



Assimilations and Replacements of Early and Middle Holocene Ceramic Productions Across Spatial and Temporal Boundaries in Northern Sudan

Elena A. A. Garcea · Giulia D'Ercole 

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Abstract The inception of ceramic technology in Sudan is a prerogative of early Holocene hunter-gatherers who established their settlements along the Nile Valley and in the surrounding savanna since the mid-ninth millennium BC. These groups were characterized by low mobility with semi-sedentary sites, a few burials within the settlements, or occasionally large cemeteries. The manufacture of pottery, in association with other technological productions (e.g., lithic and bone industries, ground stone tools), became systematic and intensive and is related to increased sedentism and the intensified practice of storing local foods. Growing social complexity also acted as a spur to the emergence of discrete ceramic traditions, which intertwined with different regional identities and local cultural spheres. Starting from the middle Holocene, although with distinct timing and

pathways, the overall climatic, economic, and cultural conditions largely changed throughout Sudan. Pottery was then produced under novel circumstances and possibly by new human populations with different physical, morphological features, and socio-cultural traits. Changes and disappearances of ceramic shapes, techniques, and functions can be symptomatic of external or internal economic, cultural, or social stresses or needs (i.e., cultural interactions or assimilation, availability of raw materials, knowledge and skills of adaptation to the environmental problems in the acquisition of raw material, etc.). These processes of loss and replacement could be either progressive or rapid, as the ceramic productions by early Holocene hunter-gatherers (Khartoum Variant), Neolithic (Abkan) pastoralists, and Late Neolithic (A-Group and Pre-Kerma) agro-pastoralists clearly illustrate.

Archaeological Periods: Khartoum Variant, Abkan, A-Group, Pre-Kerma Country and Region Discussed: Sudan

E. A. A. Garcea
University of Cassino and Southern Latium, Campus
Folcara, Viale dell'Università, 03043 Cassino, Italy
e-mail: e.garcea@unicas.it

G. D'Ercole (✉)
Department of Cultural and Ancient Studies, Ludwig-
Maximilians-Universität, Katharina-von-Bora-Str. 10,
80333 Munich, Germany
e-mail: giuliadercole9@gmail.com; giulia.dercole@aegyp.
fak12.uni-muenchen.de

Résumé L'apparition de la technologie céramique au Soudan est l'apanage des chasseurs-cueilleurs de l'Holocène ancien qui se sont établis le long de la vallée du Nil et dans la savane environnante depuis le milieu du neuvième millénaire avant notre ère. Ces groupes se caractérisaient par une faible mobilité, avec des sites semi-sédentaires, quelques sépultures à l'intérieur des établissements, ou parfois de grands cimetières. La fabrication de poteries, associée à d'autres productions technologiques (industries lithique et osseuse, outils en pierre polie), est devenue systématique et intensive et est liée à l'augmentation de la sédentarité et à l'intensification de la pratique

du stockage des aliments locaux. La complexité sociale croissante a également favorisé l'émergence de traditions céramiques distinctes, qui se sont entremêlées avec différentes identités régionales et sphères culturelles locales. À partir de l'Holocène moyen, bien qu'avec des temps et des trajectoires distinctes, les conditions climatiques, économiques et culturelles générales ont largement changé dans l'ensemble du Soudan. La poterie a alors été produite dans des circonstances nouvelles et peut-être par de nouvelles populations humaines présentant des caractéristiques physiques, morphologiques et socioculturelles différentes. Les changements et les disparitions de formes, de techniques et de fonctions céramiques peuvent être symptomatiques de contraintes ou de besoins économiques, culturels ou sociaux externes ou internes (interactions culturelles ou assimilation, disponibilité des matières premières, connaissances et compétences d'adaptation aux problèmes environnementaux liés à l'acquisition de matières premières, etc.) Ces processus de perte et de remplacement peuvent être progressifs ou rapides, comme l'illustrent clairement les productions céramiques des chasseurs-cueilleurs de l'Holocène ancien (Khartoum Variant), des pasteurs du Néolithique (Abkien) et des agro-pasteurs du Néolithique récent (Groupe A et Pré-Kerma).

Keywords Pottery · Sudan · Hunter-gatherers · Pastoralists · Early-middle Holocene

Introduction

In archaeology, discrete spatial and chronological distributions of associated material products are typically employed to define the geographical and temporal extension of diverse human cultures. Defining the geographical extent of an archaeological culture and its material products is a necessary spatial dimension for understanding historical and social dynamics (see, e.g., Gosselain 2011; Mayor, 2011; Roux, 2019). Still, dispersal areas are often archaeologically bounded within sharp borders, whereas they should be conceived as provisional narrative conventions (Roux, 2012; Tilley, 1994). Sharp and definite borders overlook an essential component of human behavior: the mobility and connectivity between multiple groups with either similar or even significantly

different material expressions (such as, for example, those of interacting herders and farmers).

In addition to geographical extents, artifactual products can also have distinct chronological dimensions. However, just like sharp spatial borders, temporal boundaries in the literature often become incontrovertible assumptions for defining archaeological cultures and assigning finds to one or another culture. These sharp borders can often be abstract and unquestioned perceptions of archaeologists, whereas temporal boundaries, like spatial boundaries, can be blurred, porous, and fluid. Furthermore, functionalist principles inspire the formulations of unilinear models and evoke synchronic evolutionary successions. To offer simplified descriptions of cultural contexts, they tend to exclude connectivity and interaction scenarios with geographical and/or temporal overlaps. Instead, a more factual reading can show that transitions between human cultures, economic systems, and manufacturing techniques do not necessarily follow a straightforward, linear progression. The definition of an archaeological culture suffers from and accentuates the pitfalls of defining discrete cultural identities. Cultural characteristics are initially defined and may even be imposed by external observers (i.e., archaeologists, anthropologists, ethnographers), while internal actors may ignore them, dismiss them, or not consider them relevant.

Among the various classes of artifacts, pottery played a crucial role in crafting and transforming past social and cultural identities (see, e.g., Delvoye et al., 2024). It is, therefore, essential to understand the distinctions, assimilations, and replacements between different stylistic and technological ceramic traditions. According to this view, assimilation includes broader processes than acculturation (i.e., Ennes & Staski, 1996), and replacement, which is not a passive event, involves deliberate choices by those who adopt new behaviors and new symbolic systems.

Concerning the early and middle Holocene archaeology in Sudan, distinct geographic distributions of synchronic and diachronic ceramic traditions have been described as “cultural orbits” (Garcea & Hildebrand, 2009). The concept of orbits implies that the area of dissemination of a cultural tradition, not just its material products, is in constant motion and interaction with other cultures. It considers continuous changes in social networks, cultural landscapes, spheres of interaction, and boundaries of cultural demarcation. Thus,

the geographical (and chronological) scales of orbits can and should be constantly revised and adjusted as research progresses. Although we perceive changes in the geographical and temporal scale of orbits in leaps and bounds, we should always remember that they are continuous and progressive.

This paper reviews approximately 5,000 years of prehistory in northern Sudan, with a particular focus on the Khartoum Variant, Abkan, and Pre-Kerma cultures, along with their associated ceramic traditions. Following the concept of (flexible) cultural orbits, the ceramic productions of Khartoum Variant (early Holocene hunter-gatherers), Abkan (early pastoralists), and A-Group and Pre-Kerma cultural orbits (Late Neolithic agro-pastoralists) provide a compelling illustration of the challenges when delineating clear cultural and material boundaries in the absence of information regarding the precise location of centers and peripheries. This paper also illustrates that fuzzy boundaries can even produce overlaps at both spatial and temporal levels. By examining these cultural interactions, we aim to challenge traditional preconceptions of cultural identity, as well as the rigid frameworks of geographical and/or chronological boundaries that have shaped our understanding of the past. Additionally, we seek to question the dichotomy between central and peripheral regions, offering alternative perspectives on the dynamic, fluid, and interconnected nature of prehistoric societies in northern Sudan.

