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Connecting crafting communities: reconstructing interactions between communities in and out of Cyprus in the early third millenium BC

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CHAPTER 4:

Pottery as a Tool
for Reconstructing
Interactions between
Communities –
A Theoretical and
Methodological
Framework

Chapter 4 — Pottery as a Tool for Reconstructing Interactions between Communities – A Theoretical and Methodological Framework

This study attempts to shed light on interactions between Late Chalcolithic communities within Cyprus, and extra-insular contacts with Anatolia, particularly Cilicia, by investigating processes of exchange of objects and pottery technologies and their emulation. In order to form an adequate theoretical and methodological framework, theoretical concepts regarding how we study pottery and how we can reconstruct interactions in the archaeological record are discussed in this chapter. First, how connectivity in the Mediterranean and island archaeology has been investigated is presented, followed by the importance of pottery in the archaeological record and the various ways in which it can be studied are addressed, with an emphasis on the *chaîne opératoire* approach. Then, ways in which pottery can function as an indicator for interactions between communities are explored. Finally, the dataset, methodologies and theoretical frameworks applied for this thesis are presented.

4.1. Connectivity in the Mediterranean and Island Archaeology

In the Mediterranean, the notions of mobility and connectivity are pivotal in historical and archaeological studies, where several societies interacted, including the Mycenaeans, the Egyptians, the Romans, the Byzantines and the Ottomans (Knappett & Kiriati, 2016). Several scholars have argued that connectivity is a defining aspect of the Mediterranean through time (e.g. Horden & Purcell, 2000; Abulafia, 2011; Broodbank, 2013). However, not everyone agrees on whether the Mediterranean was connected or divided. Braudel (1972), for example, argued that the Mediterranean consisted of “*many seas*”. Alternatively, Horden and Purcell (2000) view the Mediterranean as a whole, which includes many seascapes and micro-landscapes, from the Iron Age onwards.

In the early to mid-20th century, within the culture-historical approach, mobility of people was attributed a pivotal role in archaeological interpretations, while parallels between regions were attributed primarily to migration, colonisation or trade (e.g. Childe, 1929). Of these concepts, migration has been probably the oldest when it comes to explaining interactions. It can be defined as the coordinated movement of people to a place in order to settle down and as “*a behaviour that is typically performed by defined subgroups (often kin-recruited) with specific goals, targeted on known destinations and likely to use familiar routes*” (Anthony, 1990, pp. 895-896). Besides archaeology, migration has been researched by several other disciplines such as sociology, law, demography, and political sciences (Brettell & Hollifield, 2000, pp. 2-3). Several migration episodes have been recorded historically and archaeologically, sometimes accompanied with colonization. As a framework, it offers an opportunity to investigate issues of identity, since both migrants and local populations come in contact and re-evaluate their identities. However, one could argue that the concept of migration overlooks that mobility can happen at several scales, and it can be continuous and constant (Jones, 1997; Knapp, 2008, p. 48).

Processual archaeologists in the 1960s, favored endogenous factors, and rejected migration as an explanatory framework for cultural change (e.g. Binford & Binford, 1968). Subsequently, migration was gradually replaced by the concept of acculturation, which stems from socio-cultural anthropology. In archaeology, it is described as “*the comprehensive assimilation of new cultural elements from a dominant donor, with minor differences remaining between donor and recipient at the end of the process. This is opposed to more limited and selective emulation and adaptation of material culture and/or new cultural features within a tradition distinct from the donor*” (Smith, 1998, p. 258). Although widely used, the concept of acculturation has been criticized for its top-down approach, colonial background, and for overlooking the diversity of material culture and the dynamics of its distribution, as well as personal agency (Knapp, 2008, p. 55).

An more recent concept used as a theoretical framework to explain mobility and cultural change is hybridization. Hybridity is a term originating from Biology studies in the 19th century, to describe a cross between two distinct species of plants or animals. In archaeology, it is used to define so-called material cultures, particularly in colonial contexts, when describing the contacts between colonists and colonised. However, it has been applied to other cultural interactions, since it stems from the idea that every interaction between cultures can lead to processes of mixture and transformation of cultural elements (Knapp, 2008, p. 59). It is described as “*processes of interaction that create new social spaces to which new meanings are given*” (Young, 2003, p. 79).

As van Dommelen argued, if identity and culture are “*context dependent*” the contacts with non-local cultures affect the local ones, and new aspects of the local identity are created, which incorporate “*foreign*” characteristics interpreted according to the local perceptions. Consequently, cultural interactions can lead to a blend of cultural components which include appropriation and assimilation or rejection of foreign ingredients (van Dommelen 2005, pp. 116-118, pp. 136-137). If one accepts this argument, then hybridization offers an adequate framework for the understanding of cultural interactions and how groups perceive and assimilate cultural elements of other groups (Papastergiadis, 2005, pp. 42-48). Although supporters of this concept argue that it involves agency and accident, critics have argued that it neglects agency and promotes ideas of purity (Gosden, 2004, p. 158; Knapp, 2008, p. 59). Additionally, hybridity is strongly linked to imperialism, thus it can be asked whether it fits in the pre-modern world.

Nowadays, network thinking, a shift to post-colonial approaches and the incorporation of methods and techniques from other fields in archaeology, have led to new perspectives on mobility in archaeological contexts (e.g. Colledge & Conolly, 2007; Colledge *et al.*, 2013; van Dommelen & Knapp, 2010; Knappett, 2011). One of these is connectivity, which is defined as the capability to be connected or interconnected with someone or something. Therefore, it is an ambiguous concept appropriate to include all kinds of interactions between people, ideas and objects regardless of scale, intensity and direction of interaction. Another similar concept, which emerged in archaeological studies in the 2000s is globalization. In archaeology, it can be defined as increased connectivity and it describes several connectivities and networks between various regions, including trade, diffusion, migration and internationalism (Tomilson, 1999). It also involves the promotion of shared practices and values and the ever-increasing acknowledgment of differences. According to Hodos (2017, p. 4), its most defining characteristic is increasing connectivity as it encompasses “*processes of increasing connectivities that unfold and manifest as social awareness of those connectivities*”.

When examining connectivity in the Mediterranean, one should take into account the field of Island Archaeology, which appeared in the 1970s-1980s, initially tackling themes such as dispersal, isolation, insularity, distance, configuration, adaptation and extinction (e.g. Evans, 1977; Cherry, 1981). Out of these, maybe the most fundamental theme is insularity, therefore the quality of being isolated due to living on islands or of being detached in perception and experience, as a result of historical, social or personal exigency (Knapp, 2008, p. 18). The Latin word ‘*insula*’ (= island) is the root of the English terms ‘*island*’, ‘*isolation*’ and ‘*insularity*’. It is therefore understandable why islands have been traditionally considered isolated both geographically and culturally, “*living with their back to the sea*” (van Dommelen, 1998, p. 13). Also, due to their remoteness, they are often considered ‘laboratories’ where culturally distinct or ‘strange’ cultural developments occur, such as megalithic structures. This is what Parker Pearson (2004, p. 129) described as the “*Easter Island Syndrome*”. However, islands have also been considered vital points of interaction for people from several places to come in contact via trade and other activities. According to Braudel, isolation is relative, as islands are often connected to the “*outside world*” (Braudel, 1972, p. 150). Consolidating both views, Renfrew suggested that islands are actually a paradox: the “*polarity... between isolation (“islands as laboratories”) and interaction (“islands as reticulate networks”)*” (Renfrew 2004, 276). Hence, islands can be both isolated but also actively involved in social, cultural, political and social networks (McKechnie, 2002, p. 129).

