania has been interpreted as an expression of the populations belonging to a shared tribal community, or alternatively, a political alliance (Heidemann Lutz 2010, 259-260). It has also been shown that this close connection between the areas can be traced significantly earlier (Björk 2022, 52). It is expected that the ongoing analyses will bring further details and results to light in the forthcoming publication of this important material from Store Frigård.

Figure 3. The large vessel from grave 139 is an example of a well-preserved vessel from the Middle to Late pre-Roman Iron Age (Sample no. StFrigård 41). Note the wide belly with the transition point between belly and shoulder located in the upper part of the vessel. The transition part is thickened, 2-3 cm broad and almost cylindrical. The ICP analysis shows that the vessel was made on Bornholm (Photo: Roberto Fortuna, The National Museum in Copenhagen).

In order to study the origin of the ceramics, in addition to typological and morphological observations, it was decided early on that ICP-MA/ES analysis of a selection of vessels would be a vital part of the work. It is a method that greatly enhances the possibilities for discussing mobility and communication in the southern Baltic Sea area during the Early Iron Age.

ICP-MA/ES analyses of ceramic material

A selection of the diverse clay vessels from Store Frigård has been subjected to ICP-MA/ES analysis, providing valuable insights into their provenance. The study and interpretation of archaeological materials nonetheless present several source-critical challenges, particularly concerning the geological origin of the clays and the composition of added tempers. In recent decades, ICP-MA/ES analyses of pottery sherds have increasingly been employed to determine ceramic provenance (*e.g.* Little et al. 2004; Brorsson 2013). ICP-MA/ES is an isotope-based analytical method that provides information on the chemical identity of a sherd by measuring a wide spectrum of elements at extremely low concentrations, down to parts per million (ppm) levels (Golitko and Dussubieux 2016). Twelve trace elements in particular; Al, Ca, Ce, Co, Cr, Ga, La, Mg, Mn, Na, Sr and V, are measured, and the results are used to identify the origin of the clay from which each pot was made. The selection of elements is based on previous experience by many researchers, which has demonstrated that their use results in a reliable discrimination process (*e.g.* Thompson and Walsh 1989). The basis for the analysis is that clays and soils from different areas have distinct chemical compositions, and those with similar compositions likely originate from the same site or region. Studies of medieval pottery and stoneware from production sites in the Rhine region of Germany have demonstrated that distinct workshops can be differentiated within a radius of approximately 15-20 kilometres (Brorsson 2024b), and this distance has been used in our study as the definition of "locally produced". For this type of study, comparative reference materials are essential. Without them, it would only be possible to determine which vessels were made from the same fabric and which were different. Kontoret för Keramiska Studier (Ceramic Studies) has over the years built up a database of ceramics and clays, mainly from Europe; the database currently contains more than 15,500 samples. The reference material includes kiln waste, raw clays, and various types of ceramic material from archaeological excavations. The reference data are extensive, and it is not feasible to publish analyses of several hundred samples within a single article. Instead, the results are presented as dendrograms, although it is likewise not possible to include all of them. In the present study, between 50 and 75 dendrograms have been produced. A source-critical and methodological problem is that the comparative material from Bornholm is limited, and it would, among other things, have been desirable to include samples of raw clays. In light of this issue, the study has been complemented with analyses of ceramics from a few other sites on Bornholm.

Following well-established and widely accepted methodological procedures, in accordance with standard practices within the field, approximately 0.3 grams of ceramic powder from each sample was ground, acid-digested, and analysed using mass spectrometer. Data were processed using SPSS PASW Statistics 17.0 to generate cluster analyses and dendrograms, enabling the identification of compositional groups. The ICP-MA/ES analyses for this study were carried out by OMAC Laboratories, Galway. The procedure generated a large volume of data suitable for statistical processing. The data are therefore organised using factor analysis and cluster analysis, which group together samples of similar chemical composition, likely indicating a shared geological and geographical origin (*e.g.* Little et al. 2004). It is important to note that ICP-MA/ES analysis is not influenced by how the clay was treated. In other words, coarsely or finely worked clays taken from the same source will be assigned to the same ICP-MA/ES group, whereas two fine clays from different sources will be placed into different groups.

Compared to pXRF (portable X-ray fluorescence), ICP-MA/ES provides significantly higher analytical precision and sensitivity, allowing the detection of elements at trace levels. The method also enables the quantification of a wider range of elements, including those that are

difficult to measure accurately with pXRF. This makes ICP-MA/ES particularly suitable for provenance studies of archaeological ceramics, where subtle chemical differences are crucial for interpretation.

Isotope analyses of ceramics from Store Frigård

For the ICP-MA/ES analyses of ceramic vessels from the Store Frigård site (Brorsson 2024a), the selection process was guided by specific criteria aimed at achieving a representative sample while also allowing the inclusion of visually distinctive or atypical vessels. Three principal criteria formed the basis for selection:

1. characteristic vessel types representing each chronological phase;
2. vessels with unusual forms or decorative features, suggesting possible non-local provenance; and
3. vessels from graves containing foreign artefacts, likewise indicating potential non-local origin.

