Review Article

Emma Richard-Trémeau*, Catriona Brogan, John C. Betts, Maxine Anastasi, Nicholas C. Vella

A Review of Malta's Pre-Temple Neolithic Pottery Wares

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Abstract: Sites from the earliest known phases of Maltese prehistory often consist of scatters of sherds for the Għar Dalam and Skorba phases (6000–4800 BCE), and tomb contexts for the Żebbuġ phase (3800–3600 BCE). Neolithic studies are, therefore, heavily reliant on the study of pottery. Although traditional typological and seriation-based analyses of the pottery record have substantially enhanced our knowledge of Early Neolithic Malta, there is a growing appreciation of the need to go beyond these approaches to gain new insights. This study reviews the accessible literature on fabric studies on assemblages found in the Maltese Islands, presenting the state of knowledge for the pottery of the Għar Dalam, Skorba (Early Neolithic), and Żebbuġ (Late Neolithic) phases. Microphotographs of pottery wares were selected from a compilation produced for an ongoing project (the MaltaPot project) to illustrate the descriptions found in the literature. The advances made by archaeologists in studying the Maltese Neolithic pottery are reviewed, and suggestions for building on them are proposed, as archaeometric and petrographic techniques have not been applied systematically to Neolithic pottery from Malta.

Keywords: Early Neolithic, Maltese islands, ceramic studies

1 Introduction and Methodology

Despite the long history of archaeological research in the Maltese archipelago (Figure 1), which started in the early twentieth century, the Early Neolithic period and the Żebbuġ phase remain elusive. The islands' inhabitants left behind examples of their material culture, including pottery, which has become an essential resource for archaeologists investigating the Għar Dalam (6000–5400 BCE), Skorba (5400–4800 BCE), and Żebbuġ (3800–3600 BCE) phases (Hunt et al., 2020, p. 37; McLaughlin, Parkinson, Reimer, & Malone, 2020c, p. 38). Pottery assemblages have been studied by employing traditional typological and seriation-based approaches. Using macroscopic pottery features, researchers have established solid cultural links between Early Neolithic Malta and neighbouring Sicily, and have defined Malta's first prehistoric chronology (Evans, 1954, 1971; Renfrew, 1972; Trump, 1966). These early classifications have created a foundation for a small number of subsequent characterisation studies, which included, or were focused on, the archaeometric analysis of Neolithic pottery (Molitor, 1988; Pirone, 2017; Pirone & Tykot, 2017; Pirani, 2018).

This study compiles and compares the existing and accessible fabric- and archaeometric-focused literature to present the current understanding of the Early Neolithic pottery fabrics found in Malta. A discussion of the

*** Corresponding author: Emma Richard-Trémeau,** Department of Classics and Archaeology, L-Università ta'Malta, Msida MS2D2080, Malta, e-mail: emma.richard-tremeau@um.edu.mt
Catriona Brogan: School of Natural and Built Environment, Queen's University Belfast, Belfast BT7 1NN, Northern Ireland, UK
John C. Betts, Maxine Anastasi, Nicholas C. Vella: Department of Classics and Archaeology, L-Università ta'Malta, Msida MS2D2080, Malta

Figure 1: Map showing the location of the Maltese islands and a satellite image of Malta and Gozo. E. Richard-Trémeau.

contributions of these sources to the understanding of Early Neolithic pottery is complemented by identifying gaps within the state of knowledge that future research could address. After a general introduction on fabric studies in Malta, the pottery studies concerning the Maltese Early Neolithic period (Għar Dalam and Skorba phases) and the Late Neolithic (Żebbuġ phase) are discussed. Some notes are given in an appendix note on the current debates around the chronology of the Early Neolithic of the Maltese islands.

This study is a part of the MaltaPot project, a Marie Skłodowska-Curie grant awarded to Dr Catriona Brogan, and hosted at the University of Malta (2020–2022). This project is aimed at classifying Neolithic pottery vessels from these phases using an interdisciplinary approach, and improving the understanding of their *chaîne opératoire* and provenance. As the fabrics of Neolithic vessels were already mentioned in various publications about pottery and ware-types, it was first necessary to collate, compare, and illustrate the previous classifications used in the literature, which this study intends to do. The objectives of this study are, therefore, to present, review, and make accessible the different classifications from the literature on the Maltese Early Neolithic; and to illustrate these classifications with microphotographs of a select group of sherds and highlight the shortcomings of these classifications. An attempt has been made to bridge the different classifications in tabulated form, based on descriptions of the ware-types, fabrics, and their dominant inclusions and, when available, characteristics such as matrix texture or colour. Equivalence between classifications from the literature cannot be complete as each researcher adopted their own methodology which is not always clearly stated in the publications. This stems from the fact that, until recently, and particularly until the excavations of the FRAGSUS project were completed (Malone et al., 2020e), only small assemblages had been published extensively due to the parcity of stratified Early Neolithic deposits.

In the literature, the Neolithic wares have text-based descriptions. This review supplements this information with microphotographs and macroscopic photographs of sherds which have been identified following the descriptions in the literature. The sherd images are a representative selection made from the macroscopic analysis of an assemblage of 381 pieces from 8 archaeological sites spread across the Maltese Islands, chosen to illustrate the descriptions compiled from the literature (Richard-Trémeau et al., 2023a,b,c,d,e). The illustrated sherds had one edge ground flat to allow microphotography and fabric description to be carried out effectively. Information about the sherds and their context can be found in the catalogue in an open-access repository (Richard-Trémeau et al., 2023c).

2 Fabric Studies and Characterisation: Background

Fabric is a term used to describe the material from which pottery is made, its components and their characteristics (Whitbread, 2017, p. 200). Fabric is also the result of all the production processes, from raw material procurement to firing (Santacreu, 2014, p. 109). Thus, pottery fabrics offer insights into different stages of the *chaîne opératoire,* which might be invisible macroscopically, from sourcing the raw material to firing the product. Fabric studies assume that these stages leave diagnostic traces within the pottery that were not erased by subsequent actions (Eramo, 2020, p. 164).

Fabric analysis entails compiling a detailed record of the composition and texture of pottery in qualitative and/or quantitative terms (Rice, 1987, p. 309; Whitbread, 2017). Fabric reference groups are created based on similarities and differences between these records. These groups can then serve as a benchmark for comparison with other pottery samples and/or raw materials using petrography, chemical or mineral characterisation. Reference groups can be used to examine distribution patterns of specific fabric classes (and associated forms) and identify potential non-local/imported material (Rice, 1987, p. 412; Santacreu, 2014, p. 33).

Researchers have also argued that fabric classes, and typological classes, have strong limitations on their own and fabric attributes could rather be integrated into attribute analyses which can additionally consider form and decoration (Vella Gregory, 2018). This approach breaks down sherd characteristics into a series of attributes which are then counted and sorted statistically (Wandibba, 1982, p. 168; Wright, 1967). Vella Gregory (2018, p. 546), for instance, had argued that this approach allows archaeologists to step away from arbitrary classification such as wares or form-based classifications for the Maltese Islands. It is also useful to classify fragmentary assemblages. The advantage of these analyses is to consider all technological choices, rather than focusing on form or fabric in isolation, to consider the whole chaîne opératoire, and to identify variations through time and space (Gosselain, 2018). Such analyses for the Maltese Late Neolithic, however, describe fabric components without characterising them, relying on macroscopic observation and identification (Vella Gregory, 2018, p. 550). A way forward to converge research approaches would be to integrate petrographic identification of fabrics and temper, for instance, into the statistical models of attribute analyses.

Analysis of pottery fabric has been used to determine the intended function of the vessel. The only direct method to determine the actual function of a vessel is through the application of Organic Residue Analysis, which has, however, only been applied to a small number of Neolithic sherds from Malta (Debono Spiteri & Craig, 2015, p. 16). The shape or form of vessels is essential for determining the intended function, with specific shapes suited to certain tasks (Rice, 2015, pp. 412–414), although relationship between shape and function should not always be assumed. In an early agricultural society such as Neolithic Malta, pottery would have fulfilled various everyday roles, including storing and transporting goods and preparing and consuming food. It has become increasingly apparent that technological choices, such as the paste composition, can sometimes be attributed to the intended function of a vessel (Arnold, 2005; Braun, 1983; Müller, 2017; Müller, Kilikoglou, Day, Hein, & Vekinis, 2010; Müller, Vekinis, & Kilikoglou, 2016; Tite, Kilikoglou, & Vekinis, 2001). Potters can alter their pottery paste to address requirements such as thermal shock resistance, thermal conductivity, or water retention (Santacreu, 2014, p. 150). However, approaching technological choices in functional terms has limitations, as making pottery involves a complex entanglement of cultural understandings of suitability, social demands, environmental constraints, and practices learnt, applied and modified through generations of pottery makers (Dietler & Herbich, 1998, p. 234). Indeed, scholars, such as Gosselain (1992), have argued that ceramic specialists have mostly explained differences in pottery in deterministic and functionalist terms. However, even with a given set of environmental and functional constraints, pottery makers are presented with equally suitable options (Gosselain, 1992, p. 561), from which to choose. These technological choices should also be explored, albeit not in functional terms.

Early Neolithic Maltese pottery has been mostly explored typologically, and records of pottery fabric are general observations made on the macroscopic scale. This is, at least in the earlier studies, explained by the limitations inherent to the excavations carried out, and the local lack of access to characterisation equipment at least up to the end of the twentieth century. The lack of secure contexts and the scarcity of materials across

the Maltese Islands for these Early Neolithic periods additionally precluded further in-depth analysis of the pottery. Typological analyses seek to characterise pottery attributes, such as form, size, and decoration (Orton & Hughes, 2013; Rice, 1987; Santacreu, 2014, p. 184). The pottery in Malta has been described as either fine or coarse ware; however, none of the local research publications define these terms quantitatively (Evans, 1971; Malone, Brogan, & McLaughlin, 2020a; Sagona, 2015; Trump, 1966). The ascription of ware types as fine or coarse in the literature does not reach a consensus depending on the time period or area studied (Shepard, 1956, p. 318). In the Maltese literature, fine ware has been frequently applied to thin-walled vessels made from refined fabrics, with very fine inclusions.[1] The surfaces can be smoothed, burnished, or slipped, often with decoration, and encompass many forms, including bowls, cups, or jars. The term coarse ware has been usually reserved for rough, undecorated, thick-walled vessels with medium to very coarse visible inclusions (Evans, 1971; Sagona, 2015; Trump, 1966).

