Pottery Making as an Experimental Pedagogical Service for Understanding the Chaîne Opératoire: Results from the Gadachrili Gora Archaeological Project (Republic of Georgia)

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ABSTRACT: This paper is a report on our pedagogical experimentation using the chaîne opératoire as a means to teach students about ceramic analysis in the context of our field school in the Republic of Georgia. Through our pottery analysis we address questions related to ceramic production and consumption, in addition to issues related to social organisation and interregional interaction. In order to address these questions, we rely on the conceptual framework of 'communities of practice' and a chaîne opératoire approach. It is essential that our students understand these ideas in order to eliminate the black box effect that otherwise influences their perception of the knowledge production process in archaeology.

INTRODUCTION

We introduce our students to ‘communities of practice’ and the chaîne opératoire by having them produce earthenware ceramics over our six-week field season. Students participate in every step of ceramic manufacture. This includes collecting raw materials, preparing the clay and making ceramics; as well as building a kiln and firing the pottery. During pottery making, students experience how communities of practice emerge when individuals share knowledge and work collectively. Over the course of these pottery-making experiences we see the development of students’ pottery analysis skills, with increased speed, competency and precision. Through this process our students are able to build a clear understanding of how a small piece of pottery can hold valuable information about technical behaviour, large-scale uses of landscape and human relationships in the past.

By having students enact the stages of ceramic production we are simplifying their understanding of the otherwise complex process of ceramic analysis through situated learning (Lave and Wenger 1991). This in turn contributes to demystifying the process, and eliminating the ‘black box’ effect that exists between the collection of material in the field and the publication of results. We find that when the chaîne opératoire is experienced, students become more confident contributors to the documentation process by asking more in-depth and focused questions, and by providing insights otherwise taken for granted by researchers. To best demonstrate our pedagogical approach, we will present an overview of our conceptual and analytical methods of ceramic analysis and place them in the broader context of the region and our research objectives.

We start by contextualising our research in the Republic of Georgia by providing a brief geographical and historical background of the region, and highlighting some of the research questions. Subsequently, we will provide an overview of
the Gadachrili Gora Regional Archaeological Expedition (henceforth G.R.A.P.E) and its affiliated projects. We will then turn our attention to the theoretical and methodological approaches that we employ in our study of pottery, providing an overview of the analytical framework of communities of practice (Lave and Wenger 1991) and the role of the chaîne opératoire in understanding this concept. Finally, we will address how student involvement in pottery-making elucidates and simplifies the concepts of communities of practice and chaînes opératoires.

**CONTEXTUALISING THE LATE PREHISTORY OF THE SOUTHERN CAUCASUS**

G.R.A.P.E is a multidisciplinary research project situated in the municipality of Marneuli in the southeastern part of the Republic of Georgia (fig. 1). The watershed of the Kura River Basin dominates this area. The region comprises a relatively flat plain bounded by the Lesser Caucasus mountain range to the south and the less-imposing Iori Plateau to the east and northeast. The valley is dissected by a number of rivers, all which feed into the Kura; namely the Debeda, the Algeti, and the Khrami. Over the past 60 years this region has received differential archaeological attention (see Sagona 2018: 87 map 3.1). The areas of the Khrami and Debeda, along with the extension of the Kura River in Azerbaijan, are considered some of the most significant areas for Neolithic and Chalcolithic research in the region (see Sagona 2018).

The established cultures of the Neolithic and Chalcolithic (6000-3600 BC) derive their names from sites in the region such as the Neolithic Shulaveri-Shomu culture (Javakhishvili and Japaridze 1975; Narimanov 1965), and the Chalcolithic Sioni and Tsopi cultures (Nebieridze 2010). The Neolithic and Chalcolithic are formative periods in the development of human societies. During these periods we find the first evidence for agriculture and animal domestication, increased societal complexity, nascent social differentiation, and the emergence of specialization in both subsistence and craft production activities. Such developments are clearly attested in the Near East but are also true for the Neolithic and Chalcolithic of the Caucasus.

**CURRENT RESEARCH (G.R.A.P.E)**

Our work in the region began in 2016 as part of a multidisciplinary research team led by Dr. Stephen Batiuk from the University of Toronto and partnering with the previously established team from the Georgian National Museum led by Dr. Mindia Jalabadze. The project continued excavations at the site of Gadachrili Gora and resumed excavations at the site of Shulaveris Gora, at the invitation of the National Museum and the Wine Agency (Georgian Ministry of Agriculture), with the aim of exploring the origins of viticulture and viticulture in the Republic of Georgia (Batiuk et al. 2017). Beyond understanding the early history of viticulture and viniculture, our aims are to establish a better framework for understanding the process of Neolithisation in the region and how it relates to said process across the region at large (Batiuk et al. 2017).