More recently, scholarship around island archaeology focusses on the agency of islanders, how they consciously formed their landscape and how they modified their identities through contacts with the outside world (e.g. Rainbird, 1999; Broodbank, 2000; Knapp, 2013). Also, insularity is increasingly viewed as a cultural construct (Clarke, 2003, p. 203). Finally, it has been observed that islanders often develop a strong sense of collective identity in which their insularity is included and functions as a way of contrasting themselves to foreign elements (Parker Pearson, 2004, p. 129; Broodbank, 2000, p. 33). This is where the theme of regionalism comes into play. In archaeology, regionalism is defined as the behaviour within distinct regions or cultural zones; or the ways to identify differences between diverse areas. In this context, islands are often treated as a “*bridge*” between different regional cultures. However, in Cypriot Archaeology, regionalism is the “*cultural differences which can be identified between different parts of the island, often using the major topographic divisions to provide a natural framework to establish ‘culture areas’*” (Frankel, 2009, p. 15). This is especially true for the Late Chalcolithic in Cyprus, where research has focused more on the differences between different regions rather than similarities.

4.2. Studying Ancient Pottery: Style, Function, and Technology

Archaeological research is centred around artefacts, as they are the most substantial source of information we have about past societies (Gamble, 2008, p. 100). Pottery is a particularly important artefact type as it is usually found in vast amounts at archaeological sites, and it is used by people cross-culturally, allowing for extensive classifications and typologies. This importance is heightened when we are dealing with prehistoric communities (Arnold, 1985, p.1).

Pottery classification systems can be based on raw materials, clay composition, morphology, forming techniques, style, function, or period and context of occurrence (Rice, 1987, p. 274; Read, 2018, p. 1). These classifications can be created by studying the material macroscopically, via archaeometric methods, or even ethnographically. As Rice (1987, p. 274) defined it, the aim of classification is to create groups of similar members, while the groups themselves are different. The similarities uniting the members of a group should be reflecting something significant.

Initially, classifications were made primarily relying on macroscopic observations, mainly based on the style of the pottery. In most literature style is associated mainly with surface treatment and decoration, and it has functioned as the main tool to recognize and assign different assemblages, and to indicate when and where they occurred (Dikomitou Eliadou & Georgiou, 2023, p. 3). In a paper published in 1977, Sackett distinguished three ways style is investigated in archaeology: first, the “standard” approach of identifying when and where pottery was produced; second, the “content” approach which focuses on aesthetics and iconography; and lastly, the “ceramic sociology”, which emphasizes deriving style from pottery data (Sackett, 1977, p. 369). However, style can also be defined as a combination of several artefact characteristics, like shape, size, decoration, and colour, which appear in combination, indicating certain stylistic rules and behaviours (Prezioso, 2021, p. 172). It is therefore indicative of distinct ways of action, expression and cognition, all specific to a place and time. Pots of similar style are more likely to be from the same region or time period, whereas differences in style can indicate differences in region of production and/or time of production. Based on these, in the culture-historical approach, morphological style of pottery has been vital in the creation of typologies used for relative dating, and in investigating interactions between different communities; “*it best reflects the principle that “like goes with the like”*” (Renfrew and Bahn, 2001, p. 121) (Dikomitou Eliadou & Georgiou, 2023, p. 2).

In the 1960s, within processual archaeology, this culture-historical approach was critiqued and instead, emphasis was placed on vessel function and the impact the environment has on pottery production and use. For example, Matson (1965, p. 203) introduced the concept of ceramic ecology,

noting the defining importance of the raw materials and technologies available locally to potters. The main arguments for this shift supported that style reflects sets of rules that reoccur as norms and not as social practices. If they occurred as the latter, they should be more fluid and susceptible to change (Sanz & Fiore, 2014, p. 7105); and that the culture-historical approach ignores the importance of the environment for a society and how society might adapt to it (Renfrew & Bahn, 2001, p. 38). This approach distinguished style from function, considering the practical function of a vessel most important (McGuire, 1981, p. 14). Function denotes the artefact's practical use (Crilly, 2010). What processual researchers have in common is that they believed that material culture point at the ways in which humans adapt to the environment and the material conditions of the world around them, applying a functionalist perspective, where craft serves to fulfil a purpose (White, 1959, p. 8; Dikomitou Eliadou & Georgiou, 2023, p. 3). From a methodological point of view, this functionalist perspective encouraged the introduction and application of scientific techniques for the study of ancient artefacts, such as ceramic thin section petrography, residue analysis etc.

Additionally, processual archaeology focused on craftsmanship and ethnoarchaeological studies. Ethnographic studies have contributed immensely to the studies of ceramics. Specifically, ceramic ethnography documents the production, distribution, use and discard of pottery in societies living today (Fowler, 2016, p. 470). By observing empirically how modern-day societies engage with pottery, the ceramic ethnographer creates “reference data”, which the archaeologist can use to draw analogies with the archaeological record (David & Kramer, 2001). Even though the ethnographer and the archaeologist have different research questions, they both deal with investigating and explaining variations in pottery and potting practices, making “*the ethnographic present and the archaeological record... incommensurable, but compatible, domains*” (Fowler, 2016, p. 470). Ethnoarchaeology combines ethnographic method with archaeological research questions, as it is “*research that includes an ethnographic component and is carried out with the analogical needs of the archaeologist in mind*” (David & Kramer, 2001, p. 11). Ethnoarchaeological research has given us comparable data for every step of the ceramic production process, some of which will be presented in this thesis.

In the 1970s and 1980s many scholars dealt further with the relationship between artifact style and function. The first to introduce style as a non-functional component of objects which is not affected by technological restrictions was Binford (Binford, 1965; Conkey, 1990, pp. 8-10; Hegmon, 1992, p. 518). Meanwhile, Wobst interpreted style as a tool for “*information exchange*”, and defined it as “*that part of the formal variability in material culture that can be related to the participation of artefacts in processes of information exchange*” (Wobst, 1977, p. 321). Around the same time as Wobst, another researcher who investigated style in a much more holistic manner was Sackett. According to him, style is a distinctive way of doing something in a specific spatial and time context, and it can be identified in the “adjunct form”, like in the decoration of a pot, and in the “instrumental form”, like the manufacturing and functioning of a pot (Sackett, 1977, p. 370; 1990, p. 33). Additionally, he developed a model in which he suggested that artisans tend to choose the ways of doing something particular to their social group, even if they have other options (Sackett, 1982; 1990). So, style is the expression of technological choices which are socially transmitted, creating a tradition (Sackett, 1977, p. 371). Similarly, Lechtman argued that style resides in all parts of an artefact, since it corresponds to material expression of cultural patterning (Lechtman, 1977, p. 5).

Over the years, the study of pottery technology in all of its aspects has gained momentum, and several institutions have been central in researching into these topics. The French school has coined the *chaîne opératoire* approach, which is explained in detail in the next section. In the Netherlands, Leiden University has been a hub for the archaeological study of ceramics since the 1980s, especially for the Near East and the Mediterranean. Researchers like Loe Jacobs and Olivier Nieuwenhuyse conducted rigorous research on pottery production and technology of the region (e.g. Connan *et al.*, 2004; Nieuwenhuyse, 2010; 2017). Today the Laboratory of Ceramic Studies has an extensive reference collection of ceramics and clays from West Asia, Africa, Europe and Meso-America, as

well as various experimental reconstructions of vessels from different areas and time periods. This expertise is illustrated also by the Leiden Journal of Pottery Studies, which was published from 1983 to 2010, and covered various topics related to ceramic studies from ethnoarchaeology and experimental archaeology to ceramic thin section petrography and other archaeometric methods.