The majority of publications characterising Maltese prehistoric pottery have mostly focused on the Late Neolithic and the Bronze Age: Mommsen et al. (2006) included sherds from the Late Neolithic, Bronze Age, and Punic phases; Pirone and Tykot's samples (2017) ranged from the Late Neolithic to the Middle Bronze Age; Tanasi (2018), Tanasi, Barone, Mazzoleni, Raneri, and Giuffrida (2015), Tanasi, Daniele, Cannavò, and Levi (2020), and Tanasi, Tykot, Pirone, and Vella (2020) studied exclusively the Middle Bronze Age. Four studies have, however, applied archaeometric analysis to the Early Neolithic period. The first study was conducted by Molitor (1988), whose PhD thesis looked at pottery from the Neolithic and Bronze Age to determine provenance and production techniques, using petrological analysis on ceramic sherds and X-Ray Diffraction (XRD) on experimental samples. Molitor's work has gone largely unnoticed for some decades, most accessible texts on the Maltese Neolithic have not quoted it (Malone et al., 2009; Pirani, 2018; Sagona, 2015; Trump, 2002, 2015). Her approach to study pottery in Malta was innovative and was conducted during the 1980s. The University of California at Los Angeles (UCLA) was invited to Malta in 1983–1984 (Bonanno, 2005, p. 215). UCLA's work, and particularly Molitor's, was completed within a complex political framework (see letters and discussion in Sausmekat, 2016).

A characterisation study of a single sherd of pottery from the site of Caduta near Licata on Sicily allowed Barone, Mazzoleni, Raneri, Tanasi, and Giuffrida (2015) to identify it as a Żebbuġ import. Most recently, Pirone (2017) used portable X-Ray Fluorescence (pXRF) to examine the chemical composition of Neolithic and Bronze Age sherds for his PhD, while Pirani (2018) adopted a multidisciplinary approach, including petrography, Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM-EDS), and Raman spectroscopy, to study Skorba phase pottery for her master's degree thesis.

3 The Provenancing Challenge

Beyond classification, mineral and elemental analyses of fabric can provide clues about the provenance of the raw materials used to manufacture the vessels. In the case of provenancing clays for a regional study, it is assumed that variations between different clay sources are greater than the differences within one given source over a defined range or scale covered by the research (Hein & Kilikoglou, 2020).

Visser (1992), and then Montana, Ontiveros, Polito, and Azzaro (2011, p. 487) demonstrated that clay outcrops in parts of Sicily could be differentiated within the region, given the diverse underlying geology. Within the Maltese context, archaeologists have had challenges with the geology as it is quite uniform. For example, XRD analysis has not shown major differences between Malta and Gozo in a previous study (Molitor, 1988, p. 160). Maltese geology consists of five main exposed sedimentary geological layers, including Blue Clay, a mudstone layer which erodes and creates the typical clay slopes of the Maltese landscape (Figures 2 and 3; Continental Shelf, 2022; see Scerri, 2019 for a recent summary of Maltese geology). The chemical and mineral variations between and within the Blue Clays have not been explored fully. However, Pirone (2017) highlighted

1 The terms defining inclusion sizes can be found in Orton and Hughes (2013, p. 281).

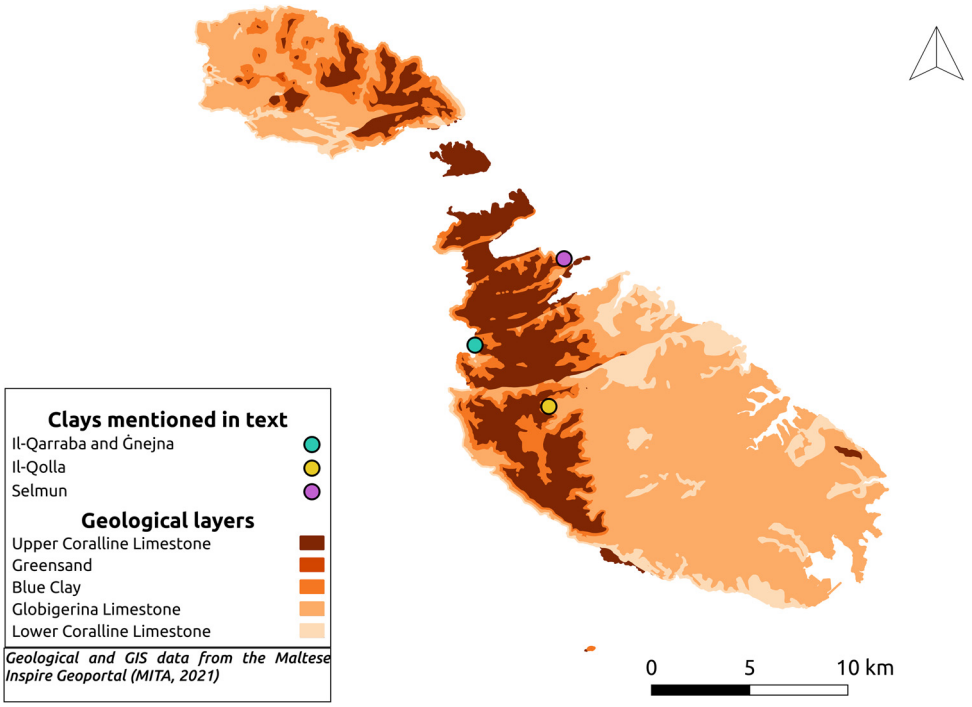

Figure 2: Map of the main geological formations of the Maltese Islands. The source of raw materials is assumed to be the Blue Clay formation although Quaternary deposits, not represented here, should be explored too. Colours do not follow the Commission for the Geological Map of the World as the layers are all dated to Late Oligocene and Miocene.

that chemical variations might be greater stratigraphically within one clay source, rather than in between sources by analysing clay samples from both Selmun and Ġnejna at different heights in the slope.

The hypothesis that Malta could share similar clay elemental composition to the Ragusa area in Sicily (Bruno, 2009, p. 109) is also yet to be tested. Indeed, DiGeronimo, Grasso, and Pedley (1981) have shown similarities between geological formations between Malta and south-eastern Sicily. More generally, studies need to address local sediments' chemical and mineral diversity and suitability for making pottery. Until then, the mineral composition of the fabric of vessels can still be assessed as consistent – or not – with Maltese origins by comparing a range of Maltese clays and temper sources with pottery found in archaeological contexts.

Figure 3: Left: Blue Clay slopes (b) at Il-Qarraba overlaid by Upper Coralline Limestone (a), North West orientation; Right: Blue Clay hill (d) at Il-Qolla (Rabat, Malta) with Upper Coralline Limestone boulders (c). Note that the clay layer provides soil used for farming (e), South East orientation with Mtarfa, Mdina, and Rabat in the background.

4 The Early Neolithic Pottery of Malta: Għar Dalam Phase (6000–5400 BCE)

A new chronological sequence for Malta suggests that the islands could have been occupied at least as early as 6000 BCE (Table 1; Hunt et al., 2020, p. 37; McLaughlin et al., 2020c, p. 39). A review of these early dates of occupation is awaiting, but beyond the scope of this study. A note is included at the end of this article to start engaging discussion on the latest dates for Early Neolithic Malta. Sites with claims of Għar Dalam phase pottery are given in Figure 4. Based on similarities in pottery shapes and decorations, it has been argued that during the Early Neolithic period, Malta retained external solid links with nearby Sicily (Bonanno, 2011; McLaughlin et al., 2020b, pp. 283, 286–287). This earliest pottery was named after the cave site in southeast Malta (Despott, 1923) and was identified as Early Neolithic, thanks to the similarities with the South Italian Stentinello pottery style (Trump, 2002, p. 28).

While there are several Early Neolithic sites on Malta and Gozo (Figure 4), very few also include structural remains. Pottery has often been found as sherd scatters, making it difficult to contextualise and interpret the available material. Examples include the sites of Taċ-Ċawla and Ġgantija in Gozo, and Kordin III in Malta, where the FRAGSUS project and earlier surveys uncovered pottery scatters from the Għar Dalam and Skorba phases (Grima, Stoddart, Hunt, French, & McLaughlin, 2020, p. 231). Layers containing Għar Dalam phase pottery are often mixed layers containing later material. For example, during recent excavations at Santa Verna and Skorba, Għar Dalam phase pottery was systematically associated with Skorba phase pottery and sometimes later Temple period pottery (McLaughlin et al., 2020a, pp. 153–154). There are currently no known pottery production sites for the Għar Dalam period in the Maltese Islands, which means that only pottery sherds can be studied to better understand the local production of vessels.

The material culture suggests external exchange and trade: the islands' limited range of natural resources might have necessitated contact with their neighbours to obtain essential supplies, encouraging other cultural connections (Robb, 2007, p. 177). Although the islanders appear to have used local chert to fashion lithics, this was supplemented with chert from Sicily (Chatzimpaloglou, French, Pedley, & Stoddart, 2020; Groucutt, 2022), obsidian from Lipari, and occasionally Pantelleria (Tykot, 1996, p. 58). Ties between Malta and its neighbour are best observed in the pottery record.