The selection was carried out by the authors in collaboration with the project leader, Tine Trolle, Aarhus University/Bornholm Museum.

In order to shed light on first of all spatial aspects of the Store Frigård pottery, both on micro and macro levels, and for chronological clarification, it was essential to date the graves containing ICP-analysed vessels using radiocarbon (^{14}C) analyses. Wood species identification of the charcoal from these graves was conducted by Arkeologikonsult AB, Sweden, and the ^{14}C analyses were carried out by Uppsala University, Sweden. The selection of vessels, along with brief descriptions and datings, is presented in Appendix 1, synchronised with the sample numbers referred to in the text and figures below. The full dataset of ICP-MA/ES chemical compositions is presented in Appendix 2, and the ^{14}C dates in Appendix 3.

The analysed material consists of 50 pottery sherds from vessels dated primarily to the pre-Roman and Roman Iron Age (*c.*600 BC-AD 300). This corresponds to samples from about 8% of the total number of vessels from the cemetery, making it one of the most comprehensive isotopic studies of Iron Age ceramics in Scandinavia. The relatively large sample size is fundamental for achieving reliable results.

All of the vessels were found in graves. In some cases, only a single pot from a grave was analysed, but in others, for example, graves 142 (samples StFrigård 38-40), 150 (samples StFrigård 9-11), and 1069 (samples StFrigård 25-27), three different vessels were analysed from each grave. From grave 124 (StFrigård 32-35), four vessels were examined. The sample includes both large, relatively coarse vessels and fine cups and beakers. For comparative purposes, a lump of pottery clay (StFrigård 6) from grave 94 was also analysed, providing valuable information about local geology.

To deepen the understanding of Iron Age ceramics on Bornholm and the relationships between different locations, comparative material from five additional sites on the island was included (see Figure 4 and following section). This pottery was also mainly found in graves and has been dated to the pre-Roman Iron Age. Without comparative material, one can only distinguish between vessels of differing chemical composition; a reference dataset is necessary to determine provenance.

The analyses show that of the 50 sherds from Store Frigård, six had a completely different chemical composition from the rest (Figure 5). The remaining 44 form several smaller groups, but all likely originated from vessels manufactured in the same general area, probably in the vicinity of the grave field. It should also be pointed out that the lump of clay has the same chemical composition as the majority of the analysed vessels from the cemetery. The results of the ICP-MA/ES analyses suggest that several pottery workshops or households were involved in production, yet that raw materials derived from the same source. This interpretation is based solely on chemical composition and does not consider chronology, vessel shape, or decoration. Since the vast majority of vessels share similar fabrics, these groups are assessed as locally produced. The inverse interpretation, that the six were local and 44 of foreign origin, is considered unlikely. For the purposes of this study, 'local' production is defined as the use of raw materials originating within a catchment of 15-20 kilometres from the site, in accordance with clay provenance analyses of German ceramic workshops (Brorsson