The Spatial Dimension of Identity: Boundaries, Centers, and Peripheries

Archaeology typically identifies a group with the material culture it produces: *I am the technology I make*. Its identity can also coincide with its economic choices: *I am the economy I produce*, or with its social, symbolic, and cultural sphere: *I am the way I live—and die* (Binford, 1962; Bourdieu, 1977; Hodder, 2012; Murray, 2005; Tilley, 2014).

The concept of “identity” has appeared in the anthropological literature since the late 1920s (e.g., Evans-Pritchard, 1940; Firth, 1936; Malinowski, 1929) and has soon become an extremely attractive key concept widely employed both in the field of cultural anthropology and archaeology (e.g., Hodder, 1986, 1999; Renfrew, 2007). However,

this term, as well as the identity perspective in general, has often been overrated, if not even used in a biased and derogatory way. Overemphasizing identity complies with the principle of conformity and otherness (similar to/different from), which has been at the root of many dangerous narratives of inequality and ethnic confinement (e.g., Remotti, 2019).

In addition, archaeology frequently focuses on the spatial dimension of identity, and a specific field, landscape archaeology, explores past relationships and engagements with place (e.g., Aston, 1997; Fleming, 2006; Layton & Ucko, 2003). The underlying assumption is that places can shape social identity and interaction (Maher, 2019). Similarly, the concepts of “persistent places” and “memory of place” were developed. Persistent places are where people repetitively aggregated, exploited natural resources, and created and reused built features. They fostered the formation of community identities and the development of social interactions (Maher & Conkey, 2019; Olszewski & al-Nahar 2016; Schlanger, 1992). They are part of a shared community-based memory of place, which fosters the entire group’s sense of belonging and identity. Memory of place is a shared community-based physical and mental space where a group develops its sense of belonging and identity. It is a collective condition on which settlement systems are based, involving recurrent reoccupations of the same sites and persistent exploitation of resources in the same places (Maher, 2019; Meskell, 2003; Spagnolo & Garcea, 2023).

When drawing the spatial identity of a cultural group to distinguish it from others, archaeologists typically look at the boundaries of material cultures and, once they presume where a “center” was located (typically eponymous sites), they resort to the dichotomy of “center/periphery” or “core/periphery.” If the concept of identity is based on the principle of similarity/otherness, the center/periphery paradigm is founded on a spatial relationship of asymmetry and hierarchical inequality between two parts (Lightfoot & Martinez, 1995; Mullin, 2011; Parker et al., 2022; Stein, 2002). In geographical terms, the center/periphery perspective can extend from a local to a regional and global scale. Still, regardless of the range considered, the two components are often mistakenly conceived as entities in contrast with each other. The weakest argument of this narrative is that peripheries

may hardly be identified without knowing where the center of diffusion of a given archaeological context was located, which can often be the case in archaeology, especially in prehistory.

The dichotomy center/periphery has been widely used in African and Sudanese archaeology from prehistory until historical times. In historical times, when Sudanese cultures became intertwined with those of their Egyptian neighbors, such discourse fed the theoretical basis of many colonialist narratives. For a long time, Sudanese archaeology turned almost exclusively to studying the so-called central sites (e.g., main settlements along the Nile Valley, large proto-urban sites, and Egyptian colonial temple towns). At the same time, more recently, there are new narratives aimed at also considering the peripheries, including the deserts and frontier regions beyond and between the Nile Valley, with a focus on the more significant cultural diversity and specific encounter dynamics (e.g., Budka, 2020; Manzo, 2017). All in all, in the last few years, the paradigm center/periphery has been primarily revised and overtaken with new definitions such as “contact space” (Stockhammer & Athanassov, 2018) or “textured landscapes” (Sulas & Pikirayi, 2020).

Moving back to the early Holocene hunter-gatherers and middle Holocene pastoralists and agro-pastoralists in northern Sudan and neighboring areas, their ceramic productions offer an exceptional example of the questionable antithesis between centers and peripheries with cases of multiple assimilations and replacements.

The Khartoum Variant Culture: A Fictional “Periphery” of the Early Khartoum of Central Sudan with an Ephemeral “Center” in the Wadi Halfa-Second Cataract Region

The earliest ceramic finds from Sudan date to the local late Arkinian period (8751–8495 and 8634–8352 cal BCE), as indicated at Site 2-R-66, in the Amara West district (Fig. 1) and a few other sites (Garcea, 2020; Garcea et al., 2016). However, these sites yielded rare undecorated pottery, suggesting sporadic productions and/or uses of ceramic containers. Conversely, the successive Khartoum Variant period (c. 8000–4900 cal BCE, Fig. 2a) represents the most emblematic pottery-bearing cultural complex

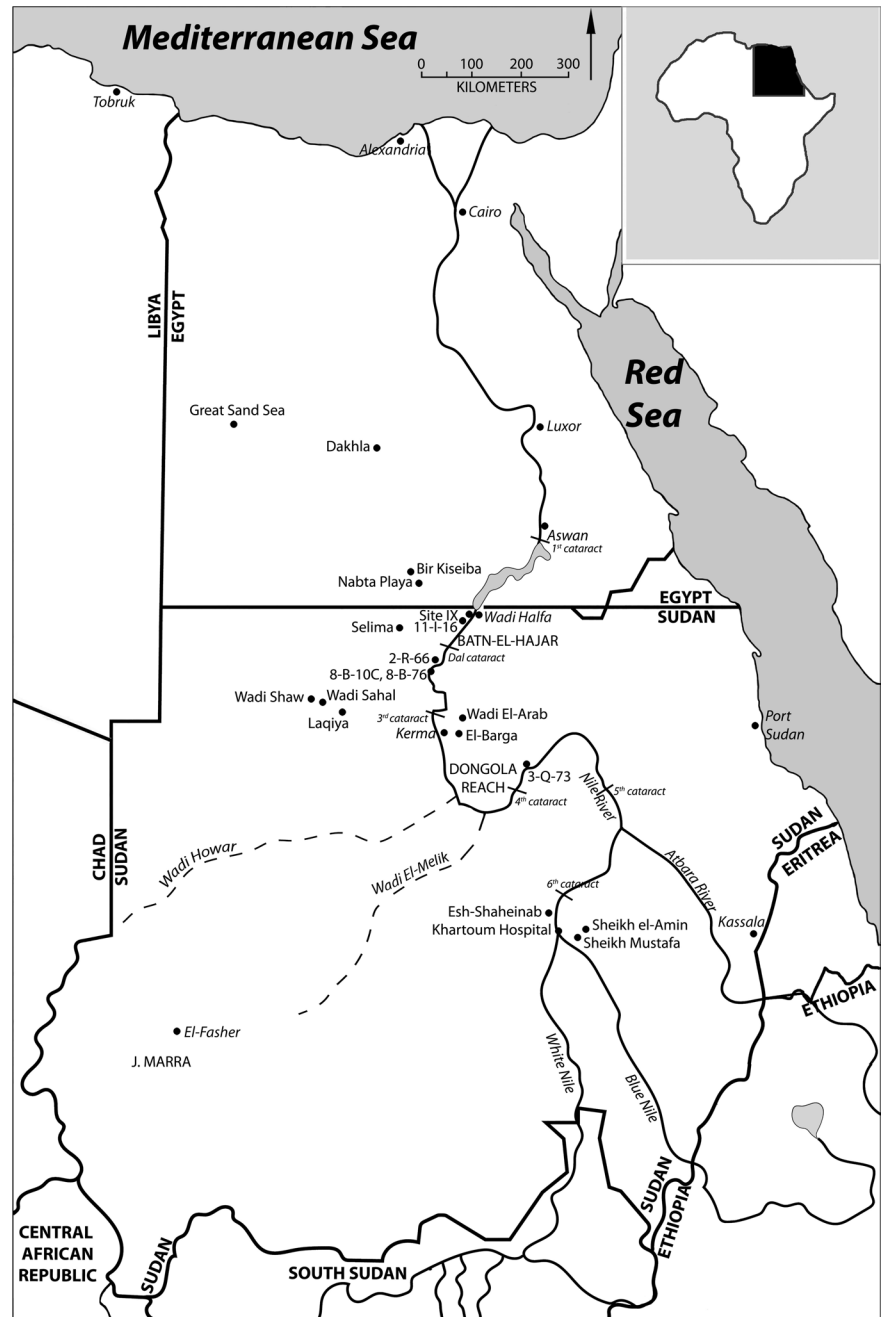
of northern Sudan associated with Holocene hunter-gatherers (Garcea, 2020).