The Għar Dalam pottery was proposed as a local variant of the southern mainland Italian and Sicilian Stentinello ware, a derivative of Impressed Ware (Bernabò Brea, 1950, p. 26; Debono Spiteri, 2012, p. 37; Giannitrapani, 1997, p. 204; Malone, 2003, p. 275). The Impressed Ware is one of the earliest pottery traditions in the central and west Mediterranean during the Neolithic (Delfino, Pessina, & Tiné, 2002). It has been pointed out that using this broad name could be problematic, as it prevents discussing spatial and chronological diversity in decoration and associated technological choices and motor actions (Vella Gregory, 2021).

Malta's Għar Dalam pottery shares many of the same forms as the Stentinello ware, mostly globular forms (Evans, 1971, p. 208; Holloway, 2002, p. 8; Sagona, 2015, pp. 29–30), and has similar decorative motifs, with geometric shapes, such as chevrons or rows of impressed lines (Figure 5), commonly occurring (Malone, 2003,

Table 1: Revised chronology proposed by the FRAGSUS project from Early Neolithic in Malta to the Late Bronze Age (Mclaughlin et al., 2020c, p. 39; Hunt et al., 2020, p. 37), and the traditional chronology by Trump (2002)

Pottery phase	Previously established chronology (Trump, 2002, p. 55)	Chronology by FRAGSUS (McLaughlin et al., 2020c)
Għar Dalam	5000–4300 BCE	6000–5400 BCE
Skorba	Grey Skorba: 4500–4400 BCE Red Skorba: 4400–4100 BCE	5400–4800 BCE
Temple period	From 4100 BCE	From 3800 BCE
Bronze Age	Tarxien cemetery: 2400–1500 BCE Borġ in-Nadur: 1500–700 BCE Baħrija: 900–700 BCE	Thermi: 2400–2200 BCE Tarxien Cemetery: 2000–1700 BCE Borġ in-Nadur & Baħrija: 1500–750 BCE

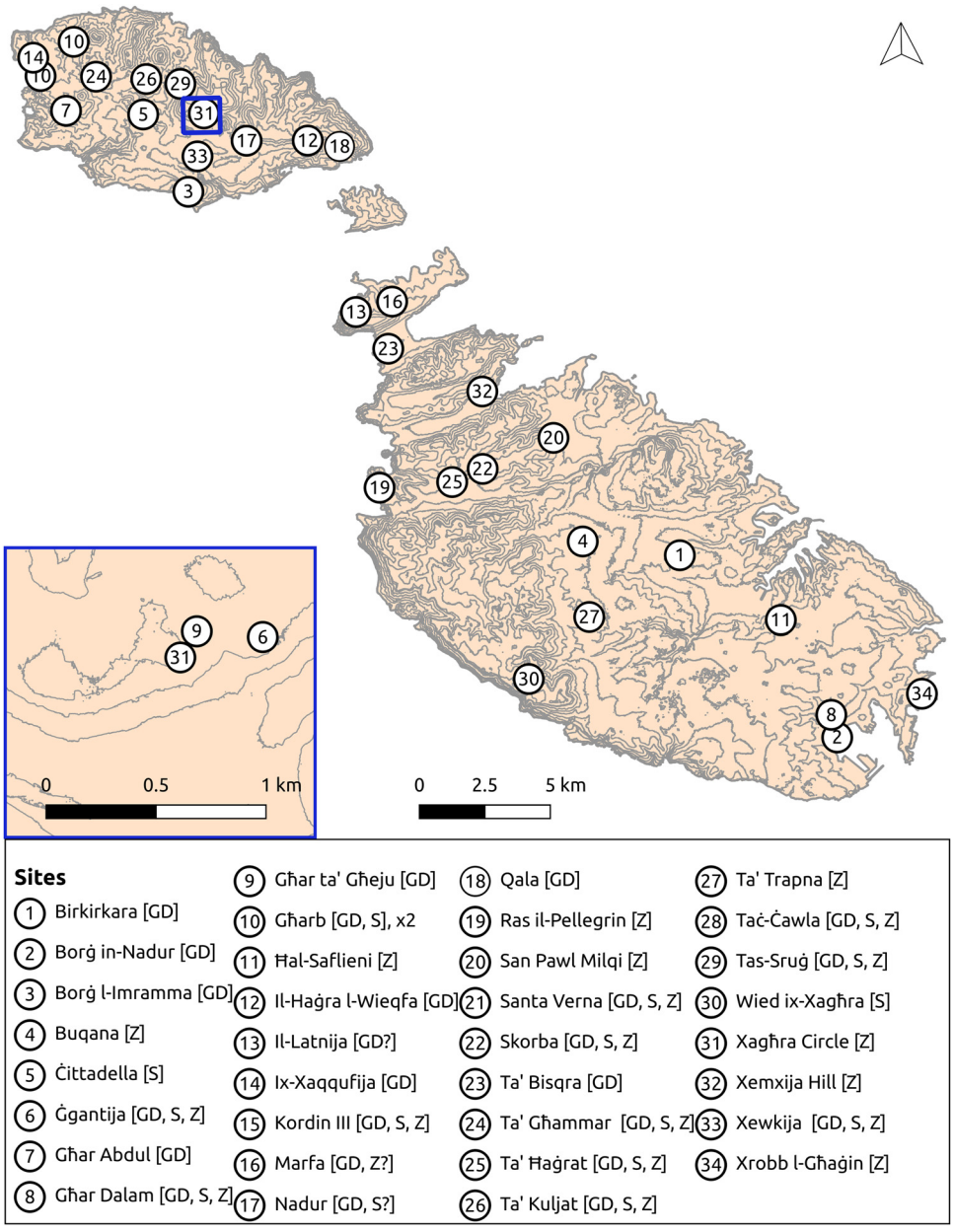

Figure 4: Map of archaeological sites in the Maltese islands where Għar Dalam (GD), Skorba (S), and Zebbuġ (Z) phase sherds were reported in the literature. Data from Cilia (2004), Evans (1971), and Sagona (2015). Elevation basemap created from 2012 Digital Terrain Model (Planning Authority, 2012). Elevation every 20 m. Data collection by J. C. Betts and map by E. Richard-Trémeau and A. Lamolière.

p. 275; Malone et al., 2020a, p. 330). One decorative element common in the Stentinello ware, but not as recorded in Maltese pottery, is the use of stamps to produce repetitive decorations (Daniel & Evans, 1975, p. 16). One example on which stamps might have been impressed is known from Santa Verna; however, it is unknown if the sherd is of Maltese provenance (McLaughlin et al., 2020a, p. 136). Despite the commonalities of forms and designs, the Għar Dalam phase pottery has been found in different contexts than the Sicilian Stentinello as settlement types and burials seem to differ between the islands (Vella Gregory, 2021). The decorations of the Għar Dalam phase have been described broadly by motif to identify and classify sherds. These decorations, however, are also part of the *chaîne opératoire* of making these vessels, and require their own set of tools and knowledge which should not be overlooked (Vella Gregory, 2021).

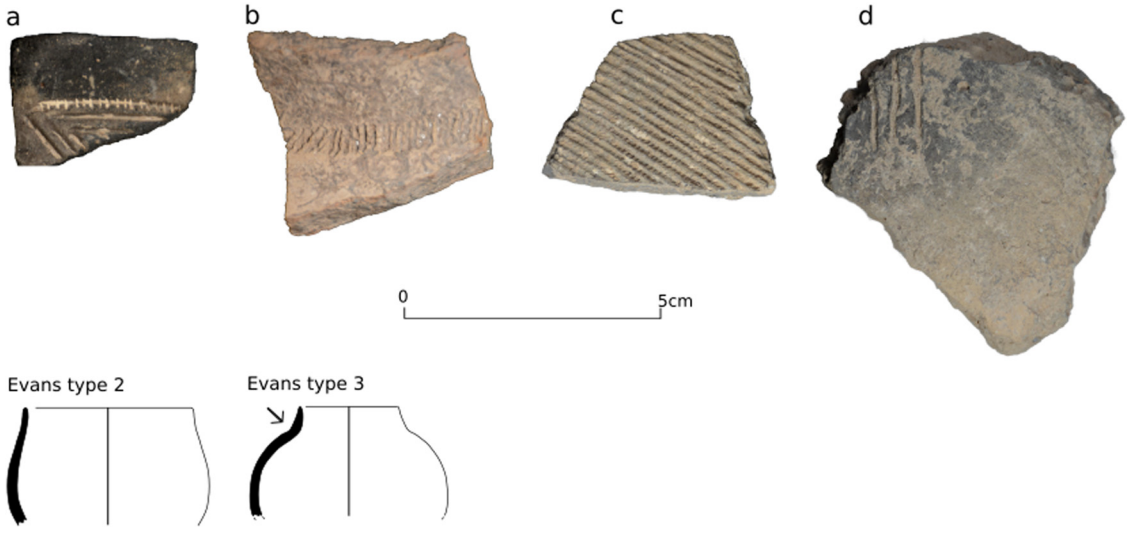

Figure 5: Macroscopic photographs of the sherds illustrated in Figure 6. Schematic types – not to scale – for the diagnostic sherds (a and b) are shown following Evans (1971) and digitised over Malone et al. (2020b, p. 750). Arrow showing the location of the sherd (shoulder). (a) G1023, (b) G1027 (c) G1005, and (d) G2004.