4.3. The *Chaîne Opératoire* Approach, Pottery Technology, Interactions Between Communities and Crafting as Social Practice

One of the most popular methodological framework archaeologists employ to study the pottery production process is that of the *chaîne opératoire*, which describes the process of production of an artefact including the collection of raw materials, and all the stages of its manufacture. As a term, it was coined by Leroi-Gourhan to define “*techniques (that) are at the same time gestures and tools, organized in sequence by a true syntax which gives the operational series both their stability and their flexibility*” (Leroi-Gourhan, 1964, p. 164). This approach is rooted in French cultural ethnography which focuses on the cultural aspects of material culture (Mauss 1947; Haudricourt 1964; Roux, 2016, p. 101). Therefore, a *chaîne opératoire* is a technical tradition defined as “*patterned ways of doing things that exist in identifiable form over extended periods of time*” (O’Brien *et al.*, 2010, p. 3797). Ethnoarchaeological studies have had a major impact on the study of the *chaîne opératoire* of pottery production in various societies. One should keep in mind that the *chaîne opératoire* approach can be applied to any type of artefact and it is widely used for the study of chipped stone tools.

For pottery, the *chaîne opératoire* comprises of the selection of raw materials, the preparation of clay, the shaping of the vessel, the decoration and surface treatment, the drying treatment, and the firing of the pots, occasionally followed by post-firing treatment (Roux, 2020, p. 17). The first step of every *chaîne opératoire* is the selection of raw materials. In this process, clay, water, and temper may be involved, although temper is not always present or necessary. Along with the selection of the clay, this phase includes the selection of tools, pigments, and fuel material (Miller, 2007, p. 108; Quinn, 2022, p. 211). Ethnographic studies have shown that raw materials are not selected randomly, but rather for their properties, availability of resources, and in the case of clay, technical properties like plasticity and shrink-swell capacity (Quinn, 2022, p. 211). An enduring ethnographic contribution to the study of this stage is Arnold’s (1985; 2006) Ceramic Distance Threshold Model or Ceramic Resource Area Model, a predictive model of clay procurement strategies, which, based on how far potters from 117 modern-day communities travel, suggests maximum distances travelled by sedentary past communities to procure clay and temper. However, Arnold himself acknowledges that not all factors have been accounted for in this model, while Gosselain and Livingstone Smith (2005, 34), have summarized different factors influencing clay procurement for African communities, such as the local geology, settlement patterns, competition among potters and social interactions. According to Arnold’s “Ceramic Resource Threshold Model”, the threshold distances to clay sources can be up to 7km (Arnold, 2006, p. 8).

After the procurement of raw materials, comes the clay processing, transforming the raw material into workable clay. Even though this stage is not always necessary, not processing the clay is uncommon (Rice, 1987, pp. 118-124). Several techniques are employed, such as pounding or crushing the soil, cleaning, sorting, sieving, levigating and/or hydrating the clay, along with the preparation of temper and pigment, if applicable, resulting in endless clay recipes, which are influenced by the suitability of the clay, but also by social and other factors, such as the type of vessel one wants to produce (Gosselain & Livingstone Smith, 2005, p. 40-41; Miller, 2007, p. 108; Roux, 2016, p. 103).

Next, the potter starts the shaping of the vessel, also referred to as “primary forming” (Rye, 1981, p. 62), or “roughing out” (Courty & Roux, 1995). Forming techniques can be divided in two broad categories: techniques without rotative kinetic energy (RKE, i.e. the potter’s wheel), like pinching and drawing, coiling, slab building and moulding on one hand, and wheel-throwing and wheel forming on the other. Also, when using the coiling and wheel-formed techniques, rotative kinetic energy can also be used in parts of the process (Roux, 2016, p. 104; Figure 24).

Once the vessel is shaped, and had been left for some time to dry, finishing techniques such as smoothing wet surfaces, or burnishing and smoothing on leather-hard surfaces, take place (Roux, 2016, p. 104). Then follows the decoration and surface treatment, which have been the focus of many archaeological studies, as they are central to chronological and stylistic typologies. Two aspects of the decoration are focal: design and techniques (Rice, 1987, p. 249). Design is referred to the execution of elements (e.g. a line) into progressively bigger components (e.g. a motif) on the vessel’s surface. Various tools, and techniques, such as burnishing or grooving, generate the elements of the decoration. Further, decoration techniques can be divided into “low relief or one-dimensional” (e.g. slipping, painting, glaze), “negative relief or recessed” (e.g. incising, impressing), and “high relief or two-dimensional” (e.g. plastic and applied decoration) (Roux, 2016, p. 104).

VESSEL FORMING TECHNIQUES

Techniques without rotative kinetic energy



pinching and drawing



coiling



slab building



molding

Techniques with rotative kinetic energy



wheel-throwing

Figure 24: Vessel forming techniques with and without rotative kinetic energy (created by Maria Hadjigavriel)

Subsequently, the vessel needs to dry and then to be fired. Drying is the process during which residual moisture leaves the vessel via evaporation. Ethnographic research has shown that potters often stack vessels outside to dry slowly, but cover them with a cloth and put them in shade when the weather is warm to avoid uneven and fast drying. Similarly, they would store them in cold and drafty places if the weather was cold (Quinn, 2022, p. 264).

Firing is the final stage of the production process, which transforms the clay objects into ceramics. The chemical and physical changes that transform clay into pottery start occurring at about 500-600 °C (Rice, 1987, pp. 90-3). Archaeologists rely on estimations of firing temperatures as proxies for ancient firing procedures (Tite, 2008; Figure 25). Overall, firing is divided into two large categories: “open” firing, and kiln firing (Rice, 1987, pp. 152-163; Gosselain, 1992, pp. 152-163). “Open” firings “are also referred to as clamp firing or bonfire firings, where the pots and the fuel are in immediate contact and are arranged in a stack on the ground or in a shallow depression” (Orton et al. 1993, p. 135). On the other hand, in kiln firing “the pottery and fuel are separate – the pots usually in a chamber which is heated by the hot gases and flames from the fuel” (Orton et al., 1993, p. 135).