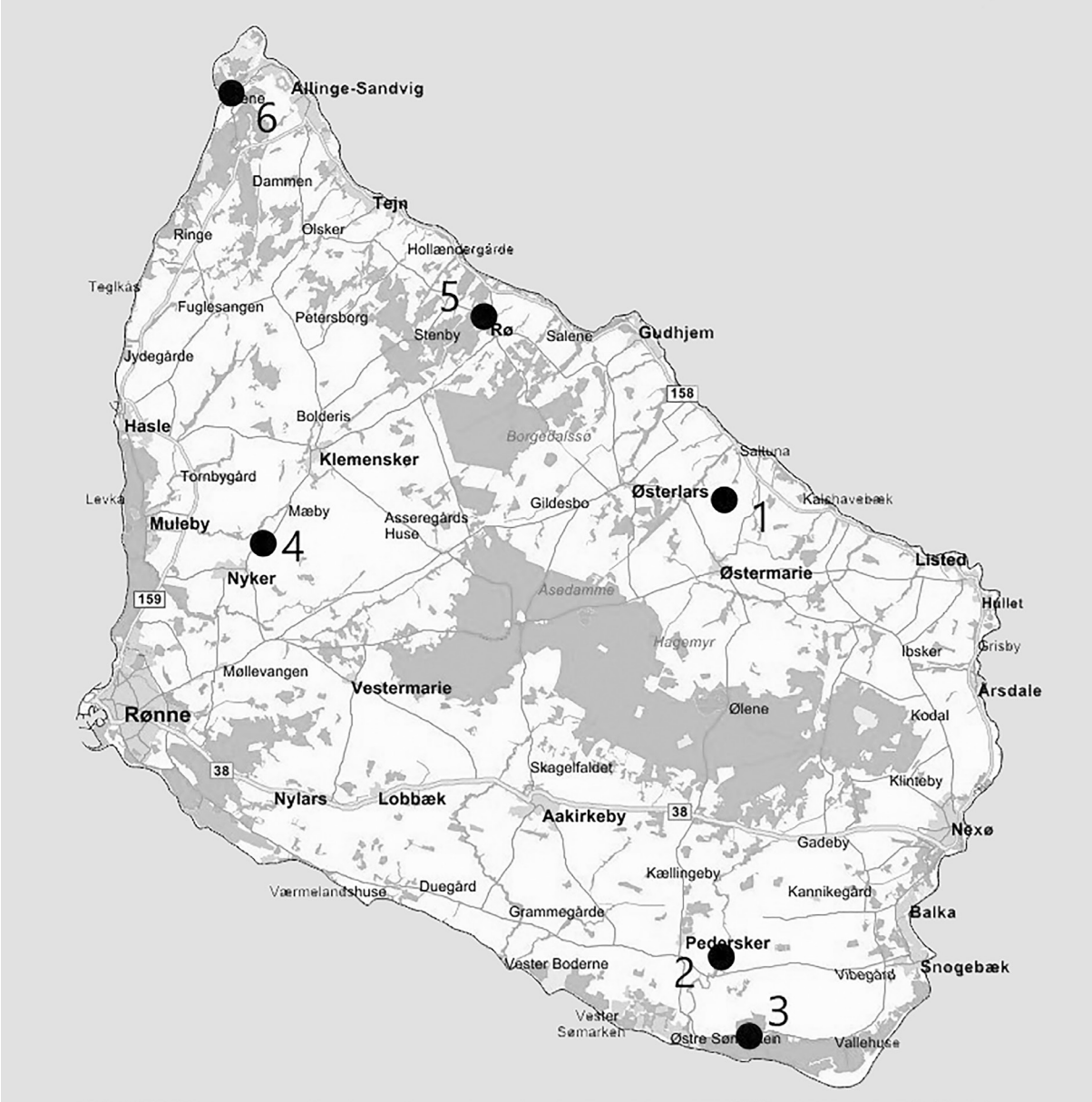

Figure 4. Localities on Bornholm with ceramics ICP analysed in this project. 1. Store Frigård, 2. Snaphøj, 3. Dammegård, 4. Grimeshøj, 5. Pilegård, 6. Blanch´s hotel (Background map modified from: https://map.krak.dk © OpenStreetMap contributors, https://www.openstreetmap.org/copyright, CC BY-SA 2.0 https://creativecommons.org/licenses/by-sa/2.0/).

2024b). It is important to note that the cemetery was in use for several generations, yet the analyses partly show that potters from different time periods used the same clay pits in the same area. Nine out of ten vessels were locally made, indicating a strong tradition of local pottery production. The vessels were likely produced at one or more nearby dwelling sites.

An interesting result is that three vessels analysed from grave 150 (Figure 5), StFrigård 9-11, are placed directly next to one another in the dendrogram, clearly consisting of identical raw materials. It may well have been the same potter who made all three vessels for that grave. Another three vessels from grave 142 were also locally made, although their chemical compositions vary somewhat from the majority. It is quite possible that these, too, were made by the same potter. The same applies to the vessels from grave 1069. We can thus conclude that several vessels placed in the same grave were made from identical raw materials, which suggests they were produced by the same individual or in the same workshop.

In contrast, four vessels from grave 124 show a completely different pattern. One of them (StFrigård 35) deviates most strongly, while the other three belong to three different local groups. It was not the same potter who produced the