Beyond excavations, our team has been involved in a number of surveys. The main objectives of our survey work were to provide a history of landscape occupation of the region and to understand diachronic changes in the relations between the
highlands and lowlands, with a primary focus on the Neolithic, Chalcolithic and the Early Bronze Age. This work was undertaken to establish an in depth understanding of the region during late prehistory by documenting the settlement history of the Marneuli Plain and understand what processes may have influenced settlement location over time (Batiuk et al. in press).

G.R.A.P.E also serves as an archaeological field school. In this capacity we aim to provide students from the University of Toronto and local Georgian universities (Tbilisi State University and Illia State University) with hands-on training in field archaeology and artifact processing and analysis. An additional goal of the field school is to guarantee that students are completely aware of, and engaged in, their active role in the production of archaeological knowledge and their contribution to academic research. In our project students partake in both surveys and excavations and work with different archaeological experts in order to solidify their learning experience. Ceramic analysis is an important component to answering major research questions, which students contribute to through the documentation process.

**CERAMIC ANALYSIS: QUESTIONS, METHOD AND THEORY**

Our ceramic assemblages come from excavations at the sites of Gadachrili Gora, Shulaveris Gora and preliminary operations at Imiris Gora. Additionally, a large number of sherds come from our regional survey (the Gadachrili Gora Regional
Archaeological Survey: G.G.R.A.S.). Through our analysis we address questions related to ceramic production and consumption, in addition to issues related to social organisation and interregional interaction.

The Shulaveri-Shomu Neolithic ceramic assemblages are very similar in terms of general shapes and design patterns. In contrast, the assemblages attested during the Chalcolithic tend to have a wider variety in all aspects of the production process. Accordingly, the broad questions we try to address in our analysis are:

1. Was the degree of perceived homogeneity in Neolithic assemblages superficial (e.g. emulation) or did it result from a deeper sharing of technical skills and expertise across the region?

2. How did the social conditions of craft organisation, attested during the Neolithic, contribute to the multiplicity of traditions that emerged during the Chalcolithic period?

In order to address these questions we have to understand the social organisation of potting as a craft during the Neolithic and Chalcolithic. By addressing them we can understand social networks of interactions through craft learning groups and how these groups may have overlapped across space and time. To reach this understanding we rely on the conceptual framework of communities of practice (Lave and Wenger 1991) and on a chaîne opératoire approach as a means for identifying the various communities.

Our basic assumption working with a ceramic assemblage is that multiple groups were responsible for the creation of the totality we refer to as a ceramic assemblage at a site (see Roux 2016: 3; Roux et al. 2011; Stark 2006: 20-23). Accordingly, we assert that each group produces a sub-set of the total assemblage that we can refer to as a sub-assemblage. An alternative means to view sub-assemblages are through communities of practice (Lave and Wenger 1991; Wenger 1998, 2010). A community of practice, coined by Lave and Wenger (1991), and later defined by Wenger as “...groups of people who share a concern or passion for something they do, and learn how to do it better as they interact regularly” (Wenger and Wenger-Trayner 2015:1).

The concept of communities of practice has its roots in practice theory espoused by Pierre Bourdieu (1977). The habitus in practice theory according to Bourdieu is composed of fields (which are the various circles we participate in). The fields that individuals participate in shape the individual beyond the initial social habitus of the family household (a university may shape a student beyond the initial indoctrination of the house one grew up in, thereby creating the generational gap). Because communities of practice are enclosed information-sharing groups, they are among those fields that have an active role in shaping individuals, by creating common experiences between its members independent in some cases of other communities of practice (Lave and Wenger 1991).

Groups engaged in craft production can be considered to form communities of practice because the actions of these groups revolve around learning and apprenticeship. Participation in such circles has been shown to influence members engaged in them and influence the way they carry out crafting tasks (e.g. potting),
by circumscribing elements of techno-stylistic expressions (see Dietler and Herbich 1989, 1994; Gosselain 2000, 2015; Roux 2019: 3). Archaeologically, the output of past crafting groups leaves a physical trace in the artifacts we uncover. By identifying the spatial distribution of various technical traits of artifacts we can begin to identify the variations and spatial extent of information sharing networks (see Gosselain 2000; Roux 2019: 3). The occurrence of a vessel or group of vessels at a site or within a region becomes a reflection of multiple complex historically contingent processes. In other words, the processes that led to the assemblages in front of us are historical events that we attempt to explain.

