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Variability and continuity of ceramic manufacturing of prehistoric pottery from Upper Nubia, Sudan: An ethnographic comparison

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ABSTRACT

In Upper Nubia (currently northern Sudan), the art of making pottery has a very ancient and durable tradition, dating back to the early Holocene and preceding the introduction of a food-producing economy. Ethnographic case studies have demonstrated that this tradition has been preserved in many areas of the country. This paper presents a comparative study of ancient and modern traditional ceramics from four prehistoric sites at Sai Island, in the river Nile, and a present-day workshop located in the nearby village of Abri. The aim of the study was to investigate any diachronic changes in the selection of clayey raw material and the technological processes of the manufacturing sequence. The study combined macroscopic and analytical approaches and examined a large set of ceramic and local clay samples by means of petrographic (OM), mineralogical (X-ray powder diffraction; XRPD) and chemical (X-ray fluorescence; XRF) analyses. The resulting data underline a remarkable continuity in raw material sourcing and composition, as well as in many technological processes, from the ceramic assemblages dating from Abkan cultural horizon (*c.* 5500 BCE) until to the present-day production in Abri. This continuity emerged after a preceding discontinuity, indicated by a different selection of clay raw material and tempers in the oldest production dating to the Khartoum Variant horizon (*c.* 7600–4800 BCE).

1. Introduction

Technological studies of ceramics began in the 1950s (Shepard, 1956) and, since then, a variety of approaches have been developed to address different questions. The approach chosen can depend on whether the technological evidence is interpreted according to 'functional' or 'cultural' criteria. The former criteria are applied to potters' decisions that seem to be related to the function and performance characteristics required of an object (Braun, 1983; Bronitsky, 1986; Rice, 1996; Rye, 1981; Schiffer and Skibo, 1987, 1997; Schiffer et al., 1994; Steponaitis, 1983, 1984). The latter criteria are applied to technological choices that appear to be the result and expression of the social and cultural contexts within which the decisions were made (Constantin and Courtois, 1985; Creswell, 1996; Dietler and Herbich, 1994, 1998; Gosselain, 1992a, 1998, 2000; Lemonnier, 1986, 1992, 1993; Sillar, 1997; Stark, 1998). Several scholars have recently stressed the importance of looking at the products of material culture, and specifically ceramic technology, via a 'holistic approach' regarding the technical practices and economic and socio-cultural contexts of the various stages of pottery production as interdependent variables within the same 'system' (e.g. Gosselain, 2012; Sillar and Tite, 2000). From this perspective, continuity is not presumed, as technical evolution and dissemination can occur when social discontinuities take place (Roux, 2013).

The concept of the chaîne opératoire (Leroi-Gourhan, 1964) has always been crucial to the discussion of pottery manufacture. In fact, "The production of every pot requires the potter to make a series of 'choices', selecting from a range of possible raw materials, tools, energy sources, and techniques. Thus each technological choice is co-dependent on other technological choices which go together to form a particular chaîne opératoire" (Sillar and Tite, 2000, 3, 5). Furthermore, according to Gosselain (2012, 246), the chaîne opératoire represents a "powerful analytical tool which imposes systematization in data collection, as well as the acknowledgement of a variety of elements that are invariably brought together in the conduct of technical activities".

This study examined the technological aspects of prehistoric ceramics from Sai Island in Upper Nubia, currently northern Sudan, dating from the Early–Middle Holocene (Khartoum Variant; *c.* 7600–4800 BCE) to the Middle Holocene (Abkan; *c.* 5500–3700 BCE

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and Pre-Kerma; *c.* 3600–2500 BCE), and contemporary pottery made by local potters in a workshop in the village of Abri near Sai Island. The aim was to illustrate and compare the chaîne opératoire of the different prehistoric ceramic complexes, published elsewhere (D'Ercole et al., 2014, 2015) and summarised here, with the results of macroscopic, petrographic, mineralogical and chemical analyses of the contemporary ceramics. Starting with the analysis of the material evidence, the ultimate aim was to outline the development of Nubian ceramic traditions and to understand whether and when variability or continuity took place during the long period of time from prehistoric to present production. More generally, the study evaluated the compatibility of the analytical/archaeometric approach with the ethnographical evidence, and the possible effectiveness of their combined analysis when applied to archaeological questions.

2. The ethnographic and archaeological contexts

Sai Island lies between the Second and Third Cataracts of the Nile, in Upper Nubia, Sudan, and has been occupied from the Early Stone Age (*c.* 220,000–150,000 years ago) until the Ottoman period (end of the sixteenth-beginning of the nineteenth century CE) and the present day. The village of Abri is located on the eastern bank of the Nile, a few kilometres downstream of Sai Island.

From a geological point of view, this segment of the valley presents two main outcropping domains: the Precambrian basement complex, mostly consisting of granitoid rocks together with a series of metamorphic rocks and magmatic intrusive sequences, and the (Cretaceous) Nubian sandstone formation that overlies it, mostly composed of unfossiliferous sandstones, siltstones and shales (Klitzch and Squyres, 1990). Elements related to the lower Precambrian basement complex are identifiable on Sai Island in association with small outcrops of metamorphic rocks (including those termed schist on the geological map in Fig. 1) and pegmatitic quartz veins, which characterise the geological substratum of the island. Schist and quartz are the terms currently used in the archaeological literature for the raw materials used in artefact production (Caneva, 1988; Kobusiewicz, 1996; Marks, 1988; Sacchi, 2013; Usai, 2008; Venditti et al., 2016). The lower Precambrian basement complex crops out extensively on the eastern bank of the Nile (Shang et al., 2010).