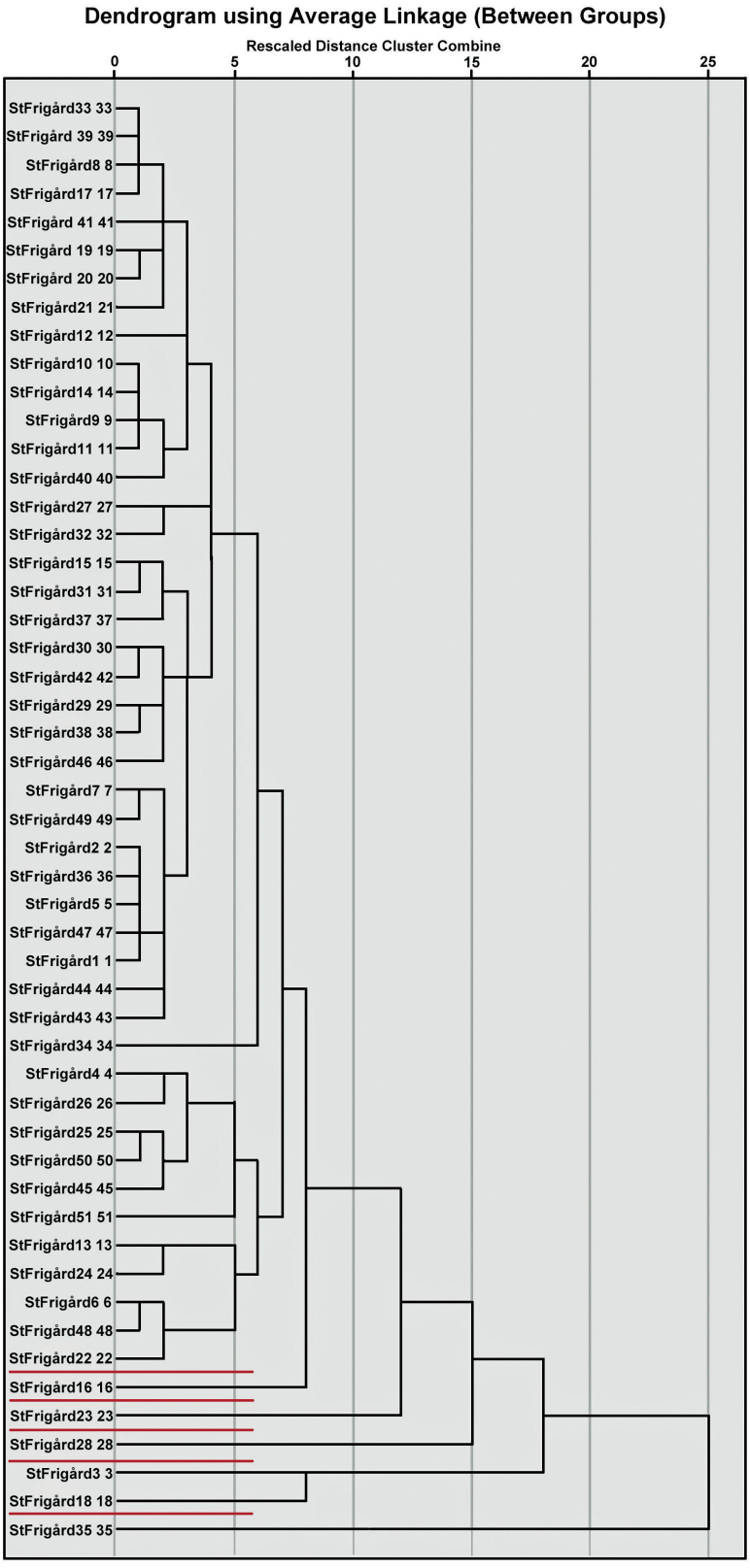

Figure 5. Dendrogram of the ICP analysed ceramic from the Store Frigård cemetery. The majority of the 50 analysed pottery sherds and the raw clay (Sample no. StFrigård 6) are relatively similar. The six sherds at the bottom of the dendrogram have a different chemical composition. Sherds that are similar to each other are grouped early according to the upper scale.

pottery in this grave, and one vessel had a markedly different chemical composition. The provenance of this vessel has not been determined, but chemically the ware contains unusually high levels of cobalt (Co) and sodium (Na). It is possible that the fabric deviates due to a different type of added temper.

From eight different graves, two vessels from each were analysed. In four of these graves, the vessels are chemically similar enough to suggest production by the same potter. In the other four, one of the vessels is chemically distinct, showing a completely different chemical composition and suggesting a different provenance. Grave 244