Over the years, several Għar Dalam ware classifications have been proposed (summarised in Table 2). The first synthesis of Malta's pottery by Evans (1954, p. 45) briefly mentions Għar Dalam fabrics, and the sherds were simply documented as fine wares at this stage. He noted a well-burnished fine ware with a grey or black fabric and another grey or reddish-brown fabric with fine white grit. Until the excavation at Skorba, however, the Għar Dalam phase pottery was known mostly from the Għar Dalam cave. Evans' wares were adopted by later classifications (Table 2), although Trump merged the two fine wares into one category in his analysis of the Għar Dalam pottery found at Skorba (1966) and recently re-published (Trump, 2015, p. 46). Having a more extensive assemblage to study and well-stratified deposits, Trump additionally identified coarse wares. His fine ware had a black, grey, or brown matrix with a homogenous texture and occasional small gritty inclusions. The coarse ware was dark grey to black in section, but the fabric was much grittier and more friable (Trump, 2015, p. 47). These categories can still be used, to some extent, to classify Għar Dalam assemblages macroscopically and, for instance, the fine and coarse wares were also identified at Santa Verna (Figure 6a and d; Richard-Trémeau et al., 2023a, pp. 9, 18; 2023c, pp. 5, 7). Sagona's (2015) overview of the Għar Dalam pottery also followed the fabric conventions established by Trump. The fine matrix as seen in Figure 6a and particularly Figure 6b does raise the question of clay purification. However, it is unknown how fine the Blue Clays can be across the Maltese Islands, and more experimental work, such as the fabrication and firing of briquettes, is needed to understand if the local clays would need to be refined to obtain such results.

A transitional type of fabric, between the Għar Dalam and Skorba phases, was also noted by Trump (2015, p. 48; Figure 6c). Based on the stratigraphic record from his excavation at Skorba, Trump identified a late form of Għar Dalam pottery with a fabric akin to the later Skorba pottery, with its white angular grit (Trump, 2015, p. 46). This fabric was found in sherds that have typical Għar Dalam characteristics, either shape or decoration (sample G1005; Figure 6c). This ware was also identified at Santa Verna (Richard-Trémeau et al., 2023a, p. 9) but might be impossible to distinguish in non-diagnostic sherds (form or decoration) as it is otherwise similar to Skorba fabrics (e.g. Figure 7a). Moreover, since the most recent excavations of FRAGSUS found Għar Dalam phase sherds systematically mixed with Skorba phase sherds, the chronological aspect of this fabric cannot, for now, be verified.

Building on these classifications, Malone et al. (2020a, p. 330) stated that it is hard to distinguish the pottery of the Għar Dalam and Skorba phases. The present team drew the assemblages from the excavation of six different sites (including Santa Verna and Skorba from which the sherds of this study were extracted) and a survey (Gozo Cambridge Survey, 1987–1994 including the Xagħra circle excavations). In the study by Malone

Table 2: Summary of the Għar Dalam ware types as defined and identified in the literature

Ware Type	Evans (1954)	Trump (1966, 2015)	Evans (1971)	Sagona (2015)	Malone et al. (2020a)
Fine	Grey or black	Black, grey, or brown with occasional small gritty inclusions	Soft paste, well-levigated, occasionally has white grits; grey or yellow	Dark to pale grey or brown, refined paste but with some gritty particles	Homogenous with occasional white grits, dark to pale grey or yellow. Thinner walls (average: 8 mm)
Fine	Grey or reddish-brown with fine white grits				
Coarse		Dark grey to black, gritty, friable	Thick and gritty, dark core with a lighter surface, brown, grey, or buff	Dark gritty	Thick and gritty, white grits, crumbles. Thicker walls (average: 12 mm)
Transitional (similar to Skorba fabric)		Gritty fabric			

Note: The data in the above table were compiled by C. Brogan.

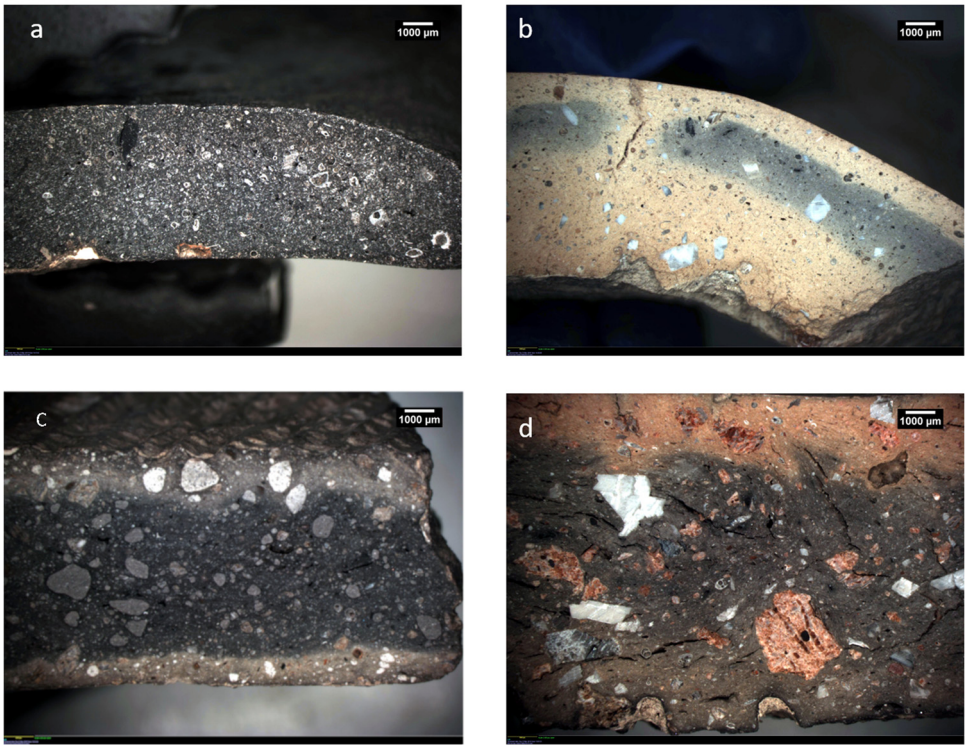

Figure 6: Examples of the different Għar Dalam phase ware types as identified in Table 2. Sherd (a) Fine: G1023, (b) Fine: G1027, (c) Transitional: G1005, and (d) Coarse: G2004 (from the MaltaPot project, C. Brogan).

et al. (2020a), the emphasis was mostly on standardising the descriptions of the vessels in terms of form, decorations, and style, as well as studying frequency and distribution across sites. Fine ware and coarse ware are distinguished following the previous classifications. The observations from Malone et al. (2020a) were recorded macroscopically although the descriptions of a number of thin sections are available, dating mostly from the Temple Period (Malone, Brogan, & McLaughlin, 2020b).

The shortcoming of using these first classifications can be highlighted. Early Neolithic pottery presents variations, and the lack of clear boundaries between categories is a challenge when classifying an assemblage. For instance, there is no clear boundary between a fine ware with white grit, Evans' second fine ware (Evans, 1954; Table 2b and Figure 5b), and the transitional ware recognised by Trump (1966, 2015). The changing definitions of fine and coarse in pottery studies do not establish the frequency or size of inclusions required for a sherd to classify as either and, for instance, the grit mentioned in Evans' second fine ware can be coarse by today's definition (0.5–1 mm, Orton & Hughes, 2013, p. 281). Moreover, the matrix can be compact with few visible fine inclusions. Since these classifications mostly relied on the study of small assemblages available at the time, these differences in fabric could not necessarily be explained in terms of variations in the *chaîne opératoire*, technological choices, or provenance. These difficulties emphasise the need for a new systematic classification, using techniques such as petrography.

The innovative work of Molitor did attempt to give some insights into the *chaînes opératoires* of the Għar Dalam vessels. Based on petrographic observations, Molitor (1988, pp. 204, 228) argued that the Għar Dalam vessels were fired at low temperatures (not above 980°C) in a reduced atmosphere and that they were tempered with crushed gypsum. Although she mentions the fine and coarse ware in her literature review as well as some evolution in firing and designs (1988, pp. 29–30), she does not mention any variation or groupings within the Għar Dalam fabrics from her results. Molitor did differentiate the Għar Dalam wares found in Gozo (Għajn Abdun), describing the Gozitan version of Għar Dalam as having coarse grit in a fine matrix, reminiscent of the two fine wares described by Evans (1954). Since neither the sherds nor the sites from which the sherds came from were described in detail, it is not possible to re-assess these variations. However,

Molitor did add to the knowledge of Early Neolithic pottery by proposing that the clay was intentionally modified by tempering.

Finally, Pirone (2017, p. 145) started addressing the gap of knowledge on provenance using chemical analysis. The pXRF analysis of five Għar Dalam phase sherds from the archaeological site of Skorba suggested that most of the sherds had trace elements very similar to those in the clay samples obtained from Malta. There are limitations to this study, for example a full quantitative method would ideally be used for trace elements rather than pXRF (Holmqvist, 2017, p. 364). In addition, Pirone used an obsidian calibration material used for similar trace elements in pXRF obsidian studies (Rb, Sr, Y, Zr, and Nb in Tykot, Freund, & Vianello, 2013). This exploratory study is, however, significant as it has been the only study to compare sherds from multiple phases using chemical analysis, besides highlighting possible avenues of research for studying local clays. The scattering of the Għar Dalam phase sherds in Pirone's principle component analysis (PCA) results suggests some chemical variations between the sherds (Pirone, 2017, p. 146), which could reflect chemical variations within clays in the Maltese Islands rather than variations in fabric.

5 Skorba Phase (5400–4800 BCE)

Around the end of the Sixth millennium BCE, cultural changes began to occur across the Mediterranean as social networks increased between regions (Broodbank, 2013, p. 236). In Malta, some material culture changes occurred from 5400 BCE, according to the latest dating (see Appendix), when the pottery phase named *Skorba* emerged. Pottery from this phase was first found and associated by Trump (1966) with structural features at the archaeological site of Skorba in Mġarr ([22] in Figure 4). Other archaeological evidence from the Skorba phase includes sherd scatters, and possibly a post hole structure at Taċ-Ċawla (Malone et al., 2020d, p. 117) and a destroyed structure at Santa Verna (McLaughlin et al., 2020a, p. 123). Before the FRAGSUS campaigns, most of these sites had not been explored thoroughly, as evidence of the Skorba phase is expected to be found below later megalithic structures (Trump, 2002, p. 182). Stylistic changes in pottery are observed across the Mediterranean, as the highly decorated impressed wares are replaced by less decorated monochrome pottery that was highly polished or slipped (Broodbank, 2013, p. 236). In the Central Mediterranean, this is exemplified by the Diana-Bellavista ware of Sicily, Lipari, and mainland Italy, and Skorba pottery in Malta (Malone, 2003, p. 275). As mentioned above, work is still required to directly date these pottery phases regionally and understand the relationships between different regions of the Central Mediterranean.