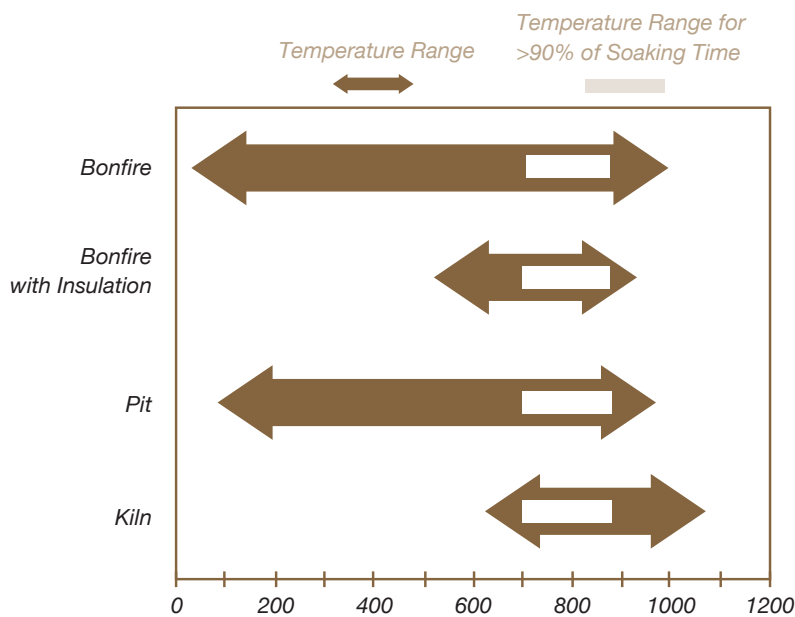


Figure 25: Range of firing temperatures and soaking times for firings in West Africa (after Fowler, 2016, p. 480)

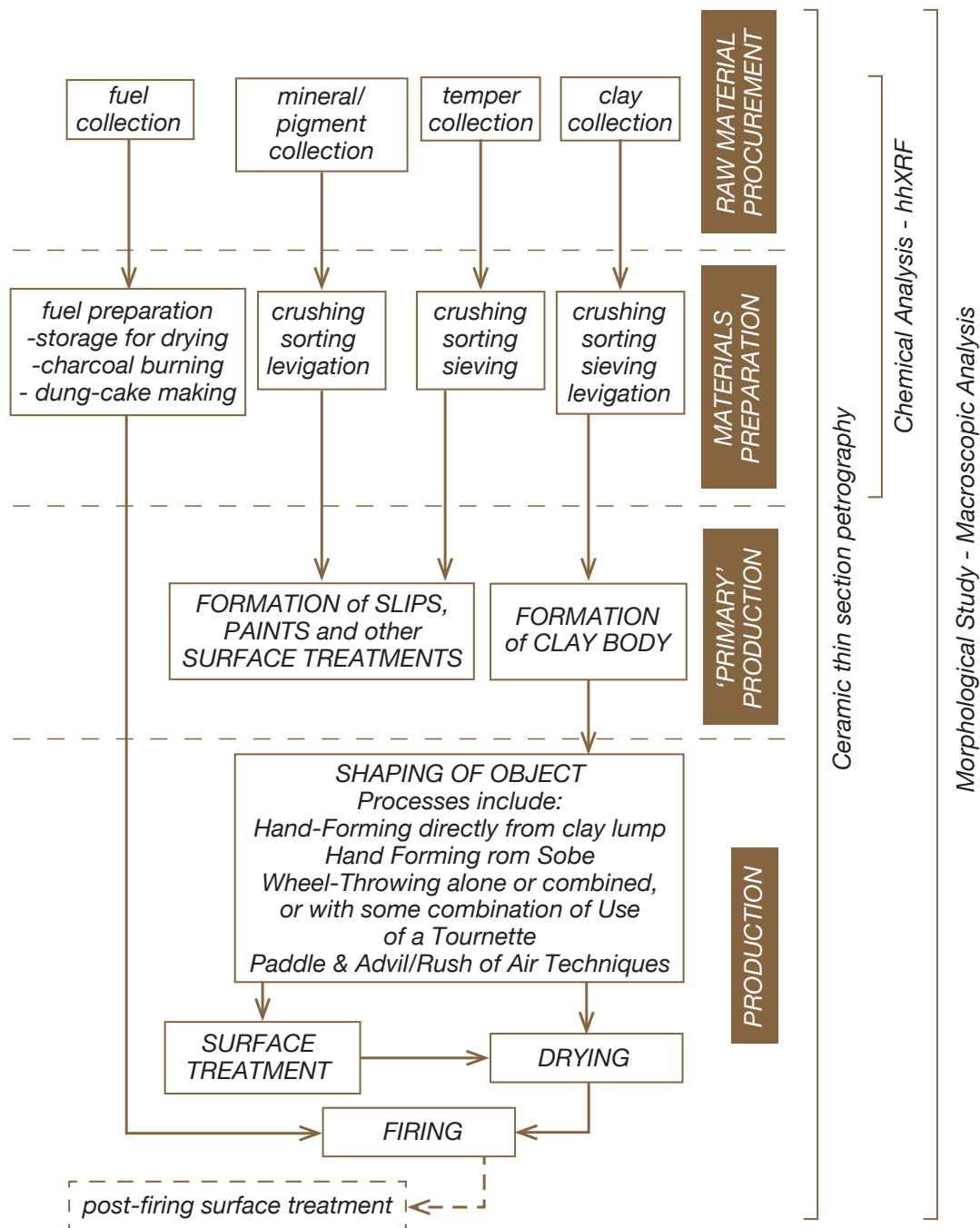
In prehistory, open firing was the most common. The typical method involves stacking the vessels over a layer of fuel and mixing additional fuel both around and inside the vessels, sometimes covering the entire stack with more fuel and/or a layer of waste sherds from previous firings. The fuel is usually ignited from below or one end of the stack, allowing it to burn through. One of the most notable features of open firing is the rapid increase in temperature during the initial phase, along with a brief duration. It can take only a few minutes to reach maximum temperature, allowing for the pots to be removed shortly thereafter (Rye, 1981, p. 102). However, some open firings can take nearly two hours to reach their peak, with the stack not being opened until eight to ten hours later (Orton *et al.*, 1993, p. 127).

Livingstone Smith (2001), investigated the characteristics of the various firing processes in terms of duration, maximum temperature, heating rate and soaking time. To do so he investigated various firing structures such as bonfires, bonfires with light insulation (a few sherds or metal basins), and bonfires with heavy insulation (complete sherd covering). When examining the duration of the firings, bonfires and bonfires with light insulation displayed average duration of below an hour, while average temperatures range between 600-900 °C (Livingstone Smith, 2001, pp. 998).

Any treatment of the vessel that happens after the firing is part of the post-firing stage. These may include polishing, incised decoration, added coating or smoking of the vessel to give it a blackened appearance. It is however often difficult to distinguish whether these stages occur before, during or after firing.

Several studies have combined ethnoarchaeological, experimental, macroscopic and petrographic data in order to reconstruct the *chaîne opératoire* of pottery production in various communities. Even though the specific steps, tools and techniques may differ, the main steps are usually the ones summarized above and illustrated in Figure 26.

Figure 26: Chart showing the different stages of a pottery production chaîne opératoire and methods of studying them in this thesis (created by Maria Hadjigavriel, after Miller, 2007, p. 108).



The *chaîne opératoire* has been developed within the broader study of technologies of production. The technology used to produce a ceramic vessel is comprised of several specific technological choices. Technological choices can be affected by both functional and sociocultural factors. Lemonnier (1986, p. 149) has characterised technological choices as “*socially pertinent choices*” which govern the production of a finished artefact. A sequence of actions is chosen, leading to the creation of artefacts, whose physical and formal properties, such as raw materials, technology of production, shape, size, and surface treatment, are assessed to classify them into groups, including stylistic groups (Lemonnier, 1986, pp. 153-155). Functional factors affect these choices greatly, as an artefact’s performance characteristics, including its compositional, microstructural, mechanical, thermal, typological or stylistic characteristics, can affect its functionality (Sillar & Tite, 2000). When we study an artefact’s morphology, observing its shape, size and stylistic characteristics, we also identify the characteristics that contribute to the artefact’s function (Eaton, 2000). For example, the form of an artefact can be a direct indication to its function (Kirch, 2015). Likewise, when we study the compositional and technological characteristics of an artefact via archaeometric methods, we can find indications of the artefact’s function. For instance, clay composition of a ceramic vessel as studied via ceramic thin section petrography (inclusions, clay matrix and voids), determines its suitability as a cooking vessel (Whitbread, 2015, p. 28). However, technological choices also have cultural and social significance (Sillar & Tite, 2000; Roux, 2019; 2020).