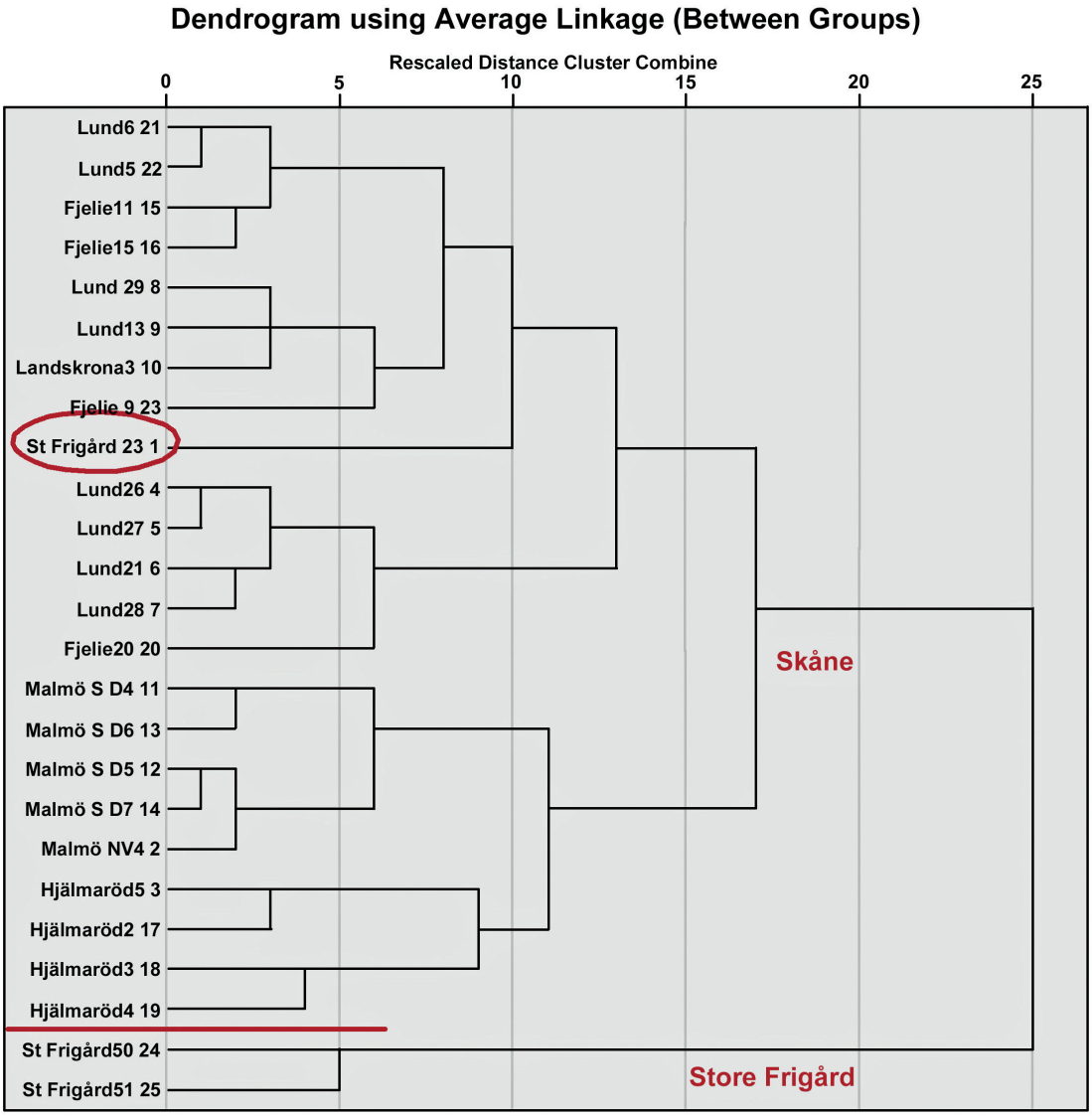

Figure 6. Dendrogram of the ICP analysed ceramic from the Store Frigård cemetery. The sherd StFrigård 23 (grave 244) places itself with ceramics from western Scania (Skåne) and it deviates from the Store Frigård pottery. The dendrogram is based on analysed ceramic objects and raw clays included in Ceramic Studies database. This dendrogram provides an example showing that St Frigård has the same chemical composition as ceramics from Skåne.

Figure 7. A neck and rim part of vessel 244a (Sample no. StFrigård 23), with a provenance to western Scania, Sweden. The grave has been ^{14}C dated to Late Bronze Age, period VI (Photo: Tony Björk).

is particularly noteworthy. It contained two larger vessels, one with oblong knobs and the other with cylindrical knobs, typical of the Late Bronze Age and early pre-Roman Iron Age. The analysis showed that these vessels had different provenances (Figure 5). Two other graves with two vessels each contained ceramics that were locally produced but made from different raw materials. These results suggest that it was relatively common for a single potter to make more than one vessel for a single household or burial. The clearest example is grave 831, where the two vessels had identical fabrics, and the clay was undoubtedly sourced from the same pit. The vessel from grave 469 also shares strong similarities with those from

Figure 8. The handle vessel from grave 200 is dated to the Late Roman Iron Age (Sample no. StFrigård 28). The vessel is decorated with three horizontal grooves with angled lines on the intermediate bands. The ICP analysis show that the vessel was made in western Blekinge, Sweden (Photo: Roberto Fortuna, The National Museum in Copenhagen).

Figure 9. The vessel from grave 185 (Sample no. StFrigård 37), decorated with angular bands of false corded ornamentation. It was presumed to have an origin in the Brandenburg area, Germany, but the ICP analysis revealed that it was produced in Bornholm (Photo: Roberto Fortuna, The National Museum in Copenhagen).

grave 831, indicating that both the clay and the temper likely came from the same source. Based on the chemical data, it may have been the same potter who produced the vessels in graves 469 and 831.

A relevant observation in this context comes from the Slusegård cemetery, where five graves from the Late Roman period (C1 and C2) contained sets of vessels that were attributed to specific potters (Bech 1996, 19). The ICP-MA/ES analyses from Store Frigård confirm, through chemical composition, that this may have been fairly common practice during the Roman Iron Age. This may reflect cases where vessels were intentionally produced for burial, as opposed to cases where household vessels were selected for inclusion in the grave.