Khartoum Variant populations occupied a vast geographical zone stretching approximately from the Second to the Fourth Cataract of the Nile River and including the western regions of Nabta-Kiseiba and Selima, and possibly the Great Sand Sea and Dakhla Oasis, in the current Eastern Sahara desert (Riemer & Jesse, 2006; see also Garcea & Hildebrand, 2009).

Khartoum Variant hunter-gatherers in northern Sudan were adapted to a drier climate than their Early Khartoum neighbors of central Sudan (c. 8500–5000 cal BCE, Fig. 2a). They lived in an environment with winter rainy seasons and semi-desert vegetation (Garcea, 2020). They developed specific adaptive systems with semi-permanent settlements, exemplified by thick stratigraphic deposits and complex intra-site patterning (e.g., Site 8-B-10C at Sai Island) (Garcea et al., 2016; Spagnolo & Garcea, 2023), as well as more ephemeral and seasonal occupations or workshops intended for specific economic activities, such as most of the sites recognized initially by Myers (1958, 1960), and later by the Combined Prehistoric Expedition (CPE) and the Scandinavian Joint Expedition (SJE) in the Wadi Halfa region (Nordström, 1972; Shiner, 1968b). These seasonal occupations, which were unfortunately submerged after the construction of the Aswan High Dam, were located either a few meters away from the Nile, in the vicinity of the Second Cataract, or out in the desert at a considerable distance from the Nile River (e.g., CPE Sites 626 and 628). It is somewhat paradoxical that these campsites or stopover stations with no or rare domestic structures, no funerary remains, and sometimes, scarce material culture constituted the so-called core of the Khartoum Variant culture, as first defined by Shiner (1968b) as a varying northern development of the original Khartoum culture of central Sudan, and later by Nordström (1972, 10–11) as a “secondary phase of the Khartoum techno-complex.”

To further confuse this picture, we must consider that Shiner’s first assessment of the Khartoum Variant presents many ambiguities regarding the chronology and overall interpretation of the material evidence. He related the Khartoum Variant industry in unison with the (Mesolithic) Early Khartoum and Shaheinab Neolithic (c. 5000–3800 cal BCE, Fig. 2a) of central Sudan. It is then evident that in comparison with the rich list of artifacts recovered by Arkell (1953) at

Fig. 1 Map of the sites mentioned in the text



Esh-Shaheinab, such as amazonite, carnelian, bone beads, stone mace-heads, and polished adzes, the material repertoire of the early Holocene Khartoum Variant culture “appears to be quite impoverished” (Shiner, 1968b, 789).

The other problematic aspect concerns the chronological attribution of the Khartoum Variant with

respect to the following (Neolithic) Abkan complex (c. 5500–3700 cal BCE, Fig. 2a). According to Shiner, the temporal relationship between the Khartoum Variant and the Abkan (see below) cultural orbits was still not entirely clear. Thus, in his report on the eight sites found in the Wadi Halfa-Second Cataract region, Shiner (1968b) lists together lithic

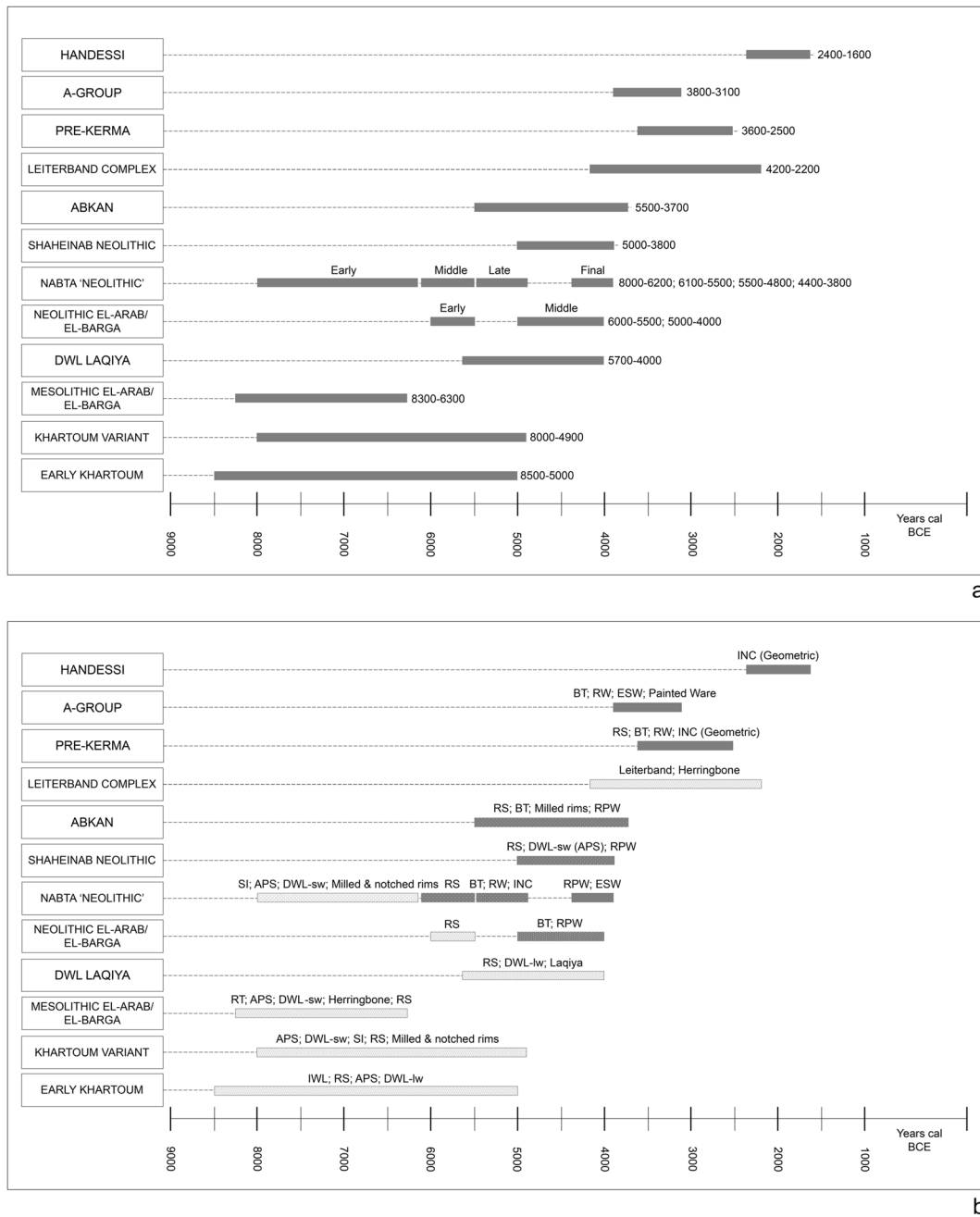


Fig. 2 **a** Chronological extensions of the main archaeological cultures; **b** Comprehensive summary of the main technological and stylistic ceramic features. APS: alternately pivoting stamp; BT: black topped; DWL-sw: dotted wavy line with short waves; DWL-lw: dotted wavy line with long waves; ESW: egg-shell ware; INC: incised ware; IWL: incised wavy line; RS:

rocker stamp; RT: return technique; RPW: ripple ware; RW: red ware; SI: simple impression. White patterns with dark dots: mineral-tempered productions; dark patterns with white dots: combined mineral- and organic-tempered productions; grey patterns: mostly organic-tempered productions

and ceramic finds related to both the Khartoum Variant and Abkan complexes.