The Nubian sandstone formation is visible in the Jebel Adu, an isolated inselberg protruding above the eroded surface of the Precambrian basement. Eroding beds of Pleistocene and Holocene silts and gravel bars from Nile palaeochannels cover most of the island, as well as the riverside of Abri (D'Ercole et al., 2015; Garcea and Hildebrand, 2009; Spataro et al., 2014) (Fig. 1).

Our case study examined the ceramic assemblages from four prehistoric sites, 8-B-10C, 8-B-76, 8-B-10A and 8-B-52A, on Sai Island, and the contemporary ceramic production of a local potter at the nearby village of Abri (Fig. 1).

2.1. The modern workshop in Abri

The village of Abri has around 40,000 residents and consists of a residential area, a market and some cultivated land. The current economy is based on trading, agriculture and pastoralism. Outside the village, near the fields and the river bank, is an active ceramic workshop, which one of the authors (GDE) visited on several occasions to interview the potters.

2.2. The prehistoric sites on Sai Island

Site 8-B-10C is located in the eastern sector of the island, near the modern village of Adu. It lies on a gravel bar above an ancient river terrace formed during the Early Holocene. This settlement was excavated extensively between 2004 and 2011 and represents the Khartoum Variant horizon, which has now been accurately dated. It provided the longest known Khartoum Variant sequence, spanning from 4840–4930 BCE (5995 ± 25 uncal. bp, 6835 ± 45 cal. BP, ISGS-A2736) to 7550–7580 BCE (8505 ± 25 uncal. bp, 9515 ± 15 cal. BP, ISGS-A2745) (Garcea et al., 2016). During the Early Holocene, climatic conditions were relatively wet, with enough seasonal rainfall to support the growth of vegetation even in the interior of the island, which is now totally barren. People lived by hunting, fishing and gathering in sedentary or near-sedentary conditions and produced the earliest documented pottery on the island (Garcea and Hildebrand, 2009).

Site 8-B-76 is located in the south-western part of the island, in the district of Arodin, on the border between the inner pediment and the Holocene fluvial terraces. The ceramic assemblage presented here came from a test excavation in 2008 and belongs to the Abkan horizon, associated with the beginning of food production based on animal husbandry and different manufacturing techniques. This horizon has been redated providing ages between 3715–3895 BCE (5005 ± 25 uncal. bp, 5755 ± 90 cal. BP, ISGS-A2306) and 5465–5485 BCE (6500 ± 20 uncal. bp, 7425 ± 10 cal. BP, ISGS-A2750) (Garcea, 2016; Garcea et al., 2016).

Sites 8-B-52A and 8-B-10A are located in the northern and south-eastern sectors of the island, respectively. Site 8-B-52A was first discovered in 1996 and was extensively excavated and documented in subsequent years (Garcea and Hildebrand, 2009; Geus, 1998, 2004; Hildebrand, 2006-2007). It consists of a large storage area with > 93 pits used as silos for both wild and domestic grains and fruit seeds. 8-B-10A is a habitation site that was excavated between 2008 and 2009. Both sites date to the Pre-Kerma horizon, which has been divided into three phases: Ancient, Middle and Recent (Honegger, 2014). The Pre-Kerma at Kerma has yielded remarkable evidence for the Middle and Recent phases, dating from *c.* 3300 to 2500 BCE (Honegger, 2004, 2006, 2011). The Ancient phase also appears to be evidenced on Sai Island, where it dates from *c.* 3600 BCE (Hildebrand and Schilling, 2016). The subsistence base during the Pre-Kerma was an integrated agro-pastoral economy (Honegger, 2006, 2011, 2014; Hildebrand, 2006–2007).

3. Materials and methods

This study used different sources of data and employed different methods of analysis. The first dataset included the results of petrographic, mineralogical and chemical analyses on the ceramic material from the prehistoric sites on Sai Island and the present-day workshop in Abri. The second dataset comprised technological and cultural information regarding the various steps of the châine opératoire collected orally during interviews with the potters. These two categories are in some ways complementary: the material data (archaeological or ethnographical) are, by definition, tangible and comparatively straightforward, but they often indicate only the final stage of a process. In contrast, the information obtained by observing the modern potters provides the means to document the whole, ongoing manufacturing sequence.

For the study of the ceramic material, both a macroscopic and an archaeometric approach were employed. The archaeometric analyses were conducted on 85 samples, of which 72 were potsherds, 12 were sediments and one was an unfired sample from the workshop in Abri. The potsherds included 22 samples from the Khartoum Variant site 8-B-10C, 19 from the Abkan site 8-B-76, 30 from the two Pre-Kerma sites 8-B52A and 8-B-10A (17 and 13 samples, respectively) and one modern potsherd from the workshop in Abri. The 12 sediment samples were collected from the prehistoric sites: one from site 8-B-10C, six from site 8-B-76 and five from site 8-B-10A (Table 1). The results of the prehistoric ceramic and sediment samples, which have already been published (D'Ercole et al., 2014, 2015), are discussed here for the first time, and compared with the new ethnographic data from Abri.

All the samples underwent optical microscopy (OM), X-ray powder diffraction (XRPD) and X-ray fluorescence (XRF) analyses. Petrographic observations of thin sections were carried out with a Carl Zeiss

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