The six sherds that deviated chemically from the local fabrics were compared with reference material from Ceramic Studies' database, with a focus on the southern Baltic Sea area. The sherds were also compared with other grave ceramics from Bornholm and other prehistoric pottery from the island. The aim was to determine the provenance of the deviating vessels. One of these sherds had a completely different fabric, possibly due to an unusual temper. Two other sherds also showed deviant fabrics, and their provenance could not be identified. However, three of the deviating sherds could be provenance-determined. One vessel from grave 244 (sample StFrigård 23), which was partially rusticated and dated to the Late Bronze Age or early pre-Roman Iron Age, differed completely from Bornholm pottery, but showed clear chemical similarities with pottery from western Scania (Figures 5-7). Another vessel from inhumation grave 200 (sample StFrigård 28) also deviated and closely resembled pottery from western Blekinge (Late Roman Iron Age, Figures 5 and 8). A third vessel from grave 428 (StFrigård 16) was similar to pottery from Schleswig-Holstein (Early Roman Iron Age).

The vessel from grave 185 (StFrigård 37) is a medium-sized pot decorated with angular bands of false corded ornamentation on the shoulder (Figure 9). This type of decoration is associated with the Göritzer group of Early pre-Roman ceramics from the Brandenburg area in Germany (Arbman 1934, 16-18). The vessel was considered unusual among the Store Frigård assemblage and presumed to be of foreign origin. However, the ICP-MA/ES analysis showed that it was in fact made on Bornholm (Figure 5). It should be emphasised that the analysis determines the provenance of the vessel, not the identity or origin of the potter. The fabric closely matches that of many other vessels from the cemetery.

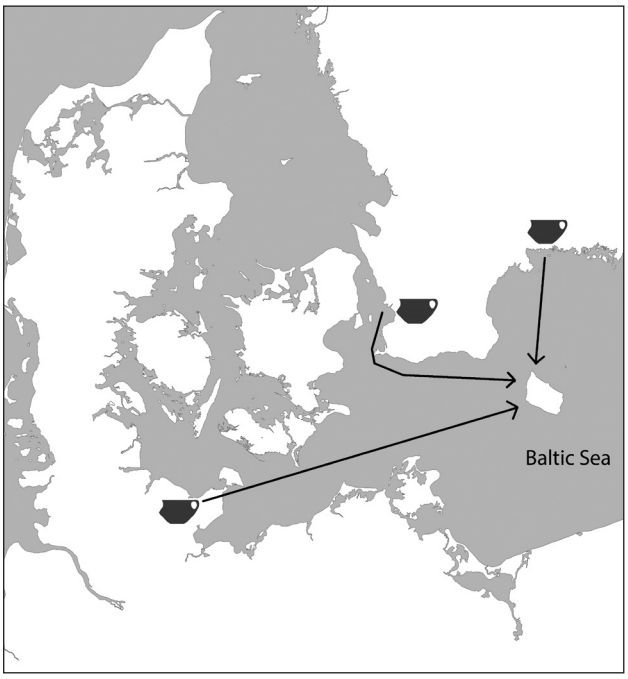

Figure 10. The approximate places of origin of the deviating vessels in relation to Bornholm. The distance between Schleswig-Holstein and Bornholm is approximately 250 kilometres, as the crows fly.

Finally, one of the sampled vessels was selected because it appeared to contain a high proportion of plant material, possibly grain or seeds. This temper may have had both a functional and symbolic purpose. The vessel (StFrigård 43), found in grave 1007, was locally produced. Interestingly, the other analysed vessel from the same grave was also local but made from a different raw material and lacked visible plant inclusions. In the plant-tempered vessel, the proportion of magnesium (Mg) was high, possibly reflecting the high organic content of the clay.

Analyses of pottery from five additional sites on Bornholm

Contemporary ceramics from five other sites on Bornholm have been analysed, representing different parts of the island. Store Frigård is located in the east, Blanch's Hotel in Allinge in the north, Grimeshøj and Pilegård in the west, and Snaphøj and Dammegård in the south (Figure 4). The distance between these sites is roughly 20 km, while the total span from the northernmost to the southernmost site on Bornholm is about 40 km.

There is a source-critical issue in the limited number of samples from each location, but the 11 sherds analysed nevertheless cover four different parts of the island. The isotope analyses showed that three out of four sherds from Pilegård, near Rønne, formed a distinct group, likely representing local pottery. One sherd from the site fell into a separate group, but all four vessels appear to have been produced on Bornholm. These sherds differ completely from the ceramics from Store Frigård and from the other four comparison sites.

From Blanch's Hotel, three sherds were analysed. These were distributed across two different chemical groups, one distinct outlier, and two with similar fabrics, yet all appear to have been made using raw materials from Bornholm. Two sherds from Dammegård in southern Bornholm were also analysed and found to belong to two different groups. One of the Dammegård sherds had a calcium (Ca) content of 32.1% (Appendix 2), which is exceptionally high. In typical clays, calcium content ranges between 0.5% and 2%, although in white-burning clays it can exceed 20%. It is possible that the ware was white-burning, and such clay types are found throughout northern Europe, including Bornholm. The sherd was compared with reference material from Germany, Denmark, Gotland, and other parts of northern Europe, but no direct parallels were found. Based on the analysis, the vessel may have been made from Bornholm clay, although a non-local origin cannot be ruled out.