Overall, the impression is that Shiner and, after him, Nordström defined the Khartoum Variant of northern Sudan, not so much for the archaeological evidence it embraced *per se*, but for the features that were missing compared to the Khartoum sphere of central Sudan. These techno-stylistic divergences—losses and replacements in the material culture—were explained in terms of geographical distance and harsher environment.

With the progress of research, mainly based on the recognition of techno-stylistic affinities in the ceramic and lithic assemblages (see below), the Khartoum Variant geographical orbit has progressively stretched to incorporate evidence from regions outside its hypothetical center in the Wadi Halfa-Second Cataract area, namely at Sai Island, in the Mahas-Third Cataract region, in the Fourth Cataract, and outside the Nile Valley, in the Egyptian Western Desert (Garcea & Hildebrand, 2009; Garcea, 2020) and in the Atbai region in eastern Sudan (Gatto, 2012; Lanna & Gatto, 2010) (Fig. 3). These areas are typically considered as peripheries of the Khartoum Variant. However, each presents its characteristics, resulting in specific settlement, economic, and social strategies.

The sites in the regions of the Third (Edwards & Osman, 2012; Herbst, 2008) and Fourth Cataracts (Dittrich et al., 2007; Wolf & Nowotnick, 2005) appear to be similar to those in the Second Cataract region, displaying small seasonal occupations or specialized sites (e.g., Site 3-Q-73 in the Fourth Cataract), with no proper structures but clusters of artifacts. By contrast, the Khartoum Variant evidence at Sai (Sites 8-B-10C and 8-B-76) testify to a more complex occupation strategy, being either continuously occupied or reoccupied over several millennia (Garcea, 2020; Garcea et al., 2016). Furthermore, in the region of Kerma, the sites of El-Barga (c. 7800–7000 cal BCE) and Wadi El-Arab (c. 8300–6300 cal BCE) (Fig. 2a), although designated as “Mesolithic” (Honegger & Williams, 2015), yielded ceramic evidence with characteristics akin to the Khartoum Variant cultural orbit (Fig. 2b). These sites present an organization of the settlement space that is different from the sites in the Second Cataract area. They are large and well-structured and consist of remains of domestic structures, such as habitations,

hearths, pits, and funerary remains (Honegger, 2014; Jakob & Honegger, 2017).

Even though geographically distant and not strictly assimilated in terms of cultural traditions besides the presence of Khartoum Variant-related pottery in both areas, the sites of Wadi El-Arab and El-Barga at Kerma find the best comparisons with the Nabta-Kiseiba region (e.g., Site E-75–6), dating to the locally called Early Neolithic period. Also in this area, settlements were occupied repeatedly over time and showed a complex internal articulation with various functional areas for domestic life (Nelson et al., 2002; Schild et al., 1996; see also Garcea, 2020).

Considering this picture as a whole, the original idea of a “center” of the Khartoum Variant culture in the Wadi Halfa-Second Cataract region with offshoots to the south, along the Nile River, and west, in the desert, seems to be rather weak and unconvincing. Indeed, if a center and a periphery of the Khartoum Variant ever existed (perhaps in different terms as initially proposed), these were not in conflict. More fluid and symmetric dynamics of mutual use of a past relatively large and textured cultural and environmental landscape should be envisioned. According to this revised picture, the Khartoum Variant ceramic evidence provides an outstanding contribution.

Khartoum Variant Ceramic Productions Across Spatial Boundaries

Seen from the outside, that is, from the hypothetical center artificially set in the Khartoum area, the Khartoum Variant orbit of northern Sudan differs from that of the Early Khartoum of central Sudan for a consistent set of attributes, which concern the decorative aspect of the ceramic productions (Figs. 2b, 4a–b). They can be summarized in terms of absences and/or variations with respect to the Early Khartoum tradition. Among these, the most emblematic is the lack of incised wavy line decorations and the absence (or low frequency) of impressed dotted wavy line motifs made with large combs (4–8 teeth), resulting in long wavy patterns, which are characteristic of the Early Khartoum sphere (Figs. 2b, 4b.7–11). Conversely, the Khartoum Variant assemblages typically show dotted wavy line impressions produced with small combs (2–4 up to a maximum of 5 teeth) and arranged in zonal patterns of curves (Fig. 4a.6–7, 9–10) or

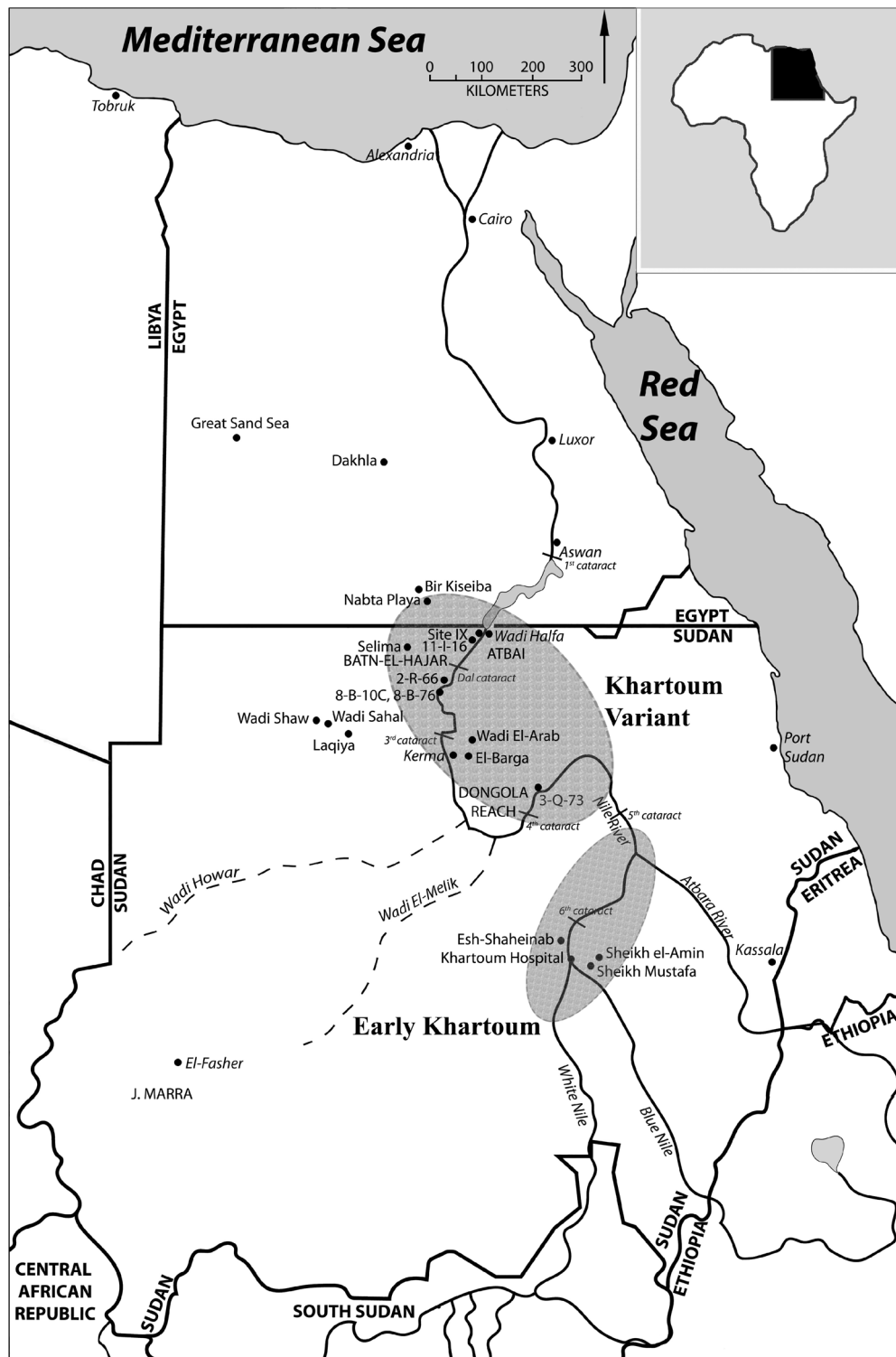


Fig. 3 Map of Early Khartoum and Khartoum Variant cultural orbits

arch-shaped dotted wavy lines (Fig. 4a.1, 8). Two emblematic sites of the Khartoum Variant, 8-B-10C on Sai Island (levels 1, 2, and 3), and Early Khartoum, Saggai (soundings F6 and D4) in the Khartoum region, show relevant differences in the frequencies of the main ceramic categories of the two cultural orbits (Figs. 2b, 5).