Conventionally, technology has been considered “*a distinctive sphere of materiality [which is] grounded [in] pragmatic behaviours separate from, underlying and implying upon politics, social organization, beliefs and value systems...built on a materialistic and rationalist edifice*” (Dobres, 2000, p. 10). This was famously argued by Marx and Engels (1970, p. 42), who suggested that humans are what they produce and how they produce it. In other words, people’s experiences and understanding of their surroundings are influencing the artefacts they produce. Of course, not everyone is a producer, and there are many ways of being. However, anyone who has ever crafted a ceramic vessel or witnessed an artisan at work cannot deny that craftsmanship is more than “motor habits” and directly linked to the maker’s experiences and skills. In archaeology, Childe (1956, p. 1) was one of the first researchers to identify the social aspects of technology and argued that artefacts are “*concrete expressions and embodiments of human thoughts and ideas*”. This led to the idea that “*pots equal people*”, a notion that has dominated archaeological investigation for decades.

However, archaeology has moved beyond this “*pots equal people*” idea, with more focus on the technology of production and its social dimensions. To investigate technological style and its social dimensions, the role of artisans and how context is central. A useful framework is Bourdieu’s “*habitus*”, in which, the habitus is the system of tendencies and dispositions which humans assimilate through continuous unconscious practice without necessarily being aware of them (Bourdieu, 1977, pp. 72-87). This framework does not imply that the artisan is not capable of improvisation or able to adjust to new demands or situations. Artisans make choices that are culturally conditioned. It is generally accepted that learning a craft, such as pottery making, requires repetitive action and developing the corresponding habitus which potters employ at all stages of a *chaîne opératoire* (Albero Santacreu, 2014, pp. 194–244; Dietler & Herbich, 1998; Sillar & Tite, 2000). So pottery technology can be perceived as “*the objectified result of techniques*” (Dietler & Herbich, 1998, p. 246). Even though habitus is only one element of Bourdieu’s model and was not meant to be applied to artisans, it is a key-concept when attempting to see human interactions via pottery production and use, as it can be used as a basis for a framework in which production processes can be linked to social identities (Ünlü, 2011, p. 5).

Several researchers have argued that the maker of an object has choices, like the kind of tools and techniques employed, which affect the end product and have meaning (Lemonnier, 1986, p. 154; van der Leeuw, 1993, p. 261; Pfaffenberger, 1992, pp. 496-498; Stark, 1999, p. 27). Similarly, Pfaffenberger (2001) coined the term “sociotechnical system”, which describes the interdependence of social and technological sides of society (Dietler & Herbich, 1998, p. 237). According to this framework, technological processes can be considered systemic since they are formed according to existing knowledge and social parameters, but it also means that they are in constant “negotiation” with aspects of the social systems in which they belong, being shaped and altered accordingly (Lemonnier, 1989, p. 156; Pfaffenberger, 1988, p. 240).

To explore the relationship between technical traditions and social groups, researchers have tried to tackle the processes by which these various traditions evolve. As Roux (2019, p. 4) points out, these processes are connected to the transmission of technological know-how. Especially when it comes to studies on pottery technology, a popular concept among archaeologists is that of “communities of practice”, which was conceptualized by Lave and Wenger while studying apprenticeship as a way of learning (Lave, 1991; Lave & Wenger, 1991). Essentially, communities of practice are groups of people who share common skills and ways of doing things, and exchange knowledge to better their craft (Wenger, 1998). In other words, they are social groups that share technical traditions, practicing together, and that common practice is what makes them a community. Such training might take place on a household or community level (Knappett, 2011; Knappett & Kiriati, 2016, p. 12; Roux, 2020, p. 18).

Based on the above, many studies have been based on the principle that similar pottery indicates interactions within or between sites, and thus social relationships (e.g. Coward, 2013; Borck *et al.*, 2015; Östborn & Gerding, 2014). However, as Knappett (2018, p. 16) maintains, only specific artefact characteristics, such as surface treatment and vessel forming techniques, can help us to investigate specific types of interactions within and between social groups. Gosselain (2008; 2018) and Roux (2020) have both argued that certain ceramic traits reflect particular types of interaction, both within and between crafting communities. Gosselain (2018, pp. 9-12), drawing upon several ethnographic studies conducted mainly in Africa, has developed a model identifying three types of interactions between artisans, traced in different stages of the *chaîne opératoire*.

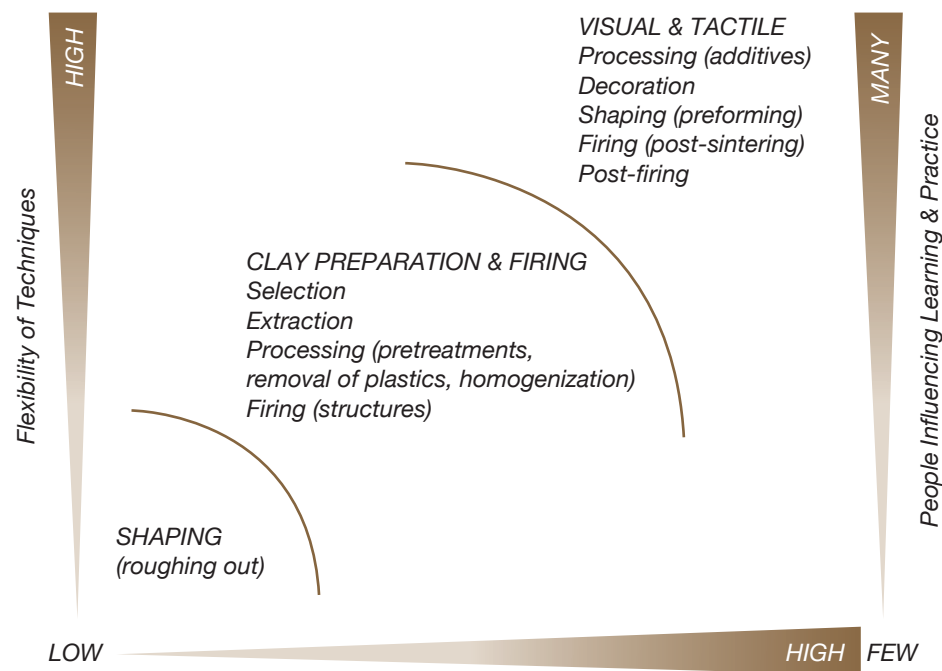
First, Gosselain argues that casual interactions between potters can take place in shared practice settings like clay sources and firing places. There, potters from different communities of practice can observe and learn from each other when it comes to raw materials selection, clay processing recipes, tools and firing techniques. Therefore, similarities in raw materials, clay processing and firing can indicate this type of casual interaction. The selection and preparation of clay materials, and firing has been the topic of many investigations, revealing great variability between potting communities (e.g. Longacre, 1991; Neupert, 2000; Arnold, 2000; Livingstone Smith, 2000; Gosselain & Livingstone Smith, 2005; Gosselain, 1992). However, one must keep in mind that this classification, in which clay procurement and firing indicate the most generic level of interaction only works from a very local perspective, and not when inter-regional interactions are studied. It is also important to mention that this type of casual interaction is only possible where clay extraction and firing occur in shared locales. However, many potters have ‘private’ clay sources about which they are very secretive. Similarly, firing does not necessarily occur in shared locales. The collection of fuel for firing can be a huge task and sharing it requires a culture of collaboration.