In general, the comparison material reveals a varied picture, and the small number of sherds makes it difficult to draw firm conclusions. The two sherds from Grimeshøj and Snaphøj respectively, as well as one sherd each from Dammegård and Blanch's Hotel, show similarities to one of the local groups from Store Frigård. Although this is a heterogeneous group, it is possible that these vessels were made from raw materials sourced from the same area. In other words, ceramic vessels from different parts of Bornholm may have been produced using clay from a shared source. One could argue that the vessels were made near Store Frigård, but it is also plausible that the clays, known for their excellent quality, were collected by potters from different settlements across the island.

Additional comparative material of Neolithic pottery from Vallensgård near Aakirkeby in

southern Bornholm, part of Ceramic Studies' database of analysed ceramics, also shows similarities to this group, further supporting a provenance in southern or possibly central Bornholm.

Ethnographic parallels from 20th century Peru (Arnold 1993, 67) and Zimbabwe (Lindahl and Matenga 1995, 27) have shown that potters typically travelled on foot no more than three kilometres to collect clay, although distances up to 30 kilometres were possible. Potters usually relied on the same clay source until it was empty. This suggests that it would not have been unusual for Iron Age potters to collect clay from sources beyond the immediate vicinity of their settlements. However, the historical, social, and environmental circumstances of 20th century Africa cannot be directly transferred to Iron Age Bornholm; these examples serve only to illustrate the general principle of potters' mobility and resource selection.

Vessel origin as a symbol of prestige and social hierarchy

ICP-MA/ES analyses were carried out with the aim of determining where the ceramic vessels were produced. The results show that nine out of ten vessels share an almost identical chemical composition, indicating that most were manufactured locally on Bornholm, as expected. However, at least 6% were clearly produced in other regions. Three vessels had a chemical composition identical to ceramics from other areas. This means that these vessels matched more closely with pottery from those regions than with ceramics from Bornholm. A vessel from grave 244, dated to the Late Bronze Age–Early pre-Roman Iron Age, had clear similarities with pottery from western Scania. A second vessel, from grave 428, dated to the Early Roman Iron Age, closely resembled pottery from Schleswig-Holstein. The third non-local vessel, from grave 200, dated to the Late Roman Iron Age, and this was the only inhumation grave in the entire burial field. Out of 1,256 graves at Store Frigård, it was only this individual that was buried in accordance with this custom, and moreover with a vessel originating from western Blekinge. In light of the well-documented connections between Bornholm and southeastern Scania (Björk 2022, 52; Heidemann Lutz 2010, 259-260; Stjernquist 1955, 99-101), it is noteworthy that none of the analysed samples indicate such a link. The vessels of non-local origin provide valuable insight into contact networks, complementing and broadening the picture given by Roman imports (Lund Hansen 1987), and forthcoming work on distribution of other metal objects and strontium isotope analyses.

A further 6% of the vessels examined from Store Frigård were probably neither from Bornholm, but their provenance could not be determined. It is possible that one or more originated from regions for which we lack comparative material, or that they were made from atypical raw materials, where the nature of the temper may have affected the chemical signature. This highlights the need to further refine provenance studies of prehistoric ceramics.

The ICP-MA/ES analyses of the Store Frigård ceramics also revealed insights beyond provenance alone. In several cases, graves containing multiple vessels made from identical raw materials, suggests that the same potter produced them. It is also plausible that they were made specifically for the burial, perhaps weeks in advance, rather than being selected from household inventories. But to confirm or dismiss this would require further analyses, *e.g.* of organic residues. Pottery production began with the collection of clay, usually in the summer months, while the clay was allowed to rest during winter. In spring, the clay was prepared and used for making vessels. The entire process of making a vessel, from shaping and decorating to drying and firing, typically took about a week (*e.g.* Lindahl and Matenga 1995, 33). It is also well known within ceramic craft traditions that the vessel must be thoroughly dried before firing, often for up to a week or two, otherwise the pot is likely to crack during firing; if a pot is too damp when it is fired, it may even explode when the last of the water vaporises into steam instead of being drawn slowly from the clay (Allan 2024, 32). The ICP-MA/ES analyses thus also shed light on the selection and production of ceramics in burial contexts. This is a valuable dimension of ceramic studies that, alongside use-wear analysis, enhances our understanding of the choices made in connection with burials.

When we study and classify ceramic material, it is usually the unique and unusual vessels that attract the most attention. This may be due to distinctive decorations or unusual vessel shapes, which often lead to an interpretation of the pottery as foreign. The example of the vessel with false-corded decoration in grave 185, which would typically have been identified as a type from Brandenburg, turned out to be locally produced. Conversely, the vessel with knobs from grave 244a, which might have been expected to be local, was instead made in western Scania. These analyses thus add a new dimension to our interpretation of the past.