The means by which we can discern and categorize technical traits is through the rhythms of their *chaînes opératoires* which is defined as “a series of operations that transform raw material into a finished product, whether it is a consumer object or tool” (Roux 2019: 1 after Creswell 1976: 13). This definition could be expanded to also include consumption practices (see Dietler and Herbich 1989, 1994) and discard practices, as measures of consumer identity. This approach is not only an analytical tool for identifying and describing the material life history of artifacts, but also a conceptual framework that provides empirical rigor while also accounting for the human agency (Dobres 1999: 124; 2000).

Ceramic analysis at Gadachrili Gora and Shulaveris Gora focuses on the *chaînes opératoires* of past production and consumption. What this means is that the recording system revolves around interrogating the steps involved in clay procurement and preparation, the vessel’s construction technique, its surface treatment(s), firing, use and finally discard. By viewing these stages of the manufacturing process from this perspective we try to understand the specific social dynamics involved in the production process across space and time (excavation levels across three sites in addition to survey sites). This allows us to define groups of producers and modalities of consumption, which in turn makes it possible to understand social networks of communication and information sharing.

**STUDENT ENGAGEMENT: ENACTING THE CHAÎNE OPÉRATOIRE AS A WAY OF MOULDING A COMMUNITY OF PRACTICE**

The concepts of communities of practice and *chaînes opératoires* are complex concepts for students to grasp. We introduce the concept to students through the actual enactment of specific *chaînes opératoires*. This fosters a deeper understanding of ceramic manufacture in past societies, and thus develops trainees’ ceramic analysis skills. The experiment also provides a segue to introducing the concept of communities of practice. Our collectively shared experiences through the enactment of this process contributes to our group becoming a community of practice (Lave and Wenger 1991). This phenomenon is not exclusive to the recreation of certain *chaînes opératoires* but to the entire archaeological field school experience. In a field school setting we use forms of apprenticeship to teach trainees. The transmission of knowledge becomes more of a hands-on experience than merely a traditional academic lesson.

The purpose of these experiences is purely educational. We are not recreating specific past techniques. Throughout the steps of the experience we introduce a
number of alternative techniques, while granting the trainees latitude of action in certain steps of the chaînes opératoires.

**CERAMIC ANALYSIS**

Standardised forms are used to record our ceramic data (fig. 2). There are nine sections in the pottery recording sheet, labeled A-H. Certain sections of the form are not strongly impacted by the experience of pottery making. For example, sections B and C record attributes that are observable on the sherd or derived through the use of a reference such as a diameter chart or Munsell chart. The vessel diameter, proportion of rim, weight, and colour/s are all observable attributes.

Section E records the non-plastic, mineral inclusions and voids within the sherds. The processes of clay procurement, clay preparation, forming and firing all play a role in transforming the proportion and character of the inclusions within pottery (Rye 1981: 7). Throughout the course of the pottery making experience, trainees are able to observe how different mineral and organic inclusions are added to clay and distributed within the matrix. They also see how firing clay transforms these inclusions, burning organics and leaving voids in the final product.

The form also records inferred information, such as manufacturing technique, firing type and surface treatment. Inferences are made based on a sherd’s observable attributes and the analyst’s knowledge of ceramic materials. Section D requires the use of a key to interpret the firing and manufacturing techniques used to produce the vessel. The firing technique is inferred based on the array and arrangement of fabric colours visible in the sherd (Rye 1981: 116). Students become well acquainted with the process of firing pottery during the experiential training. As a result, students become aware of the implications that colour variation carry in pottery sherds.

Pottery making noticeably develops trainee’s ability to infer manufacturing techniques in archaeological pottery, also recorded in Section D. As trainees manipulate clay in the course of creating their ceramic artefacts, they experience how actions (manufacture techniques) leave lasting visible impressions in pottery. In particular, the clay preparation, forming and learning from past experiences were impactful. Students are able to confidently identify the differences in manufacturing techniques based on the feel of the sherd (i.e. consistent horizontal ridges = coiling) and by examining breaks in the sherds. By looking closely at sections of the fabric, trainees examine how inclusions are distributed which assists in identifying the actions used to manufacture the vessels (Rye 1981: 7).