The second claim is that mediated interactions, such as periodically coming in contact with other communities of practice and their products can be indicated by processes that are visible on the pots themselves, such as preforming, decoration, pre-firing and post-firing treatment. For example, a potter can imitate the decoration of an imported vessel and achieve a similar result using his own techniques (Gosselain, 2018, pp. 9-12). Finishing operations and surface treatment vary in relation to

the cultural and functional factors. The same goes for decoration practices, whether they take place before or after firing. Since these processes are available to a broader category of potters, and they are easily transmittable, altered and appropriated, they are also less permanent and significant when it comes to reconstructing shared crafting communities (Gosselain, 2000, p. 191).

Finally, direct long-term face-to-face interactions between potters are most evident in the stages of the *chaîne opératoire* that require specialized skill and knowledge gradually acquired by learning in a community of practice. These are the forming and roughing out of the vessel, and gestures, tool handling or sensorial appreciation of the materials (Gosselain, 2018, pp. 9-12). A series of ethnographic examples have demonstrated that a vessel of the same size, shape and function can be formed with various techniques and methods, which can vary greatly from one group to another (e.g. Gallay, 2012; Gosselain, 2008; Gelbert, 2003). One could argue that the forming of vessels is the most stable aspect of the *chaîne opératoire* when it comes to the study of interactions, as they result from long repeated interactions with a tutor, and they don't change according to the consumer's demands as visible features of a vessel may, like the colour or decoration. Since the techniques associated with forming the vessel are the result of long-term apprenticeship and become part of the potter's motor habits, they are difficult to unlearn (Bourdieu, 1990, pp. 60-61; Gosselain, 1998, pp. 92-102; 2000, p. 192; Roux *et al.*, 2017; Roux, 2020, pp. 19-20). Gosselains' model is illustrated in the figure below (Figure 27). The model developed and used for this thesis is building on the aforementioned studies, and is presented at the end of this chapter.

Figure 27: Technical and social influences on pottery production based on African case studies (after Fowler, 2016, p. 482, using data from Gosselain, 2000).

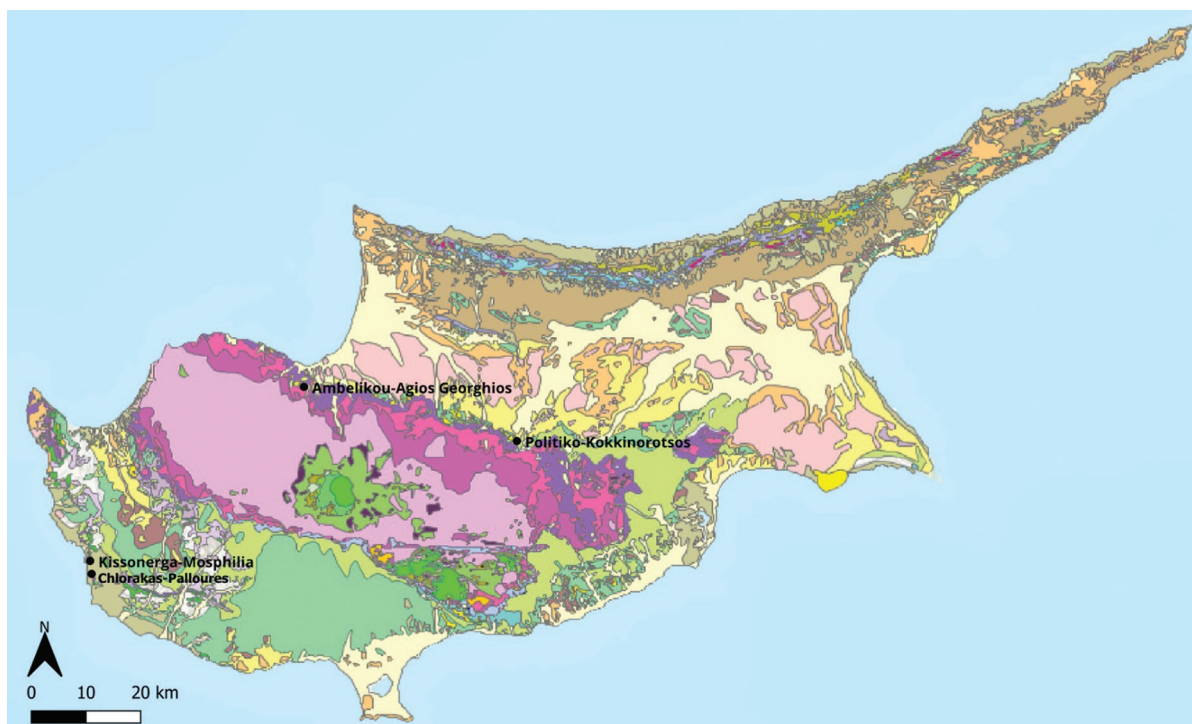


4.4. Dataset and Methodologies

4.4.1. Dataset

The main dataset for this study is comprised of Late Chalcolithic pottery from four sites in Cyprus: *Chlorakas-Palloures*, *Kissonerga-Mosphilia*, *Ambelikou-Agios Georghios*, and *Politiko-Kokkinorotsos*. These sites were selected based primarily on their location. Since the interactions between different communities across the island is the main topic of investigation of this research, sampling sites across the island was imperative (Figure 28).

Figure 28: Map indicating the sites selected for this study (created by Andreas Livadiotis)



In addition to this, specific criteria apply to the selection of each site. First, *Chlorakas-Palloures* is an ongoing excavation in which I am involved and I am very familiar with the material, so including it in this dataset was a natural decision. It is a substantial Chalcolithic settlement that is being excavated systematically and the pottery is processed by Dr. Charalampos Paraskeva and myself. *Kissonerga-Mosphilia*, another Chalcolithic settlement located close to *Chlorakas-Palloures*, is well-published, and the macroscopic similarities between pottery assemblages from both sites have been studied before (Hadjigavriel, 2019; 2021). Therefore, wares from this site have been included for comparative purposes.

When it comes to the northern part of the island, among the sites excavated prior to 1974 and with material accessible for research, *Ambelikou-Agios Georghios* has been selected as it dates exclusively to the Late Chalcolithic. The pottery has been published by the excavator, Dikaïos, and other researchers (Dikaïos, 1962; Peltenburg, 1991c; Gjerstad, 1980). The material is located in the Cyprus Museum in Nicosia, and could therefore be easily accessed. Finally, *Politiko-Kokkinorotsos* has been excavated in the late 2000s, it is well-published, and the pottery assemblage is well-

catalogued and accessible (Webb *et al.*, 2009a). It is also situated in the Mesaoria plain in the centre of the island and it has been interpreted as seasonal hunting station. It can therefore give us a glimpse on pottery from its broader surrounding region.

These assemblages are first analysed macroscopically. Subsequently, pottery from all sites is sampled and studied mineralogically and chemically to investigate possible variations in raw materials, forming techniques, surface treatment and morphological style, in order to reconstruct interactions between ancient potters and their communities. A detailed overview of this dataset is provided in the following chapter. Finally, in order to tackle extra-insular interactions, a pottery dataset from Tarsus-Gözlükule is studied macroscopically and a literature review is conducted to sum up all known Anatolian imports/exports and technological influences in the Late Chalcolithic archaeological record, paired with information on well-published ceramic assemblages of the Philia Phase, from Marki-Alonia (Dikomitou Eliadou, 2012). Tarsus-Gözlükule has been selected due to its geographical proximity, the presence of Cypriot pottery in the assemblage, and accessibility to the reference collection, which is stored at Bryn Mawr College, in Philadelphia (USA).