Malta seems to have retained material links with Sicily. The lithic evidence associated with Skorba pottery shows that imports of Sicilian flint and obsidian from Lipari and Pantelleria continued (Trump, 2015, p. 51; Vella, 2008a,b,c, 2016). Trump (1966) classified Skorba phase pottery into two distinct groups: Grey Skorba, which has a grey burnished surface, and Red Skorba, which has a distinctive red slip. Grey Skorba pottery is

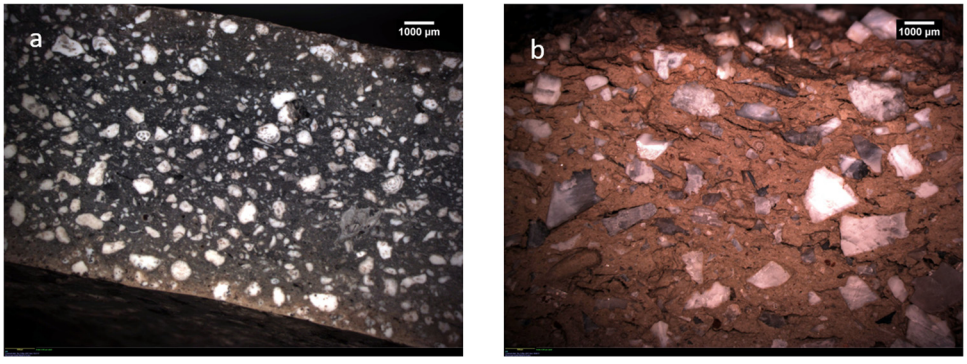

Figure 7: Examples of the different Skorba fabric types as identified in Table 3. Sherd (a) Fine ware: S3009 and (b) Coarse ware: S6012 (from the MaltaPot project, C. Brogan).

Table 3: Skorba ware types as defined and identified in the literature

	Ware Type	Trump (1966, 2015)	Evans (1971)	Sagona (2015)	Malone et al. (2020a)
a	Fine ware (Grey and Red Skorba)	Grey matrix fabric with white grit (crushed gypsum)	Grey matrix with white grit throughout	Dark grey matrix, crushed white angular inclusions (crushed limestone or chert)	Compact, grey fabric (with some firing variations in Red Skorba). White gritty inclusions (shells). Different surface treatments (polish and slip in Red Skorba)
b	Coarse ware (Grey Skorba)	Compact, orange-buff matrix	—	White gritty inclusions, pink matrix	More grits, no surface treatments and pink surfaces

Note: The data in the above table were compiled by C. Borgan.

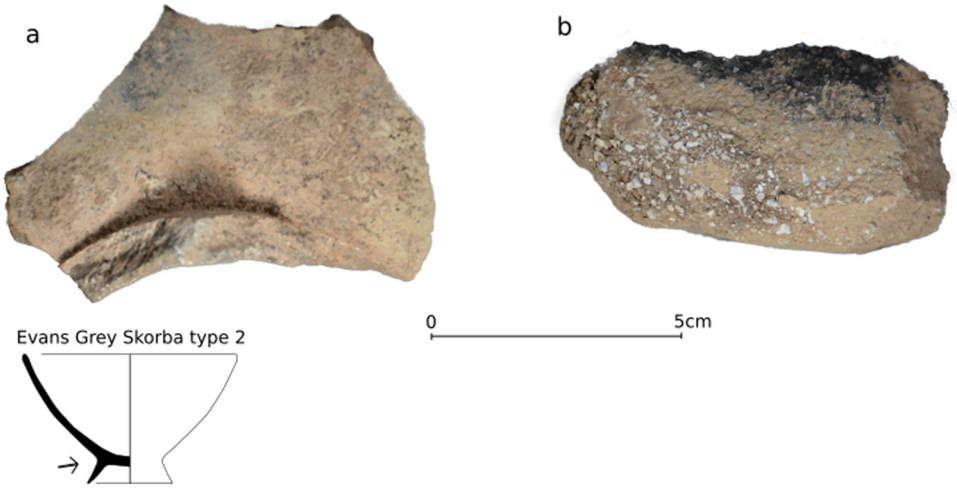

Figure 8: Macroscopic photographs of the sherds illustrated in Figure 7 and schematic type for the diagnostic fineware sherd (a) as defined by Evans (1971); drawings not to scale, digitised over drawings presented in Malone et al. (2020b, p. 750). (a): S3009; (b): S6012; see microphotographs in Figure 7.

generally regarded as the earlier and contemporary to the Serra d'Alto ware found in Sicily, Lipari, and southeast Italy (Malone, 2003, p. 275; Trump, 2015, p. 68).

The Serra d'Alto ware and Grey Skorba are stylistically very different, as the former, with its elaborately painted designs, bears little resemblance to the generally plain Grey Skorba ware. Red Skorba, with its use of a red slip, is stylistically more similar to Diana-Bellavista ware. Trump argued that the Skorba pottery is a local Maltese development that evolved from the later Għar Dalam wares (Trump, 2015, p. 49). Little is written about the Skorba vessels (Table 3 displays the summary). Variations in the Skorba fabrics (even between the Grey and Red Skorba wares) have not been explored, with most sources describing it as a grey-coloured fabric with distinctive white grits (Evans, 1971, p. 209; Sagona, 2015, p. 35; Trump, 2015, p. 49). Trump already recognised a degree of variation within the Skorba fabrics as he notes a coarse ware described as "compact" (Trump, 2015, p. 51; Figures 5b and 6b).

In practice, when archaeological contexts are mixed, Skorba phase pottery is mostly recognised by a combination of white grit and surface treatment, as Skorba "fine" sherds are often highly burnished. However, this can lead to error as these white inclusions are also present in Trump's Għar Dalam transitional ware. Other time periods can have white gritty inclusions, for example, Bronze Age coarse ware (e.g. Tanasi, 2015, p. 39). Moreover, the criteria to distinguish Skorba fine and coarse wares can vary relative to the composition of the assemblage under study, to the presence of reference sherds used for comparison, and the publication of microphotographs. There are no size thresholds for the inclusions to positively attribute a unique sherd to fine or coarse ware. Skorba assemblages have been found highly fragmented (Malone et al., 2020a, p. 323) and coarse ware tends to be crumbly and damaged making the identification of the phase difficult (e.g. Figure 8b). The development of reference collections and online databases are generally required in fabric studies (Quinn, 2013), hence the publication of microphotographs in this article and in open-access catalogues and photo-collections (Richard-Trémeau et al., 2023a,b,c,d,e).

The variations in inclusion size and shape could also be better researched. For instance, in Figure 7a, the inclusions are not as angular as Figure 7b, hinting at different clay processing techniques. Other Skorba sherds have microscopically very rounded inclusions which should be characterised, as the raw material or temper used could be different (e.g. Richard-Trémeau et al., 2023d, p. 28). There has been little agreement on the nature of the white grit, with Trump (2015, p. 49) suggesting that this is made from powdered gypsum, while Sagona (2015, p. 35) has indicated that it may be either crushed limestone or chert debitage from local chert working. Petrographic analysis would allow both the characterisation of these fabrics and the ability to research if this white grit differs chronologically or spatially, for example. These inclusions have been considered in two different petrographic studies (Molitor, 1988; Pirani, 2018), and more recently mentioned by Malone et al. (2020a, p. 333), who suggested shell tempering.

Pirani (2018) analysed 31 Grey and Red Skorba sherds from Trump's excavations at Skorba using petrographic microscopy, SEM-EDS, and Raman spectroscopy. The study identified four distinct fabrics but noted that the overall composition and texture of the fabrics were quite similar (Pirani, 2018, p. 55). The petrology study suggested that potters deliberately tempered the fabric with calcite (Pirani, 2018, p. 55). These findings do not agree with the thin-section analysis carried out by Molitor (1988, p. 240), who suggested that the Skorba sherds were tempered with gypsum. These might represent variations within the Skorba phase pottery, aspects which could be amplified by future research. One point of consensus, however, is that all these authors proposed that Skorba phase pastes were tempered rather than the raw clay left untreated in a similar way that it was discussed for the transitional Għar Dalam ware. There, therefore, seemed to be a common practice of preparing paste and tempering the paste within the Skorba phase. This practice is also known from other red-slipped vessels of the Italian Neolithic (Levi, Cannavò, & Brunelli, 2019, p. 50), and could suggest contacts, knowledge, and craft transmission between the Maltese Islands and Southern Italy.

Pirani also highlighted that there is no apparent difference between the Grey and Red Skorba fabrics other than the distinctive slip of the Red Skorba (Pirani, 2018, p. 56). The breakdown of the Skorba phase into two chronological phases, observed stratigraphically by Trump at Skorba (Trump, 1966, p. 16; 2015, p. 44), has been re-assessed due to evidence from other sites. The recent FRAGSUS work at several sites where Skorba phase pottery was identified did not confirm this stratigraphic division (Malone et al., 2020a, p. 331). Malone et al. (2020a, pp. 332–333) described Skorba according to sub-phases, namely, Grey Skorba, transitional Skorba, and Red Skorba (Malone et al., 2020a, p. 332) to emphasise possible differences between slipped and unslipped vessels while highlighting the similarities between fabrics.