Section G and H record modifications made to the primary clay form and surface of an object. Decoration and applique in Section H are elucidated through the forming and surface treatment. The primary difference between these two stages is that decorations added during forming are added to wet clay, while alterations made in the ‘surface treatment’ phase of the experience are alteration to a leather-hard form (Rye 1981: 89). A combination of the observable and inferred properties of the pottery is combined in Section F, where the sherd is rendered, and comments can be added.
The project’s ceramicists and field school trainees produce ceramics over the six-week period. The process begins with the collection of clay from a deposit located near our main excavation site, Gadachrili Gora (fig. 3A). The clay deposit is a large dry deposit exposed in the banks of the Shulaveris River (Rye 1981: 16; Roux 2019: 20). Chunks of clay are gathered in buckets using handpicks and trowels and carried back to Gadachrili Gora before being loaded into vehicles and brought back to the dig house (fig. 3B). Clay is collected on a number of occasions throughout the season as need arises. In total approximately 450L of clay was collected during the 2019 season.

To prepare the clay, water is first added to the dry clay to break down and evenly mix the clay particles. Lumps are kneaded out or removed (Rye 1981: 17). The clay is often left to soak in water overnight (fig. 3C). The clay and water solution is heavy and unruly. Therefore, the basins are stored near the processing area, in a covered area of the front porch. Once the clay has been thoroughly soaked and homogenised, the mixture is strained through a cloth. The excess water escapes through the cloth, leaving behind a moist and malleable clay which is left to sit in the cloth until all excess moisture has drained (fig. 3D). At this stage, the clay is ready to be tempered and shaped into artefacts. The clay is tempered with a...
combination of obsidian, charcoal, and local sand (fig. 3E). The sand is collected from a deposit in the village. Obsidian is collected from Mt. Chikiani, located in the lesser Caucasus mountain range, during the field season (fig. 1). Temper is added and kneaded into the clay until a desired consistency is reached (Rye 1981: 19). The clay is worked until it is sufficiently tempered to withstand the firing process (Rye 1981: 39).

Trainees subsequently create their own pots/vessels with the guidance of the project’s ceramicists. Slab construction, coiling, moulding and drawing techniques are modeled for trainees (fig. 3F) (Rye 1981: 67, 72, 81). The pottery making experience is a loosely directed exploration of ceramic chaîne opératoires (Roux 2019). Therefore, trainees are instructed merely to create a clay construction that can be fired. There are no further specific expectations of the final products. Most students used a hybrid of the methods to create bowls, tablets, figurines and pipes. The artefacts are left to dry to a leather-hard state at which point they can be burnished, slipped and mended (fig. 4A). Trainees decorate using a combination of burnishing, slipping, painting and incising (fig. 4B) (Rye 1981: 24, 90). The reddish slip is made using a mixture of clay, water and iron oxide (fig. 4B).

Ceramicists and trainees have constructed two types of firing features over the course of the pottery experiences: firing pits and kilns (Rye 1981: 97-98). The initial steps of construction are similar: an area is cleared, and a pit is dug for the fire. In the case of the fire pit a 1.5x1x0.5m rectangular pit was excavated. Smaller pits are required for updraft kilns. At this stage the firing pit is ready for fuel and pottery (fig. 4C).

Figure 3: (a) Main clay source located in the Shulaveri River cut (Gadachrili Gora marked by red star); (b) Excavation house in Saimerlo, Marneuli: pottery manufacture takes place in the open yard; (c) Raw clay is mixed with water. Lumps are kneaded or removed and the mixture soaks; (d) Clay solution is poured over a cloth. The excess water is strained out. Clay sits in the cloth until excess moisture has escaped; (e) Samples of temper; various local sands, charcoal, and obsidian; (f) Students making pottery (photos by authors).
The kilns are composed of three sections: the firing chamber, the grill, and the kiln walls. The firing chamber can consist of a pit or a pit with foundations constructed above it. The ceramic grill sits above the firing chamber, creating a surface for the unfired pottery (see Rye 1981: 104, fig. 88) (fig. 4D,E). The kiln walls are then built upward, sealing the grill and foundations. The clay walls are constructed by laying lumps of clay in concentric circles, pressing, and smoothing the lumps into shape. The kiln clay is a mixture of raw clay, water, and dried grasses (fig. 4D,E). Within the firing pit ceramics are laid in a bed of dung with logs and dried grasses placed on-top. Fuel is added to the firing pit for 6-8 hours (Rye 1981: 98). In the

Figure 4: (a) Burnishing leather-hard bowl; (b) Decorating a vessel; (c) Clearing area and digging fire pits. At this stage the fire pit is ready for fuel and pottery; (d-e) Building a kiln. Kilns are constructed around a shallow firing pit with grill above it. A superstructure is built upward. Kiln A: clay foundations and superstructure; Kiln B: clay-sealed cinderblock foundations and clay superstructure (cinderblocks were used expediently to construct large kiln); (f) Kilns and fire pit during firing; (g) Fired ceramics (photos by authors).
case of the kiln features, logs are fed into a narrow opening in the firing chamber. The fire is tended to for 6-8 hours and then left to extinguish. The pottery gradually cools for 10-12 hours (fig. 4F). Once cooled, ceramics are complete (fig. 4G).