4.4.2. Methodologies and Research Objectives

4.4.2.1. Morphological Study – Macroscopic analysis

Even though traditionally the typological and morphological study of pottery has been pivotal, one can say that over the past decades pottery typology and form studies have been neglected in favour of archaeometric analyses (Albero Santacreu *et al.*, 2016, p. 183). However, for this study, the morphological characterization of pottery is equally important to the mineralogical and chemical characterization. An overview of pottery studies in Cyprus and Cilicia is provided in Chapter 3. The macroscopic study of the pottery sherds selected is conducted using a calliper, a 10x magnifying lens and a x400 USB microscope (Veho, Discovery VMS004).

The relevant pottery types from each site are studied in detail, in order to observe and record morphological characteristics: clay procurement and preparation, vessel forming techniques, surface treatment, colour and decoration, and firing. Clear sections are made to observe the colour of the clay, the feel, the texture, and the colours, size, frequency and sorting of all visible inclusions. This is referred to as “macroscopic fabric” or “or macro-fabric” throughout the thesis. Studying the macroscopic fabric of a vessel, therefore the clay paste, is an essential first step in analysing vast datasets of material such as pottery. It can be defined as the systematic study of pottery fabrics with the help of a hand lens or a handheld microscope. It is a process that is empirical and finding standardized procedures for it in literature is a challenge, besides important contributions by Peacock (1970), Rice (1987) and Whitbread (1986). The most common process is for the archaeologist to first categorize pottery into wares “*giving a single description which covers the variation within the group rather than then describing every catalogued item in detail*” (Orton & Hughes, 2013, p. 155). Identifying a ware is based on several morphological characteristics (i.e. form, style, decoration), technological features (i.e. clay composition, surface treatment, vessel forming techniques, firing), the chronology and geographical location, and the function of the vessel. Usually surface treatment is the primary indicator of a ware, while clay composition plays a secondary role. For this study, even though the wares as defined by prior literature used, a detailed macroscopic analysis of the macrofabric is conducted, building on the methodology developed by Paraskeva during the Chlorakas-Palloures excavation. This methodology is outlined in detail in Chapter 5. Additionally, hardness, wall thickness, rim diameter and the shape of the vessel are also recorded.

4.4.2.2. Mineralogical and Compositional Analysis – Ceramic Thin Section Petrography

Even though scientific research into ancient ceramics was conducted sporadically in the 19th and the first half of the 20th century, it only became a coherent field in the 1950s, partially in the spirit of processual archaeology and its overall emphasis on sciences, and on the study of technology and craft (Tite, 2016, p. 8). From then onwards pottery studies expanded, drawing in more techniques. A very popular method at present is ceramic thin section petrography, conducted with an optical polarizing light microscope. Ceramic petrography is employed for ceramic compositional analysis, which is the detailed study of the material ancient ceramics are made of. Since clay forms naturally from the weathering of rocks, ceramic compositional analysis is built upon geology and the scientific study of rocks and sediments. Thin section ceramic petrography is an interdisciplinary method, combining principles and techniques from thin section petrography, soil micromorphology, sedimentology and sedimentary petrography. It is used to characterize the pottery according to the types of minerals it contains and other visual characteristics (Quinn, 2022, pp. 1-6, 13). In other words, thin section ceramic petrography is “a form of ceramic compositional analysis that is concerned with the characterization and interpretation of ancient ceramic artefacts in ‘thin section’ under the microscope...It applies the techniques of optical mineralogy and thin section petrography to archaeological material in order to identify the types of mineral and rock ‘inclusions’ that they contain” (Quinn, 2013, p. 4; 2022, p.13).

A ceramic thin section is a 3 µm slice of a vessel or sherd, fixed onto a glass microscope slide. These sections are studied with a polarizing microscope under magnifications of x25-400. Two types of lights are employed: plane polarized light (PPL) which is similar to regularly transmitted light; and crossed polars (XP), in which the light is polarized in two directions and interacts with the minerals of the thin section, producing optical effects that may help us identify them (Quinn, 2022, p. 13). By applying the techniques of optical mineralogy and thin section petrography to archaeological objects, we can recognize the rock and mineral inclusions in the clay matrix. To learn how to recognise these one must study geological examples and use several reference material. Methodologies from sedimentology and sedimentary petrography are employed, such as the description of particle shape and texture. Also, soil micromorphology methods are applied to describe the nature of the clay matrix (the clay overall, the “background”), and the voids (the empty spaces in thin section).

By comparing the mineral and rock inclusions identified in thin sections, with geological maps or soil samples from the areas of interest, the provenance of the pottery may be determined, making a method suitable for exploring trade, exchange and pottery distribution patterns. As Quinn noted: “Thin section petrography is particularly well suited to the interpretation of ceramic provenance in that geological information about ceramic raw materials (rock type and mineral species of inclusions, type of clay deposit) can be readily interpreted under the microscope by a trained analyst and compared to knowledge of bedrock and superficial geology” (Quinn, 2022, p. 167). Additionally, a thin section can give us information on the ceramic manufacture. For example, when the elongated inclusions are parallel to the vessel walls, they can indicate the use of a potter’s wheel (Roux, 2019, pp. 154-186; Quinn, 2022, pp. 241). Petrography can also provide data for finishing layers, like slip, paint or glaze, when they are visible in thin section, confirming their presence and application technique. When it comes to the drying stage of the *chaîne opératoire*, ring voids around aplastic inclusions may indicate clay shrinkage due to rapid and uneven drying (Quinn, 2022, p. 264). For estimating firing conditions, observing the colour of the clay matrix, its porosity, whether it sinters or vitrifies, whether specific minerals decompose or alter, can be very informative (Quinn, 2022, p. 266, 274-277). Overall, an advantage of this method is that it can simultaneously investigate ceramic provenance and technologies. As it is a visual approach, it is flexible and adjusts according to the material under study, and although it is a destructive technique, it is relatively inexpensive in comparison to other methods like isotope analysis (Degryse & Braekmans, 2016, p. 234; Quinn, 2022, pp. 13-17).

For this project, ceramic thin section petrography was employed for the mineralogical and technological characterization of the chosen samples, and for the identification of micro-morphological characteristics which may indicate their provenance or manufacture technology. Cross-sections were detached from 81 ceramics sherds and were prepared into thin sections. This process was conducted by me at the Science and Technology in Archaeology and Culture Research Center (STARC) of The Cyprus Institute, under the instructions and supervision of Dr. Maria Dikomitou-Eliadou and Dr. Jelena Živković, within the framework of PlaCe-ITN, a Horizon2020 project. The exact methodology applied for ceramic thin section petrography in this thesis is presented in Chapter 6.

4.4.2.3. Chemical/Elemental Analysis – hhXRF

X-ray fluorescence (XRF) technology has been widely taken-up in archaeological studies over the past decade, especially due to the development of hand-held instruments which can perform high-resolution and multi-element analysis in a non-destructive way. Especially handheld XRF (hhXRF) instruments have been used often in archaeological provenance studies (Foster *et al.*, 2011, p. 389). An encompassing definition of this technique is this: *“X-ray fluorescence spectrometers measure the energy level and intensity of secondary (fluorescent radiation) X-rays produced by primary X-rays striking the sample and creating vacancies in an inner shell of the atoms, which are then filled by lower-energy electrons from an outer shell. For producing quantitative results, the intensity of the primary X-rays must be high enough to produce sufficient secondary X-rays for statistical measurement, and therefore is different between major and trace elements in the sample”* (Tykot, 2016, p. 43).