For provenance analysis, Pirone (2017, p. 146) analysed 28 Skorba phase sherds in total from the sites of Skorba and nearby Ta' Ħaġrat: 15 Grey Skorba and 13 Red Skorba sherds. The interpretation of the statistical analysis suggested four groupings of samples. However, they might chemically represent variations in the raw materials rather than between fabric groups. These chemical groups are yet to be related to macro/micro-observations on the samples, as for now it is impossible to assess whether these groups represent different fabric types or raw materials. Two of Pirone's groups are similar in composition to the local Maltese clays from Selmun and Ġnejna. In contrast, a third group is less specific and might represent local variation in raw material compositions which have not been sampled for the study. One of the Għar Dalam phase samples and four samples from the Skorba phase cluster with a set of Early and Middle Bronze Age sherds, which are believed to have been produced in Ognina on the east coast of Sicily (Pirone, 2017, pp. 143–145). Apart from these few samples, Pirone argued for mostly a local origin (Blue Clays), which is consistent with Pirani's conclusions (2018, p. 55). The possible difference in provenance highlighted by Pirone's analysis could be taken further by future research to differentiate if some Skorba phase pottery could have been made in Sicily or not.

6 Żebbuġ Phase (3800–3600 BCE)

According to the most recent published dates for pottery cultural phases, the Żebbuġ phase began, at the latest, around 3800 BCE (Table 1). After a hiatus in the archaeological record, argued for by the FRAGSUS team (McLaughlin et al., 2020c, p. 31), this period is considered the start of the Late Neolithic. Pottery has been found widely associated with funerary structures, which are the first evidence of formal burial in the Maltese islands. Malta appears to have had very strong cultural connections with Sicily, which can be seen in the pottery record and the adoption of formal burial within rock-cut tombs (Baldacchino & Evans, 1954; Cultraro, 2008; Evans, 1954, 1971; Trump, 1966). Żebbuġ pottery is part of a tradition that saw incised pottery become widespread across many areas of the Mediterranean, including the Aeolian Islands, southern Italy and Greece. However, it is most closely affiliated with San Cono-Piano Notaro ware of Sicily (Cultraro, 2008, p. 6) and possibly the Conca d'Oro pottery of Northwest Sicily (Malone et al., 2020a, p. 310).

The first Żebbuġ phase tombs were uncovered in 1947 by workmen digging trenches at the site of Ta' Trapna, Ħaż-Żebbuġ, Malta (Baldacchino & Evans, 1954). Excavations revealed five shallow rock-cut pits containing multiple inhumations associated with pottery, lithics, and personal ornaments, all of which had been liberally sprinkled with red ochre (Baldacchino & Evans, 1954, p. 1). Analysis of the pottery identified

Figure 9: Left: Sherd Z1010. Right: Sherd Z1008. Both sherds are from open bowls and Z1008 has similarities with Sicilian Tre fontane sherds.

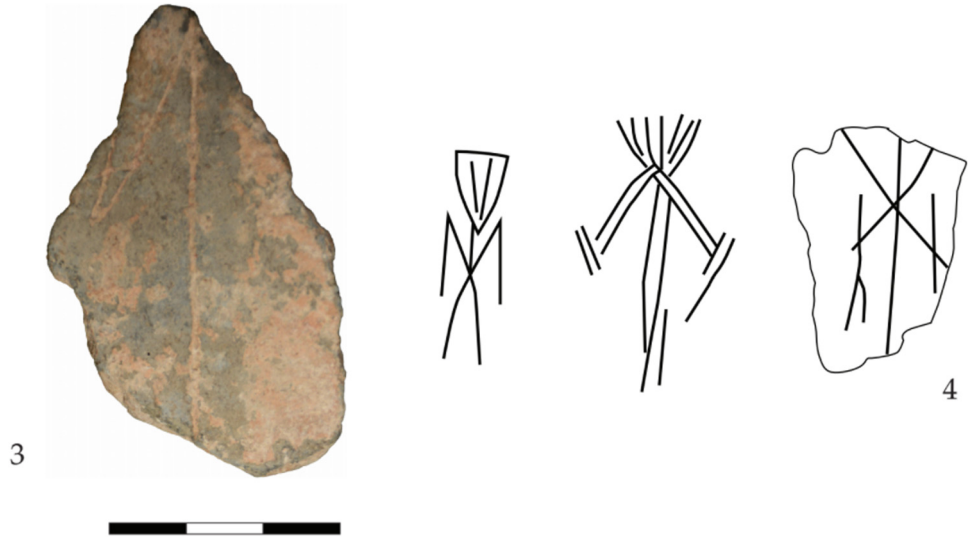

Figure 10: Sherd Z6023 showing traces of a "stick figure" motif (3) (photograph MaltaPot project). More complete "stick figure" motifs can be seen on the right (4) for comparison.

parallels between the Ta' Trapna burials and those from San Cono in Sicily (Baldacchino & Evans, 1954, p. 20). It was also the first time that Żebbuġ pottery was recognised as a distinct cultural phase. Żebbuġ pottery has since been found in sites such as the Xagħra Circle (Malone et al., 2020b, p. 220) and non-funerary sites such as Santa Verna (McLaughlin et al., 2020a, p. 143; Evans, 1971, p. 189) and Skorba (Brogan, Parkinson, McLaughlin, French, & Malone, 2020a, p. 233; Evans, 1971, p. 38).

Żebbuġ phase pottery is stylistically very different from the preceding Għar Dalam and Skorba pottery, with a much wider range of forms and decorative motifs (Trump, 2002, p. 48). It is considered a break from the earlier pottery traditions (Malone et al., 2020a, p. 341). The petrographic analysis carried out by Molitor revealed that fabric-wise the main difference with previous periods is the introduction of chert-tempering and oxidising firings (Molitor, 1988, p. 239). The bulk of known Żebbuġ phase assemblages have, however, only been recently published.

The Żebbuġ pottery decorations are quite varied, but generally consist of incised triangles (Figure 9), arcs, fringed lines, irregular lines, and occasionally "stick figures" (Figure 10). Decorations were not common in the Skorba phase, while some motifs, like the chevrons, are used both in the Għar Dalam and Żebbuġ phases. Of note, some sherds were probably incised after firing, where decoration was scratched with a hard material (e.g. Richard-Trémeau et al., 2023e, pp. 8, 24–25), a process which is not identified in earlier periods. Some sherds are either slipped with a cream material or whitened during firing as exemplified in Figure 11e, which makes red-painted decorations stand out. Overall, the *chaînes opératoires* of these wares seem to have more diversity than in earlier periods.

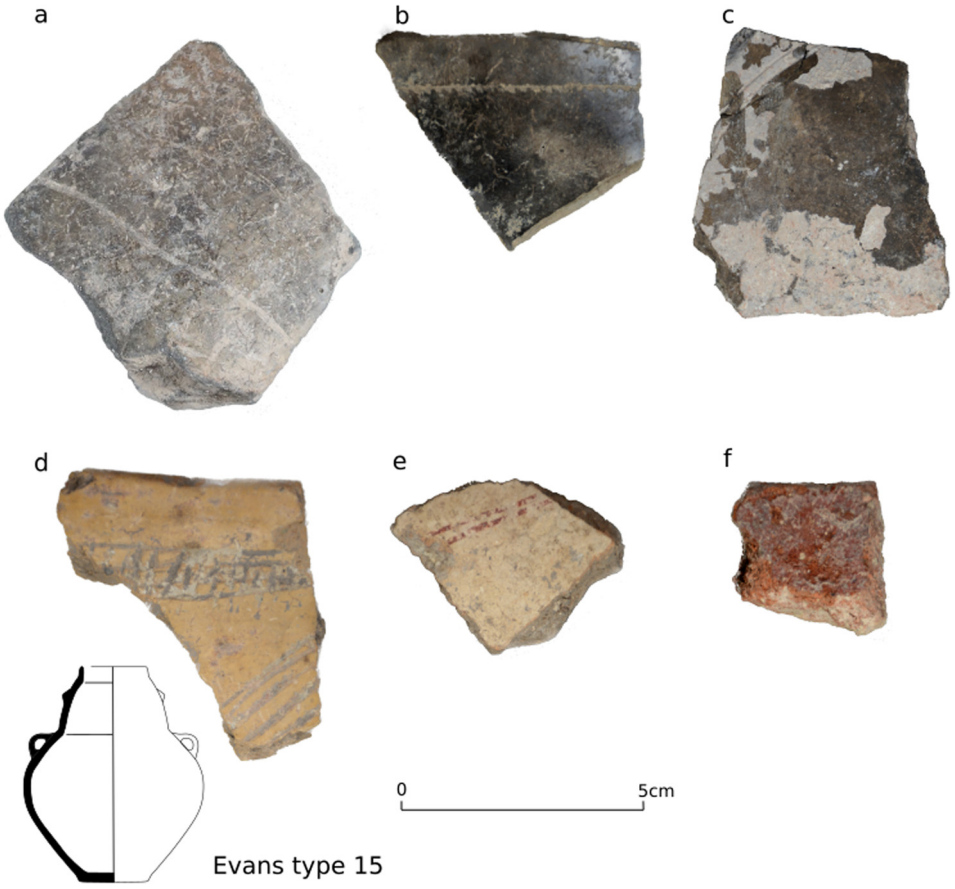

Figure 11: Macroscopic photographs of the sherds illustrated in Figure 12 and schematic types for the diagnostic sherd as defined by Evans (1971); drawing not to scale, digitised over drawings presented in Malone et al. (2020b, p. 750). (a) Z3025; (b) Trefontane: Z1017; (c) Z6048; (d) incised: Z7020; (e) painted: Z5034; and (f) Z4004. Associated microphotographs in Figure 12.

Comparing the macroscopic visual aspects of Skorba and Żebbuġ phase fabrics, the choice of tempering the paste adopted systematically in the Skorba phase seems to disappear. The question of clay refining, already mentioned for Għar Dalam phase sherds, is still prevalent for the fine wares, for example as shown in Figure 12b.