The distinctions between the Khartoum Variant and Early Khartoum decorations also concern the conceptual logic behind the structure of the decorations, which are banded instead of continuous on the body of the vessel, as well as the decorative techniques, exemplified by the absence of incised wavy line motifs in the Khartoum Variant. These distinctive features support the evidence that the Khartoum Variant was not just a “periphery” of the Early Khartoum as formerly proposed (Nordström, 1972; Shiner, 1968b) but a distinct culture in itself (Garcea & Hildebrand, 2009; Gatto, 2006a; Jesse, 2002). On the other hand, other parameters regarding raw material procurement (mainly use of local clays and tempers related to granite and granitoid outcrops, i.e., the suite of the Precambrian Basement Complex), paste preparation (mostly mineral-tempered pastes containing quartz, mica, and alkali feldspar inclusions), manufacturing technology (coiling or a combination of paddling and coiling), surface treatment (mostly smoothing or self-slipping, rarely burnishing), and firing (low firing, mainly in open-air oxidizing conditions) are similar in the Khartoum Variant and the Early Khartoum assemblages (for a summary, see Fig. 2b and D’Ercole, 2021).

At a generic level, the Khartoum Variant ceramic tradition might give the impression that it was relatively homogeneous and standardized. However, upon closer observation, it appears that the significant contraposition between the Khartoum Variant and the Early Khartoum spheres obscured the Khartoum Variant’s internal variability. Gatto (2006a) published a revision of the typology of the pottery corpus recovered by the CPE from the Khartoum Variant sites in the Wadi Halfa-Second Cataract region. In her work, she described the different attributes, fabrics, surface treatments, and decorations of over 2000 sherds and compared them with the ceramic production from Nabta Playa, mainly established upon the assemblage from the Early Neolithic Site E-91–1 (Gatto, 2002). The results are pretty striking. Although a number of decorative types overlap, being present in

both contexts, other decorations appear to be exclusive to one or the other context. For example, one of the observations that catches the eye is the variety of decorative motifs obtained with the alternately pivoting stamp (APS) technique recorded at the CPE sites (over nine variations) compared with only one type (A1) recognized at Nabta Playa (Gatto, 2002, 69; Gatto, 2006a, 60). Similarly, Gatto reports on a more frequent and diversified use of the simple impression (SI) technique at the Nile Valley sites compared to those in the desert at Nabta Playa. However, it should be noted that both the alternately pivoting stamp and the simple impression techniques were mainly used to make rim-band decorations at all these sites. Therefore, their higher frequency in the Wadi Halfa-Second Cataract ceramics than in those from Site E-91–1 at Nabta Playa may result from a greater occurrence (or selection?) of rims in the former than in the latter assemblage. Furthermore, Gatto (2006a) interpreted the distribution of specific decorative patterns and ware groups within the El Nabta and Abka (Site IX) sequences as time-sensitive. She also attributed the absence of specific ceramic wares in the desert to climatic reasons, as the desert may have been possibly abandoned during the dry seasons, unlike the sites in the Nile Valley.

Moving south along the Nile, the Khartoum Variant ceramic production in the insular context of Sai presents a more restricted repertoire of decorative motifs. Here, the assemblage from Level 1 at Site 8-B10C shows that the rocker stamp technique was mainly applied to make packed zigzags of dots or dashes and, to a lesser extent, the typical (banded) impressions of small dotted wavy lines (Fig. 5). The simple impression and especially the alternately pivoting stamp techniques are otherwise rarely recorded. However, the alternately pivoting stamp was one of the first techniques in the assemblage from level 2 (c. 7600–7200 cal BCE) at the same site (D’Ercole, 2017; Garcea & Hildebrand, 2009).

In the region of Kerma, during the local Mesolithic II phase (c. 7800–7200 cal BCE), the sites of El-Barga and Wadi El-Arab yielded ceramics decorated mainly with the alternately pivoting stamp technique, exhibiting similarities with contemporary Khartoum Variant sites in the Second and Third Cataracts, Sai Island (Level 2 at 8-B-76), and the Nubian desert (Fig. 2b). Conversely, during the Mesolithic III phase (c. 7200–6300 cal BCE),

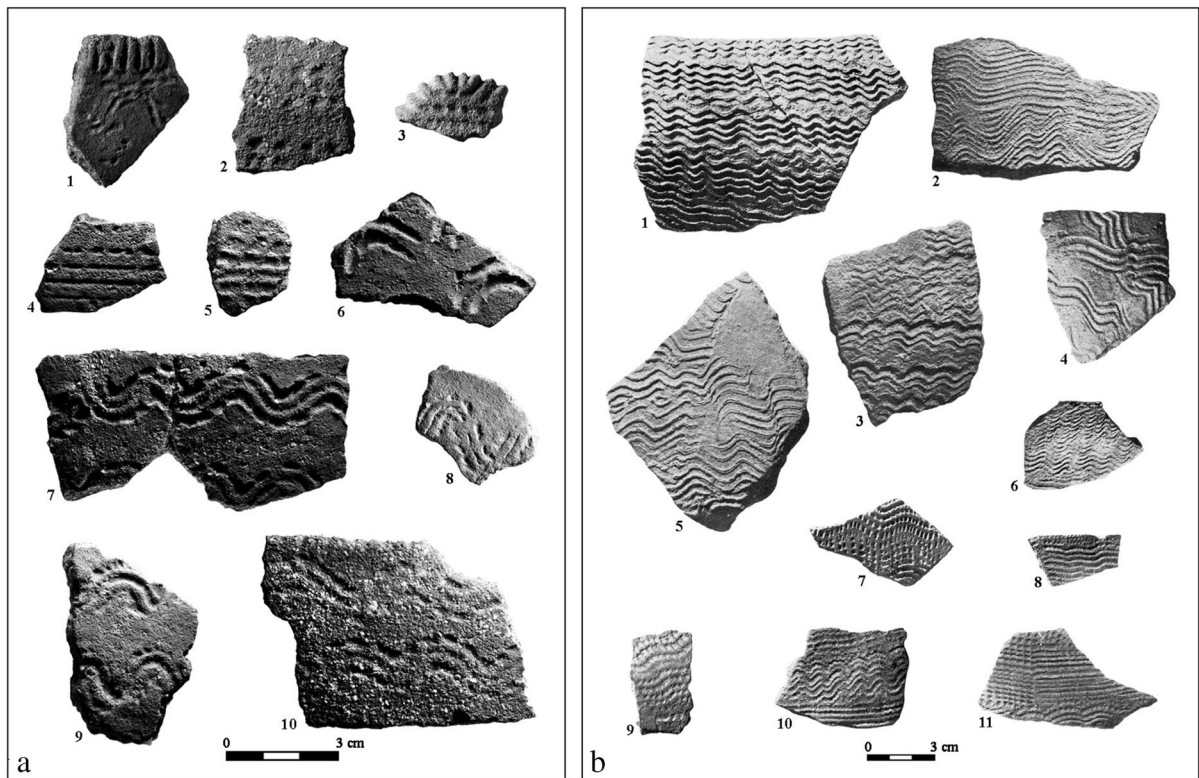


Fig. 4 a. Khartoum Variant dotted wavy line and zigzag pottery (from Garcea & Hildebrand, 2009, Fig. 4, with permission from Elsevier); b. Early Khartoum wavy line and dotted wavy line pottery (modified from Caneva, 1983, Figs. 9 and 15, with permission)