We conduct our chaîne opératoire experiential learning sessions every field season. As such (with the exception of our first experiments), every new group of trainees is able to see a model of final products made by others who preceded them in the community of practice. Pots made by previous participants influence the trainees’ ideas for their own creations (fig. 4G). These older pots are an excellent teaching tool. We are able to break them and show how a fragment relates to the whole. Furthermore, by encountering a complete pot and subsequently enacting the chaîne opératoire necessary to make that pot, trainees build an understanding of how specific processes are reflected in ceramic materials. This helps them in the process of creating their ceramic objects as well as analysing archaeological ceramic sherds.

**EXPERIENCING THE CHAÎNE OPÉRATOIRE: BECOMING A COMMUNITY OF PRACTICE**

Over the six-week course of the pottery experiential sessions, the dynamic spatial presence of ceramics becomes readily apparent to trainees. First, students become aware that their ceramics are irrevocably linked to specific places in the landscape. The clay source near Gadachrili Gora, inclusions from Mt. Chikiani and the fuel and sand from the village, all come together to make a specific artefact. Second, students become aware of how much space is required to produce ceramics. During the sessions trainees also experience how communities of practice emerge when individuals share knowledge and work collectively. Trainees learned to manufacture ceramics in a group, as such, their relationship to each other is partially mediated by their collective experiences collecting raw materials and manufacturing pottery. Often, trainees who were struggling to master a manufacturing step will consult their peers for guidance and replicate successful techniques. This lateral learning between peers further enhanced similarities between trainees’ ceramic practices.

Through this entire process trainees negotiate scale; between the large actions carried out across the landscape, the medial scale actions around the dig house, to the creation of small artefacts. Most importantly they are able to build a clear understanding of how a small piece of pottery can hold valuable information about large-scale uses of landscape and human relationships. Ultimately trainees are repeatedly confronted by the idea that the bits of pottery we find in the archaeological record are small clues to a larger world.

**DISCUSSION AND CONCLUSION**

We have been actively implementing this pedagogical method over the past three seasons of the G.R.A.P.E. field school. We are still in the process of enhancing this method, with the intention of taking it beyond the subjective success and to develop a coherent, quantifiable measure of success that accounts for the duration it takes to analyse a sherd (speed), degree of instruction and supervision required...
(competency) and mistakes committed (accuracy). Although we have not devised a system of quantifying the success of this approach, we do see tangible results in terms of elevated performances of students in all facets of the recording process (speed, competency and accuracy). This can be observed in the differences when filling out the analysis sheet by students who enacted the chaîne opératoire and those who have not. At the Wadi Ziqlab archaeological lab at the Department of Anthropology (University of Toronto) we use the same ceramic analysis sheet (section 4.1) for our recording of Neolithic ceramic assemblages from Jordan. In this setting we have student volunteers analysing sherds under the supervision of specialists (including the authors of this paper).

Without the benefit of enacting the chaîne opératoire, mastering the process of ceramic recording takes a long time for our lab volunteers. Moreover, they are in constant need of specialist supervision to answer questions related to every step of the recording process. Despite that, mistakes are constantly made and rectified by staff. With many volunteers, it usually takes the entire semester (two sessions of two hours per week over a 12 week period) to build up the students’ competence level. In contrast, during the field season, after the enactment of the chaîne opératoire, our students are significantly faster, more independent and insightful, and exhibit a higher level of accuracy when recording. Moreover, this higher level of competence is reached within five, one and a half hour, sessions.

We believe that the success of this educational method is down to a number of factors. Primarily, it is fun. We can see the enthusiasm in the students during our experiential sessions and the eagerness they exhibit, especially in the sessions pertaining to vessel forming and surface treatment, kiln construction and firing. The second factor is the casual relaxed atmosphere in which it is carried out. During the course of the season trainees realise that the instructors are also learning through pottery making (this is especially true in clay preparation strategies and kiln combustion dynamics). Having the education process impact both the trainee and instructor, removes the dichotomy between teacher and student and enhances the sense of community building. Finally, physically enacting the potter’s experiences solidifies the basic understanding of the craft in the students’ consciousness, creating a reservoir of experiences that serves as a mental foundation for a more informed analysis. This foundation surpasses the abstraction inherent in simple verbal instruction that students in our lab encounter.

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