The existing literature includes at least six different wares which were identified in the assemblage compiled in the open-access catalogue (Richard-Trémeau et al., 2023e). These wares are summarised in Table 4 and illustrated in Figure 12.

The most noted ware is a moderately well-fired pale or milky-grey fine ware with thin walls, often burnished (Evans, 1971, p. 212; Malone et al., 2009, p. 222; 2020a, p. 341; Sagona, 2015, p. 50; Trump, 1966, 2015, p. 58). This description is similar to the pottery found within funerary contexts, although the funerary wares are described as having white inclusions (Baldacchino & Evans, 1954, p. 15; Malone et al., 2009, p. 222) which were observed in Ta' Trapna vessels (Figure 12c). However, moderate fine to coarse white inclusions were also observed in the assemblage of Ta' Haġrat and might therefore not mark the difference between funerary and non-funerary assemblages. These inclusions are likely to be from the raw material itself as they are not as abundant as in the Skorba phase (Figure 12a and c, compared to Figure 7a).

Trump (2015, p. 51) noted another fine ware (Figure 12b), which he observed at the sites of Skorba and Santa Verna. However, recent excavations show that it is also present at Ġgantija and Taċ-Ċawla, both in Gozo (Brogan et al., 2020b; Malone et al., 2020d). This pottery has incised decorations which closely parallel Sicily's inscribed triangle motifs of the Trefontane pottery (Cultraro, 2008). The sherds of this incised pottery from Santa Verna and Skorba may represent either genuine Sicilian imports or a local imitation of the Trefontane

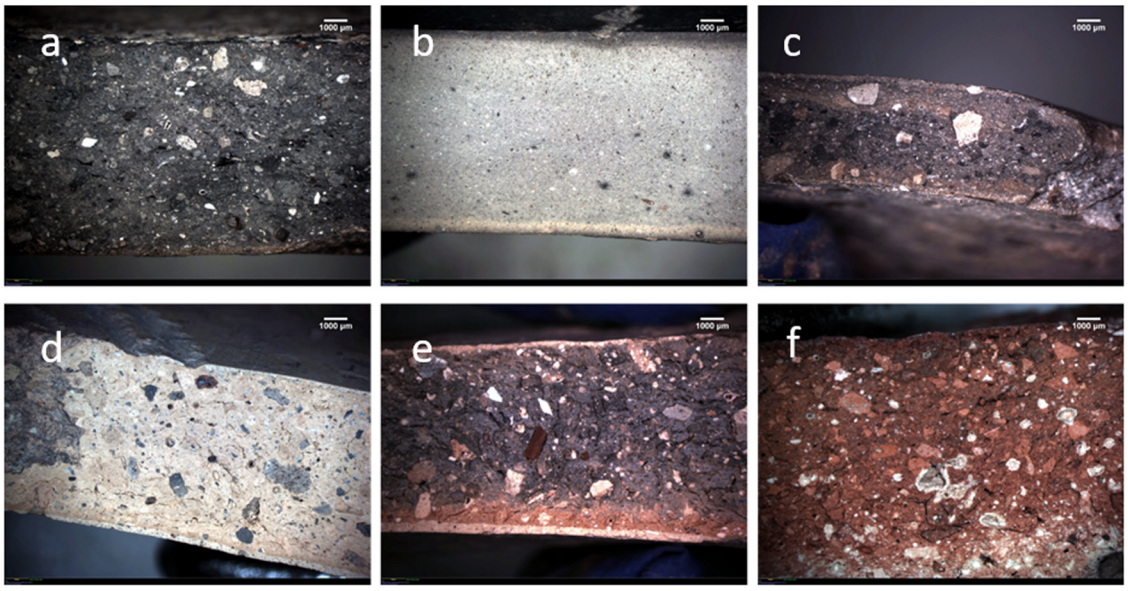

Figure 12: Examples of the different Żebbuġ fabric types as identified in Table 4. Sherd (a) Fine: Z3025; (b) Fine (Trefontane style): Z1017; (c) Fine (funerary): Z6048; (d) Fine (incised): Z7020; (e) Coarse (painted): Z5034; and (f) Coarse: Z4004 (from the MaltaPot project, C. Brogan).

ware. Some of the sherds bear incised triangles, often positioned just below the inner rim, while others have incised softened triangles, with rows of incised wavy lines below (Figure 9). This ware has been recognised based on its decorations rather than fabric composition. However, not all sherds follow the descriptions for Trefontane by Trump (1966) at Skorba, having a fine grey matrix (Table 4b; see Richard-Trémeau et al., 2023e, entry Z1008 for an example). This exemplifies the need for characterisation to build on Trump's work to assess the possible variations and provenance of these sherds. More generally, as highlighted in Table 4, Żebbuġ wares have been described based on their various surface treatments and contexts, rather than their fabric. However, the fabrics themselves vary greatly and more work is required to understand the variations in raw materials sourcing and processions, inclusion types, and firing temperatures.

Malone et al. (2020a, p. 341) have recently compiled a list of the fine wares for the Żebbuġ phase. Some of the descriptions expand and reclassify the earlier literature which can be explained by the scarcity of excavated and published assemblages for the Żebbuġ phase (e.g. Baldacchino & Evans, 1954; Malone et al., 2009). The aim of Malone et al. (2020a, p. 341) was to publish an extensive compilation of Żebbuġ sherds found, and provide a starting point for additional research. Only indications of surface treatment could be provided, so comparison with the literature describing the matrix and/or inclusions is an additional task for future researchers building on from this work. The list by Malone et al. also introduces wares which are not mentioned elsewhere in the literature, such as "Thin brittle and overfired red-purple coloured fabric, grey on exterior" (Malone et al., 2020a, p. 341).

Two main coarse wares were described in the literature and identified for illustration. The most commonly described coarse ware has a poorly fired coarse fabric (Figures 11e and 12e), and tends to have a smoothed matt finish, but can sometimes be burnished and with fine stone inclusions according to the descriptions by Evans (1971, p. 212). The surface is decorated with incised lines or lines of red, brown, or purple paint, which is yet to be characterised. The other coarse ware is the so-called Pellegrin ware, after the location Ras il-Pellegrin (19 in Figure 4), on the west coast of Malta, where it was first discovered. The fabric is very distinctive as exemplified in the fabric mosaic in Figure 12, where it has a unique bright red to deep purple colour and over-fired with a thick plaster-like outer layer (Evans, 1971, p. 213; Sagona, 2015, p. 52: Trump, 2015, p. 58, and Figure 12f). This ware was also identified in other assemblages such as at Ta' Haġrat (Richard-Trémeau et al., 2023e, p. 9) and Taċ-Ċawla (Richard-Trémeau et al., 2023e, p. 11). The bright red colour differs

from the other wares and hints possible differences in the *chaînes opératoires*: for making this pottery, different raw materials or firing regimes might have been used.

Malone et al. (2020a, p. 341) mentioned that Żebbuġ wares could have context-based differences (temple vs funerary), which is a statement that future research could build on. Funerary vessels are not as well-fired as the vessels found in temple sites. They identified tempers as "vegetable, shell, limestone, and sand" (Malone et al., 2020a, p. 341) based on their thin-section analysis (Malone et al., 2020b, p. 745). In an earlier publication (Malone et al., 2009, p. 222), it had been noted that funerary pottery appeared to be of a lower quality than the pottery found in the temple sites and that they were more prone to breakage due to the large limestone inclusions in the matrix. If this was to be confirmed across sites and through either petrographic or XRD analysis, one could question whether material requirements were different according to use, and if potters might have used different techniques for pottery specifically made for funerary contexts for example.

Considering the variations in form, surface treatments (Figure 11), and fabric appearance, and specific similarities in decoration with Sicily, the question of provenance will be essential in future research to understand if all these wares would have been manufactured in Malta. Pirone sampled 30 Żebbuġ phase sherds: 21 from the temple sites of Ta' Ħaġrat and Skorba (non-funerary), and a further 9 sherds from the funerary sites of Ta' Trapna and Ħal Saflieni. Based on his PCA, five distinct Żebbuġ compositional groups were identified: three of the Żebbuġ groups were most likely made of Maltese clays, while the other two may have come from either an unsourced Maltese clay or from a non-local clay source (Pirone, 2017, p. 152). A few sherds from Pirone's Żebbuġ groups A and E (2017, p. 150) clusters away from the main bulk of Maltese clay samples and the pottery samples from other phases. The Ta' Trapna funerary sherd, bearing a "stick figure" motif, similar to those from Grotta Zubbia in Sicily (Pirone, 2017, p. 193), is almost certainly of local production. Furthermore, the samples from funerary contexts from Ħal Saflieni could have different compositions than from the non-funerary site of Skorba, while the sherds from Ta' Ħaġrat are very diverse in composition.

Further chemical characterisation could provide comparative material to better understand import and export of pottery, and the goods they might contain. For example, the reassessment of the pottery from the multi-period site of Caduta in Sicily revealed two potential Maltese Żebbuġ phase vessels: an ovoid jar and a handled cup (Barone et al., 2015, p. 24). A sample from the ovoid jar was subjected to petrological and XRF analysis. The thin section revealed a fossil-rich matrix tempered with grog and organic matter and had rare quartz grains (Barone et al., 2015, p. 25). When the XRF results were compared with Sicilian and Maltese potsherds and clays, it was suggested that the jar was of Maltese origin, suggesting that Maltese goods had been imported into Sicily (Barone et al., 2015, p. 29). This shows that there were networks where goods circulated between the Maltese Islands and at least parts of Sicily (Malone, Chatzimpaloglou, & Brogan, 2020c, pp. 445–446; McLaughlin et al., 2020b, p. 310).