	Rocker zigzags	Dotted Wavy Lines	APS	Incision/Single lines	Incision/Wavy Lines	Simple impressions	Undecorated	Total
Sai Island - Site 8-B-10C	160	24	2	1	0	15	676	878
Saggai - F6 + D4	2064	26	217	0	1430	0	784	4521

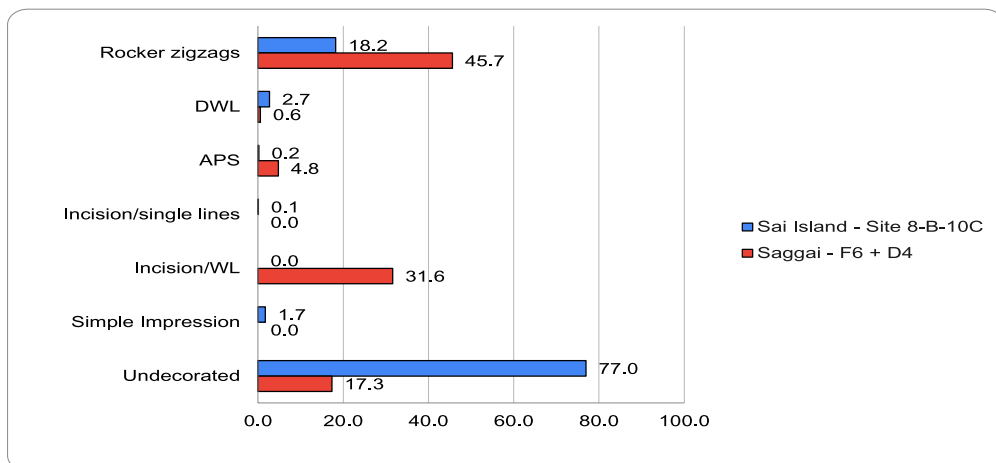


Fig. 5 Frequencies of main categories of Khartoum Variant pottery at Sai Island – Site 8-B-10C (from D'Ercole, 2017) and Early Khartoum pottery at Saggai (from Caneva, 1983)

herringbone and dotted wavy line patterns prevail, suggesting significant affinities with the region of Nabta-Playa (El-Nabta phase) (Honegger, 2014).

Differences in the ceramic decorative features could mirror a chronological significance. However, stylistic variations could also suggest a certain fluidity and a pervious circulation of diverse groups within the same cultural orbit. In terms of decorative choices, the insular context of Sai, although recurrently occupied, possibly represents the most monotonous panorama. This might depend on the physical limits of the local environment, which would have prevented the simultaneous presence of different groups. Conversely, the sites in the Wadi Halfa-Second Cataract region display the widest variety of decorative motifs and wares. Considering that these sites were seemingly encounter places of different groups, rather than members of a center/periphery system, their occupants were allied to the Khartoum Variant cultural orbit but moved back and forth from the Nile Valley to the desert, developing their own stylistic expressions.

Generally speaking, one must consider another variable that may hinder a full assessment of the potential variability within the same cultural orbits: archaeologists' selection criteria of the material collections. It should be considered that most early collections consist of selected samples (rims and decorated sherds). The methodological differences in how ceramic assemblages are collected and studied do not always allow for observing the internal variability of technological and morphological parameters in detail. Information on raw material acquisition, paste preparation, and use of the vessels are only available from a few contexts, while emphasis has been typically given to describing decorative parameters.

All in all, any analysis of decorative motifs should be an integral part of a comprehensive approach to the entire production sequence, including the production technology, use, and function of the vessels. Functional studies on organic residues in ceramic vessels from Sudan have been successfully initiated (D'Ercole et al., 2024; Dunne et al., 2018, 2021, 2022; Garcea et al., 2020; Valancius et al., 2024) but currently cover only a limited part of the country and should be continued. Only in this way can a rigorous interpretation of the economic and cultural relationships between the different Khartoum Variant cultural groups be elucidated.

The Abkan Culture: Expanding Boundaries of Plural Centers and Multiple Peripheries

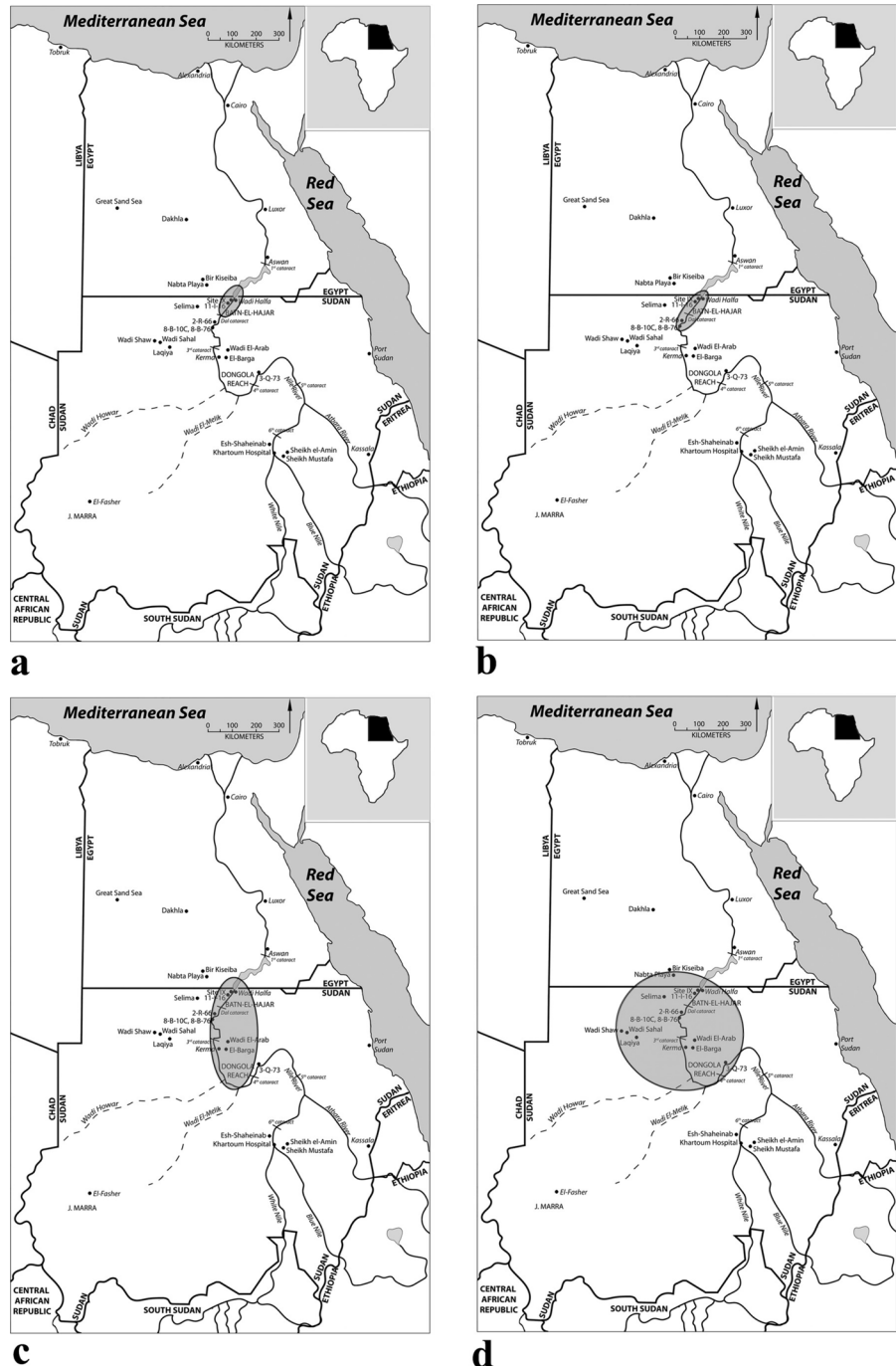
As mentioned above, eponymous sites, or those from the oldest excavations, are often artificially and implicitly placed in the center of hypothetical distribution areas. This is the case, for example, of the *Abkan*, the pastoral Neolithic period in northern Sudan, which developed between 5500 and 3700 cal BCE (Garcea, 2020) (Fig. 2a). Site IX is the eponymous site of the Abkan, which was located near the village of Abka in the Second Nile Cataract, 20 km south of Wadi Halfa in southern Lower Nubia. This site was excavated in 1948 and re-excavated in 1957 (Myers, 1958, 1960). Seven other sites in the Second Cataract area were assigned to the Abkan culture between 1962 and 1966, before the area was inundated following the construction of the High Aswan Dam (Shiner, 1968a). These first Abkan sites were found along both banks of the Nile, quite close to the river (Fig. 6a).