At the Sejlflod burial ground in northern Jutland, materials from graves dated mainly to the 5th and 6th centuries AD have been classified into high-, medium-, and low-status categories. Ceramic vessels were present across all groups (Ringtved 1991, fig. 27), including beakers and cups. If these vessels had been made of glass rather than clay, however, they would have been found exclusively in the high-status group. Weapons such as axes and swords, as well as symmetrical brooches and various forms of gold and silver jewellery, were also found in the high-status category. Fibulae and other items appeared in both the medium- and high-status groups, which also included beads. In the lowest-status group, only ceramic vessels, bone combs, and iron knives were found. Based on this hypothesis, the presence of pottery alone cannot be used to determine the status of the deceased, but certain vessel types or their provenance may indicate elevated status or foreign contacts.

From today's perspective, this classification is perhaps unsurprising, but additional aspects must be considered when categorising grave goods. The selection of objects was likely also related to the deceased's gender and possibly their age. At the Ytter Restad cemetery in western Sweden, dated to the Roman and Germanic Iron Age, smoothed vessels were primarily found in male graves, while burnished ceramics were mostly associated with female and child graves (Brorsson 2015, 342). A similar pattern emerged in a study of ceramics from southern Norway, where cups with handles occurred in both male and female graves, though they were almost standard in female burials (Løchsen Rødsrud 2012, 139). These examples from burial grounds across Scandinavia thus indicate that variation in ceramics was primarily associated with social differentiation, although certain vessel types were more commonly linked to specific roles or positions in society.

Ceramics functioned as carriers of both social status and cultural identity. While the presence of pottery alone does not necessarily signal high status, certain distinctive vessels likely did, and foreign ceramics in particular may reflect cultural belonging. It seems unlikely that someone was coincidentally buried with a vessel from the other side of the Baltic Sea; more likely, the provenance of such a vessel carried meaning, signifying status, identity, or both. There are of course several possible reasons for some foreign vessels reaching Bornholm during the Early Iron Age. It could be because of trade, gifts, intermarriage between people from different areas, as containers for individuals who had died abroad and then brought home in one, or a few other reasons. Below we are briefly discussing the role of the vessels as parts of the staging of the prestige and social role of the deceased and the survivors.

Concluding remarks

The Store Frigård cemetery yielded an exceptionally rich ceramic assemblage, and through large-scale ICP-MA/ES analyses, we have demonstrated some of the interpretative potential of such a dataset. The analysed vessels reflect a wide range of practices and interactions, and the information they offer covers a long span of time at a single burial site. Collectively, they are fragments that reveal glimpses of the interactions that shaped this community. There is good reason to pursue this type of work further, both at sites on Bornholm and in other regions around the Baltic Sea, for example, as a means of mapping networks of interaction between people connected by seafaring and exchange.

Acknowledgements

The authors would like to thank Torsten Söderberg's Foundation and Ebbe Kock's Foundation,

both of which generously supported the studies of the Store Frigård ceramics, the ^{14}C analyses, and the ICP-MA/ES analyses. We would also like to thank project leader Tine Trolle for her practical assistance and valuable comments on the text; the staff at Bornholm Museum for their help in selecting ceramic material suitable for comparison with the Store Frigård site; and Anders Pihl at the University of Copenhagen for his support in orienting us within Bornholm's geography. Finally, we are also grateful for valuable input on our article from the editor and two anonymous reviewers.

The project *"Bornholm – the island in the middle. Society, exchange and alliance systems in the Baltic area on the threshold of history"* is based in Denmark, at Aarhus University and Bornholm Museum, and is conducted in collaboration with researchers from the universities of Copenhagen, Oslo, Lublin, Poznań, and Toruń, as well as Sydsvensk Arkeologi and Heimdal Archaeometry. The comprehensive ceramic analysis of the Store Frigård vessels will be published in a monograph on the cemetery (Bornholm – the island in the middle), with contributions from all project participants. The monograph is planned for publication in 2026-2027.

Declaration of interest statement

The authors declare no competing interests or personal relationships that could have influenced the work reported in this paper. The funding sources are disclosed above.

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Supplementary Material

Material see also .xlsx-attachment on the website

Appendix 1. Result of vessel type analysis. Samples named SF are from Store Frigård, the following 11 are from other sites on Bornholm. The grave number is the same as the vessel number, but the finds have a letter added for individual artefacts (e.g. Grave 41 contain finds 41a – razor knife, 41b – belt fitting, 41c – rivet, 41d – ceramic vessel).

Appendix 2. Results of ICP-MA/ES chemical compositions from Store Frigård, Dammegård, Grimeshøj, Snaphøj, Pilegård and Blanch Hotel, Bornholm. Context ID = grave number + find (e.g. 41d as described in Appendix 1).

Appendix 3. Radiocarbon dating results from Store Frigård.