7 Summary and the Way Forward

Overall, the growing number of archaeometric studies has added some new information to traditional pottery studies, helping to elucidate various aspects of the pottery record of each of the chronological phases discussed in this study (Table 5). In addition, the gradual progression of publications, and student dissertations on varied time periods (including Asciak, 2019; Grech, 2019; Humann 2022; Molitor, 1988; Pirone, 2017; Pirani, 2018; Richard-Trémeau, 2023; Xuereb, 2021), has introduced archaeological sciences applied to the study of pottery found in the Maltese Islands. This has only been made possible by previous archaeological research, both on the sites and on the previous typological and theoretical studies on the material culture, laying the foundations and providing material and opportunities for additional research. This study has produced a catalogue of sherds and their fabrics, examples of which were used in this work to provide a fabric description for the pottery types described by previous work. When complete, additional elements including petrography will be published to better identify elements of the *chaîne opératoire*.

The understanding of the different pottery fabrics produced by Malta's early potters is still, however, very limited. While the increased application of characterisation techniques and different theoretical approaches to fabric studies have contributed to the current understanding of where and how vessels were made in the Early

Table 4: Żebbuġ phase fabrics as defined and identified in the literature

	Ware Type	Evans (1954)	Baldacchino and Evans (1954)	Trump (1966, 2015)	Evans (1971)	Sagona (2015)	Malone et al. (2009, 2020a)
a	Fine ware burnished and inscribed	Dark grey or black – not very well fired	—	—	Grey or black – hard-fired, brittle ware	Pale grey to black – moderately hard fired	Thin and hard burnished milky grey – domestic
b	Fine ware Trefontane style	—	—	Fine grey ware	—	—	Not associated with one specific fabric
c	Fine ware, funerary ware	—	Compact grey ware mixed with small white grits	—	—	—	Thin wall, black paste with medium limestone grits (smoothed)
d	Fine ware –yellow incised	—	—	—	—	—	Buff-pale, white infill in incisions; domestic contexts. Well-fired, usually yellow
e	Coarse ware painted or incised yellow ware	Self-slipped, poorly-fired, and brittle – has small stones throughout	—	—	Grey or black – poorly fired, with small stones throughout	Coarse yellow fabric – poorly fired	Various tempers used, small grits with pale-cream yellow surface
f	Coarse ware – Pellegrin ware	—	—	Coarse, over-fired, bright red	Coarse, over-fired, bright-red	Coarse, over-fired bright red to purple	Considered a fine ware; brittle, over-fired, bright red

Note: The data in the above Table were compiled by C. Brogan.

Table 5: Summarised results of the archaeometric observations of the Għar Dalam, Skorba, and Żebbuġ pottery in relation to the composition, production techniques, provenance, and fabric groups

Phase	Hypothesis of fabric composition	Hypothesis for provenance	Polarised light microscopy groups	Compositional groups (Pirone, 2017)
Għar Dalam	Gypsum temper (Molitor, 1988)	Similar to clays from Ġnejna Bay (Pirone, 2017)	—	—
Skorba	Gypsum temper (Molitor, 1988)	Made of local materials (Pirani, 2018)	Four (Pirani, 2018)	Four
	Blue Clay, fossiliferous limestone with algae, and Globigerina limestone, tempered with spathic calcite (Pirani, 2018)	Mainly made of local material (clay similar to Ġnejna Bay or Selmun), with possible use of Sicilian clay in some samples (Pirone, 2017)		
Żebbuġ	Chert temper (Molitor, 1988)	Maltese clay (Barone et al., 2015; Pirone, 2017)	—	Five
	Fossil-rich matrix, grog, organic matter, and quartz grains (Barone et al., 2015)			

Note: The data in the above Table were compiled by C. Brogan.

Neolithic, a systematic study of several assemblages using varied techniques might allow the creation of local reference groups. Moreover, these varied techniques would allow a better understanding of the local *chaînes opératoires* and their variations in time and space as the different stages of making vessels in Early Neolithic Malta are challenging to interpret based on the current evidence. The review of the existing literature has revealed the following issues:

1. By reviewing various contributions made on the study of Early Neolithic pottery, it is apparent that there are gaps in knowledge that would need to be addressed by future research. The most obvious is that a systematic, dedicated, and detailed characterisation study of all the Early Neolithic pottery traditions needs to be conducted. By characterising the different fabrics within each phase, archaeologists would gain a more nuanced understanding of the different fabrics and their chronology. This could subsequently be used to examine geographic and temporal variation within the pottery record and aspects of the *chaîne opératoire*. A detailed chronological understanding of fabric could support the identification of undiagnostic or worn sherds recovered from fieldwalking surveys. A detailed fabric study would also help to resolve the compositional discrepancies between Molitor's work and subsequent archaeometric studies.
2. This review raises an important issue, namely, there is still a limited understanding of local clays. Recent publications have provided a good overview of the Blue Clay formation on the islands (John, Mutti, & Adatte, 2003; Pedley, Clarke and Galea 2002; Scerri, 2019), but there is a lack of detailed mineralogical or chemical studies of the different clay outcrops to assess variations between the deposits. As highlighted by the discussion of Pirone's work (2017), the variations between groups of sherds can only be understood in light of variations between sources. To date, most of the clay samples obtained for provenance studies of the prehistoric pottery have been collected from the island of Malta (Barone et al., 2015; Pirani, 2018; Pirone, 2017; Pirone & Tykot, 2017; Tanasi, 2018). The only exception is Molitor, who collected clay samples from eight Gozitan sites. However, the samples are unavailable for study, and there are no detailed records of the clay composition. There is a clear need to broaden the sample sites to include other potential clay sites in Malta and Gozo. Possible pottery raw materials in Malta should be tested, using experimental samples, to assess their properties and limitations.

   To achieve the above, it is suggested that a nation-wide study should be undertaken, in the form of a plan of action guiding future research on archaeological pottery materials, fabrics, and *chaînes opératoire*. This would build on the body of available knowledge and material, and identify targets for research into typology and fabrics to progressively and systematically tackle pottery found in Malta from the Early Neolithic onwards. This can be achieved through a series of small-scale studies which continue to involve graduate students, thereby supporting familiarity with, and training in, the study of pottery and application of the techniques used. Activities within this plan should include:
   1. The analysis of additional material from these same, and subsequent, phases;
   2. The compilation of data and material collections;
   3. The study of specific features, such as the decorative white paste on Għar Dalam phase sherds, or the red slip on Skorba phase pottery;
   4. A geological survey to complement the research on pottery with material and geographic data, and the characterisation of clays and other geological materials which were, or may have been, used for the fabrication of pottery;
   5. Coordination and collaboration with researchers in Sicily and its islands, southern Italy, and possibly Tunisia and Tripolitanian Libya, to provide a more holistic view of this region of the Central Mediterranean;
   6. Timely publication of reports and data on Open Access repositories.

Abbreviations

BCE	before Common Era
PCA	principle component analysis
SEM-EDS	scanning electron microscopy with energy dispersive spectroscopy

XRD X-ray diffraction
XRF X-ray fluorescence

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Appendix: Notes on the Chronology of Early Neolithic Malta

The recent chronology of the Maltese Islands proposed by the FRAGSUS project (McLaughlin et al., 2020c) suggests pushing back the dates for the Early Neolithic in Malta (Table 1). The previously established chronology relied on five dates for Għar Dalam to Żebbuġ phases, mostly from the site of Skorba by Trump (1966) and summarised and calibrated with additional dates by Renfrew (1972).

Considering the new FRAGSUS dates, the appearance of the Għar Dalam pottery phase could not be dated from the archaeological sites of Skorba and Santa Verna, as no pure Għar Dalam phase layers were found, and the earliest FRAGSUS date is set between 5570 and 5340 BCE, assumed to be associated with Skorba phase material (McLaughlin et al., 2020c, p. 35). Parkinson, McLaughlin, Stoddart, and Malone (2021a) argued that the bulk of the FRAGSUS radiocarbon dates for Skorba predates the bulk of available dates for Diana Ware, which is considered the Sicilian parallel to Skorba Ware. However, the dates used in the FRAGSUS modelling were extracted from contexts that are not pure Skorba phase layers and always contain residual material.[2] At Santa Verna, for example, the systematic mixing of the earlier Għar Dalam material with later Skorba phase sherds could have artificially pushed back the date of the Skorba phase. This is a consistent problem in Early Neolithic layers across Malta, and these limitations are dictated by the nature of contexts found in excavations in the Maltese islands.

The Maltese Islands' original cultural sequence was mainly established based on the site stratigraphy of Skorba by Trump (1966), and the changes in pottery styles (mostly form and decoration) used to date contexts. However, these chronological phases, associated with specific wares and typological packages, might need review when new evidence will come to light. Similarly, the gradual changes in material culture in the Maltese Early Neolithic are poorly understood within and between phases, and the possible contemporaneity of the wares needs consideration.

The dating issue is similar in Sicily, where the chronology relies heavily on the pottery typological sequence (Giannitrapani, 2023, p. 161). The chronological sequence for Late Neolithic Sicily is based on a limited number of dates (Giannitrapani, 2023, pp. 159, 161; Parkinson et al., 2021a, p. 210; Parkinson, McLaughlin, Esposito, Stoddart, & Malone, 2021b, p. 319). Therefore, until more dates associated with the different facies are published, the relationship between the material culture of the islands and their contemporaneity can be hypothesised and questioned.

2 Contexts (63) and (113) at Santa Verna overlay Skorba phase *torba* floors and could have provided a *terminus post quem* for the floor levels (McLaughlin, Parkinson, Reimer, & Malone, 2020d, pp. 513–514; 2020a, p. 143). However, residual material from the Għar Dalam phase was found in these contexts and, therefore, what is exactly dated is uncertain. More generally, the contexts from Santa Verna used for dating this phase (contexts 90 and 119 in McLaughlin et al., 2020d, pp. 513–514) are not pure Skorba and always contained residual and intrusive material.