Besides Lower Nubia, further research expanded the Abkan geographical extent southward into northern Upper Nubia, in the Batn-El-Hajar (Carlson, 1966) and Sai Island (Fig. 6b) (Garcea 2006–2007; Geus, 2002). Additional Abkan finds were recognized further south in the Dongola Reach, 350 km south of the Second Cataract (Fig. 6c) (Gatto, 2002). Here, several ceramic and lithic technological features of the locally called *Karat Group* likened this technocomplex to the Abkan in the Second Cataract (Marks & Ferring, 1971). Prominent among them are a prevalence of undecorated pottery, lunates produced from good quality raw materials (chert and agate), miniature polished axes, and small, unifacially flaked, and unpolished gouges made on Nile pebble (Marks & Ferring, 1971).

Climatic conditions may have been a common denominator for the spread of the Abkan in the north but were not a necessary condition for the expansion of Abkan traditions in the Dongola Reach. While the Second Cataract, the Batn-El-Hajar, and Sai Island occasionally receive winter rains and are not affected by summer monsoons, the Dongola Reach is south of the Intertropical Convergence Zone (ITCZ), bringing summer monsoons (Williams, 2019). Furthermore, research in the Eastern Sahara showed that the Abkan cultural orbit was not only confined to the Nile Valley of Lower and Upper

Fig. 6 Maps of the expanding Abkan cultural orbit.

a Abkan sites in Lower Nubia; **b** Abkan sites in Lower and northern Upper Nubia; **c** Abkan sites in Lower and Upper Nubia; **d** Abkan sites in Nubia and Eastern Sahara



Nubia but extended as far as the savanna areas west of the Nile Valley in southwestern Egypt and northwestern Sudan (Fig. 6d). In the Egyptian Western Desert, support for Abkan affinities comes from the Nabta-Kiseiba area, which has been included in the Nubian cultural tradition (Gatto, 2002).

Furthermore, research in the Lakiya region (Wadi Shaw and Wadi Sahal) in northwestern Sudan identified a number of technological features, including comparable ceramic fabrics, decorative techniques, surface treatments, raw material selection for stone industries, composition of the toolkits (with a

prevalence of borers and groovers), settlement patterns, and economic organization, which advocate clear connections between the Abkan and the Eastern Sahara during the 5th millennium BCE (Lange & Nordström, 2006) (Figs. 2a, b).

Regarding Abkan connections with the Eastern Sahara, the authors of these finds, Lange and Nordström (2006), preferred a parsimonious classification to a general “Early Nubian-related group” or “Abkan culture group” instead of assigning them to the Abkan culture. This consideration brings us back to the dichotomy between centers and peripheries. Was Site IX at Abka the center and the other regions, where comparable archaeological materials were found, peripheries? There is no evidence to prove this. All we know of the now-flooded Site IX is that it was a multiple pothole about 15 m across with a series of rock drawings (Myers, 1958). Generally speaking, the geographical distribution of Abkan sites, north and south of the ITCZ and nearby and far away from the Nile Valley, shows that the people who occupied them had developed a flexible adaptation pattern. They utilized food resources from different climatic and environmental conditions and relied on an alternation between the resources of the Nile Valley and those of the savanna.

A final consideration regarding Abkan sites is that their settlement system involved functionally differentiated sites. Northern Upper Nubia provides the most comprehensive, currently available evidence in this respect. While specific sites were temporary campsites used on a repetitive basis, such as 5-S-25 on Shagrir Island (Nordström, 2014) and Site 1001 (Shiner, 1968a), others were prolonged occupations by low-mobility herders, such as 8-B-76 and 8-B-81 on Sai Island (Garcea, 2020). Within this settlement system, the Nile Valley was more intensively occupied as the density of sites and their functional variability document. The lack of comprehensive documentation on Site IX at Abka does not allow us to assess whether this site was a temporary camp or a prolonged occupation. At any rate, instead of looking for a single center and many peripheries, it seems that Lower Nubia and northern Upper Nubia must have played a central role, while the sites in the savanna and the Nile Valley further south had a more peripheral, but still functional and complementary role in the Abkan settlement system.

Abkan Ceramics Across Spatial Boundaries

Contrary to its original interpretation (Shiner, 1968b), Abkan pottery, from the very beginning of its appearance, displays entirely novel and different technological, morphological, and typological characteristics compared to the Khartoum Variant tradition, and any form of assimilation between the two ceramic traditions can be most likely excluded (D’Ercole, 2017, 2021; and see below). Abkan ceramics were usually made with silty alluvial clay, typically showing a dark or greyish-brown groundmass and containing abundant inclusions of silt, fine sand-sized quartz, and feldspar. Organic tempers (carbon particles and possibly herbivore dung) appear for the first time (D’Ercole, 2017) (Fig. 2b). Because the groundmass of these ceramics is usually very soft and dusky in color, Nordström (1972, 49) suggested that they were fired in a weakly oxidizing and smoky atmosphere and that firing was probably shorter in comparison with the Khartoum Variant fabrics. Vessel morphologies mainly consist of small bowls and straight-walled jars with thinner walls than the Khartoum Variant types. Surfaces were often burnished inside and outside the vessel and occasionally polished (e.g., D’Ercole, 2017; Garcea & Hildebrand, 2009; Nordström, 1972).

Abkan pottery is mostly undecorated (Fig. 7a.1–4) and can be black-topped (Fig. 7a.1–3) or rippled (Fig. 7a.5). It presents a highly repetitive decorative repertoire, essentially restricted to the use of the rocker stamp technique producing plain zigzags or zigzags of dots, as well as a few decorations made with the alternately pivoting stamp and with the simple impression techniques (Fig. 2b). However, most decorations are only located on the rim of the vessels (Garcea, 2020).

Within the CPE and SJE areas of concession in the Wadi Halfa-Second Cataract region, Shiner and Nordström report on small amounts of Abkan pottery (often appearing as sherds from a single vessel), frequently in combination with either Khartoum Variant or A-Group types. Only Sites SJE 365, 369, and 429 at Abka show pottery assemblages where the Abkan tradition (Fabric IC) is fully predominant (Nordström, 1972, 50).

Still in the Second Cataract area, in the district of Murshid, approximately 150 sherds made with Nile silt were found at Site 11-I-16, at the village