One should keep in mind that the term hhXRF is used to describe various instruments. In general, hhXRF instruments are of small size, in a gun-shape and light weight, to facilitate portability, and their precision varies per device. They have been described as “point and shoot” instruments. Although this can be seen as an advantage, one needs to keep in mind that this method has several limitations. Despite the increasing use of hhXRF in archaeology, concerns have been raised concerning the precision, accuracy and sensitivity of the instruments (Holmqvist, 2016). Additionally, this method has various limitations, as it measures fewer elements and is less sensitive than destructive methods of analysis, such as SEM or NAA (Foster *et al.*, 2011, p. 389). As a result, and according to the accuracy and precision of the measurements, few elements are actually used for further analysis. Another limitation is that when employing hhXRF the analytical signal comes from the surface layer, meaning that any irregularity or layering on the surface affects the results. Therefore, flat clean freshly-cut surfaces of the fabric are preferable (Holmqvist, 2016). Finally, it focuses on a spot smaller than a few millimetres in diameter, which might be an issue when analysing heterogenous materials, such as ceramics, even if you take multiple measurements. On the other hand, the main advantages of handheld XRF its non-destructive in nature, which allows access to museum collections, that it is less expensive than other methods, and its capability for rapid analysis, which enables the analysis of large assemblages in a small amount of time. It is also more sensitive to peaks of interest than the stationery XRF (Foster *et al.*, 2011, pp. 389-390). According to Frahm and Doonan (2013, p. 1429), the most frequently cited reason for employing hhpXRF is that the analysis had to be performed on-site at museums, monuments or the field, along with its non-destructive nature.

HhXRF is often applied to obsidian and other rocks, paints and pigments, metal and glass objects. Soil and sediments are not analysed by hhXRF often because there are usually no issues with getting permissions for destructive analysis. For pottery, understanding the effects of grain size and mineralogy, surface morphology and post-deposition processes is crucial, given the limited elements hhXRF is able to measure accurately and precisely (Foster *et al.*, 2011, p. 389; Frahm, 2018, p. 12). Additionally, the intensity of the primary X-rays is not always enough to produce quantitative results, this is highly depended on the elements measured. The response to the primary X-rays is depended on the type of elements targeted and fluorescence happens at different depths in the sample for

different elements. Therefore, hhXRF is often used as a complementary method, to test and validate hypotheses drawn from destructive analyses on the same dataset (e.g. ceramic petrography), and to evaluate instrument performance and compatibility with other methods (Frahm & Doonan, 2013, p. 1429).

For the hhXRF device to be calibrated, standard reference materials of known composition are used, which are measured often throughout the analytical process, to also estimate accuracy, precision and inter-method inconsistencies. The reference materials selected should have similar matrix characteristics and effects to the samples to be analysed (Holmqvist, 2016). The use of standard reference materials is also important because besides inter-method inconsistencies, hhXRF also shows inter-instrument accuracy issues. Along with the standard reference materials, appropriate software is also crucial (Tykot, 2016, p. 43).

Often, the data drawn from hhXRF analysis are used for Principal Component Analysis (PCA). PCA is employed by archaeologists to trace compositional groups within a dataset. This method can summarise the full set of variables by a smaller number of compound variables, determining the new variables based on correlations between the original variables (Shennan, 1997, pp. 269-270). Multidimensional datasets allow for highly-precise classifications of such groups and subgroups. However, one must keep in mind that these analyses encompass only a part of the object's chemical composition, as not all elements are included (Foster *et al.*, 2011, p. 391). Thus, the value of PCA analysis employed on hhXRF data from ceramics lies in the ability to interpret the data in meaningful ways in accordance to the archaeological questions, like the acquisition of raw materials or technological choices (Frahm, 2018, p. 13). For this project, the ceramic samples which were selected for ceramic thin section petrography were also analysed with a hhXRF. The analytical instrument employed was a Hitachi XMET 8000 handheld XRF analyser, and this was done at the Science and Technology in Archaeology and Culture Research Centre (STARC) of The Cyprus Institute, under the instructions and supervision of Dr. Maria Dikomitou-Eliadou. The workflow employed is presented in detail in Chapter 6.

4.4. Summing Up the Theoretical and Methodological Framework

This research aims to investigate what the development of pottery technology in Cyprus can tell us about interactions between communities within the island and with communities from Anatolia in the early third millennium BC. To do so, whether ceramic circulated within and outside Cyprus, how pottery technology evolved in the Late Chalcolithic and in comparison to the Philia Phase, whether different regions within Cyprus share technological traditions and to what extent pottery technologies transferred to Cyprus from Anatolia are investigated from a craft-centred perspective.

Pottery datasets from four Cypriot Late Chalcolithic sites, Chlorakas-*Palloures*, Kissonerga-*Mosphilia*, Ambelikou-*Agios Georghios* and Politiko-*Kokkinorotsos*, and one from Early Bronze Age Tarsus-*Gözlükule* in Anatolia are studied. To begin with, all the assemblages are studied macroscopically, and the pottery from Cyprus is also examined via ceramic thin section petrography and energy dispersive X-ray fluorescence (hhXRF) analysis. The aim of these analyses is to reconstruct several stages of pottery production at these sites, including clay procurement and preparation, vessel forming techniques, surface treatment, and firing. Building on the frameworks provided above by Gosselain (1998; 2000; 2018) and Roux (2020), where these different stages of the *chaîne opératoire* may be linked to various types of interaction by crafting communities, a methodological framework is constructed.

To begin with, pottery from the sites in Cyprus is analyzed macroscopically, in order to investigate the vessel forming techniques, surface treatment and decoration, vessel shapes and firing of the relevant pottery wares. Subsequently, 81 sherds are sampled for further study. The mineralogy, composition and technology of these samples is studied by employing ceramic thin section petrography, in order to investigate all stages of the *chaîne opératoire*. Additionally, their chemical/elemental composition is analysed with a hhXRF, and the retrieved data are subjected to PCA analysis, giving as an insight on clay procurement and preparation.

Clay procurement and preparation, investigated by the three methods mentioned above, can determine whether pottery was produced in the same region, and subsequently, whether pottery is exchanged between sites.

Vessel forming techniques, vessel shapes, and firing, investigated by the morphological study conducted via macroscopic analysis, the thin section ceramic petrography and the publications, can illustrate long-term interactions and shared pottery technologies within and between communities, indicating whether people moved and lived long-term in other communities.

Further, vessel shapes, surface treatment and decoration, investigated via the macroscopic analysis, ceramic thin section petrography and the published data, are visible pottery characteristics that can be imitated. Therefore, they indicate mediated interactions, where people would move from site to site and have at least seen what each community was producing.

Finally, studies on the Tarsus-Gözlükule assemblage, both on a macroscopic and a microscopic level (Goldman, 1956; Mellink, 1991, Ünlü, 2009; 2011; 2016) are paired with the macroscopic analysis conducted here to tackle the issue of extra-insular interactions. An overview of the model employed in this thesis is presented in the diagram below (Figure 29).

Figure 29: Diagram showing the methodology of this study (created by Maria Hadjigavriel).