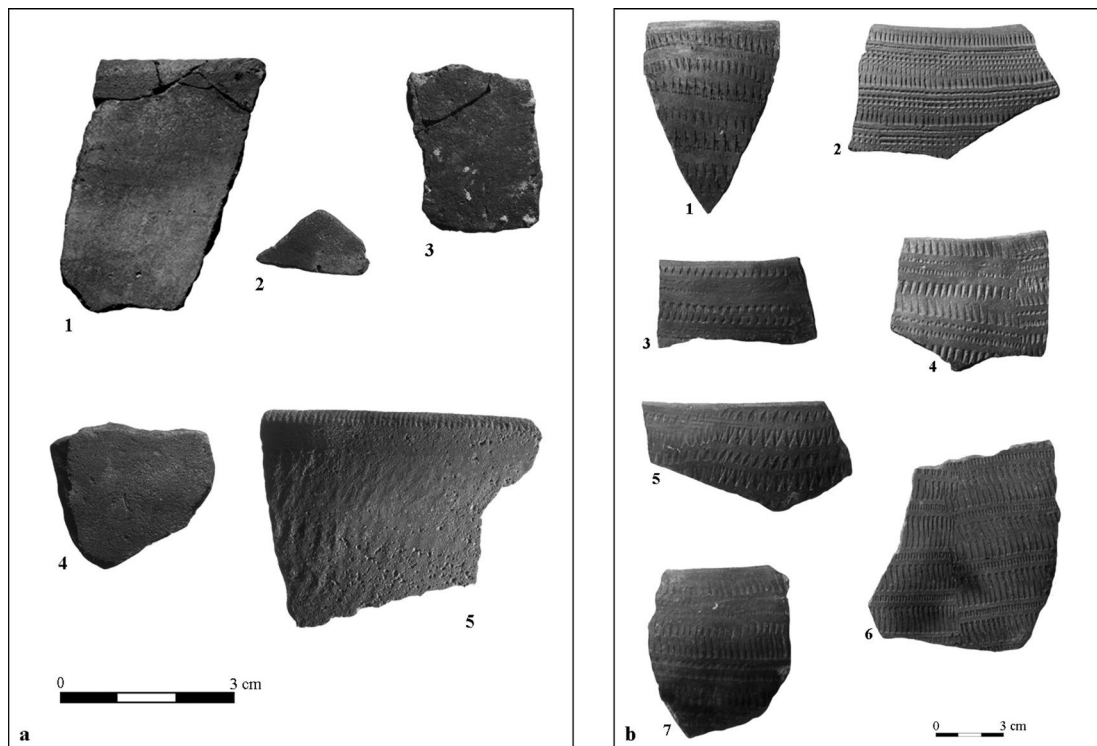


Fig. 7 **a** Abkan pottery (from Garcea, 2020, Fig. 6.1, with permission from Springer Nature); **b** Esh-Shaheinab pottery (from Garcea, 2020, Fig. 6.4, with permission from Springer Nature)

of Karagán. They refer to large and small shallow bowls, carinated bowls, and neckless jars, mostly with plain, smoothed brown surfaces. They rarely display brushed, red-slipped, polished, rippled, and occasionally decorated surfaces (Carlson, 1966).

At Sai Island, typical Abkan ceramics were found in small amounts (<50 sherds) at Site 8-B-76 (D'Ercole, 2017; Garcea & Hildebrand, 2009), and a few came from 8-B-81. South of Sai Island, in the region of Kerma, the first evidence of burnished pottery decorated with the rocker stamp technique comes from the cemetery of El-Barga and dates to the local Middle Neolithic phase (Figs. 2a, b). Otherwise, the first red and black-topped ware and the ripple technique, comparable with Abkan types, appeared in the region from approximately 5000 cal BCE (Honegger, 2014).

North of Sai, at Nabta Playa, the pottery from the Al Jerar phase still presents some techno-stylistic affinities with the assemblage of the earlier El Nabta phase, described above. However, during the second phase of the local Middle Neolithic (c. 5500 cal

BCE), it changed in terms of paste recipes (porous grey to dark pastes tempered with organic inclusions), surface treatments (mainly smoothed surfaces), and decorations (no more rocker impressed motifs but mainly undecorated surfaces) (Nelson et al. 2002) (Fig. 2b). The same trend can be recognized in the ceramic traditions of the region of Laqiya (Lange, 2006–2007; for a summary, see D'Ercole, 2017).

Overall, the Abkan ceramic production appears much more monotonous and scant than the Khartoum Variant assemblages. The impoverishment of decorative techniques and motifs, which are now mainly limited to the use of the rocker stamp impression for making plain or dotted zigzags, is striking. This evidence is even more remarkable if we consider the large variety of decorative types recognized in the contemporary Shaheinab Neolithic (c. 5000–3800 cal BCE, Fig. 2a) ceramic assemblages in central Sudan (see for example, Fig. 7b) (for more details, see D'Ercole et al., 2024; Garcea, 2020). Interestingly, the upper portion of the vessel seems to acquire greater importance, as seen in the impressed decorations on

most Abkan rims and especially in the widespread use of the black-topped ware. This could reasonably reflect not just a new aesthetic trend but also new social traditions and uses of the vessels. Information on the original function of the vessels and what commodities may have been processed came from organic residue analysis of the Esh-Shaheinab pottery (D'Ercole et al., 2024), while the same analysis of the Abkan pottery is under study. The vessels from Esh-Shaheinab were mainly used for processing ruminant carcass products or mixtures of ruminant and non-ruminant products. Ruminant products only partly originated from cattle and ovicaprids, whereas most came from wild fauna. Residues of non-ruminants also came from wild animals, such as turtle, Nile monitor lizard, crocodile, hare, or warthog. Plant lipid biomarkers are absent at Esh-Shaheinab, suggesting that ceramic vessels were basically used for meat processing.

As the Abkan ceramic tradition appears relatively homogeneous and markedly different from the Khartoum Variant, Early Khartoum, and Shaheinab Neolithic productions, technological and/or stylistic differences, boundaries between the various Abkan sites, and hypothetical centers and peripheries are even more challenging to trace based on the sole material evidence.

The A-Group and Pre-Kerma Cultures: The Quintessence of Intersecting Boundaries

The geographical distribution of the Neolithic cultures in Sudan shows that they occupy distinct and discrete areas (Garcea, 2020). If, on the other hand, we look at the geographical distribution of the succeeding *A-Group* and *Pre-Kerma* periods, the picture is different (Fig. 8).

The A-Group culture (c. 3800–3100 cal BCE, Fig. 2a) is mainly known for its rich cemeteries in Lower Nubia and northern Upper Nubia (for an updated overview, see Gatto, 2021). A-Group populations were trading herders and were strategically established to act as intermediaries between northern and southern communities. Their trading activities grew in response to the increasing demand of the Egyptian Naqada elites for gold, copper, ivory, semi-precious stones (amazonite, malachite, carnelian), exotic animals, cattle, and incense in exchange

for olive oil, beer, wine, and cereals from the Mediterranean Basin. This period was divided into distinct phases. The Early A-Group was contemporary with the final Abkan. It consists of a limited number of cemeteries concentrated around the First Cataract in the northernmost part of Lower Nubia. The Middle A-Group still incorporated Abkan elements and expanded westward in the Laqiya region (Wadi Shaw and Wadi Sahal), where A-Group elements occurred in habitation sites instead of cemeteries (Lange, 2003, 2006–2007). Not only considerable amounts of A-Group ceramic vessels were found in the Laqiya region, but also other characteristic A-Group items, including stone palettes and a copper awl. Considering the increasingly drier environmental conditions in the Laqiya region, it has been suggested that A-Group herders visited the savanna during, or shortly after, the rainy seasons to find pastureland that might not have been available in the Nile Valley (Lange, 2006). Being highly mobile, A-Group herders made their major investments in cemeteries rather than settlements, as the frequency of A-Group cemeteries and scarcity of settlements demonstrate (see, e.g., Garcea, 2020; Gatto, 2021; Nordström, 2004, 2006–2007; Stevenson, 2012). The funerary offerings, particularly those from the cemeteries of the Nile Valley, demonstrated that the first elites emerged in the Middle A-Group. The wealth of grave goods continued to increase until the Terminal A-Group (Nordström, 1972, 2004, 2006–2007, 2014). The ceramic assemblage consists of local and imported vessels (Fig. 9a). The local pottery includes ash- and dung-tempered, black-topped, red-and-black rippled, and rocker stamped wares (Gatto, 2006b; Nordström, 1972). In addition, red-polished plain types and thin-walled eggshell ware are typical A-Group types. During the Final A-Group, the ripple ware was replaced by red-painted geometric motifs (Fig. 2b). Imported vessels include storage jars of Egyptian origin (Takamiya, 2004).

The Pre-Kerma culture (c. 3600–2500 cal BCE, Fig. 2a) was first identified in a large settlement (5–10 hectares) below a cemetery of the Kerma kingdom and therefore defined as Pre-Kerma (Bonnet, 1992). Unlike the A-Group, which is represented in cemeteries, this culture is mainly known for its settlements and underground storage facilities (see, e.g., Garcea & Hildebrand, 2009; Geus, 2004; Hildebrand & Schilling, 2016; Honegger,

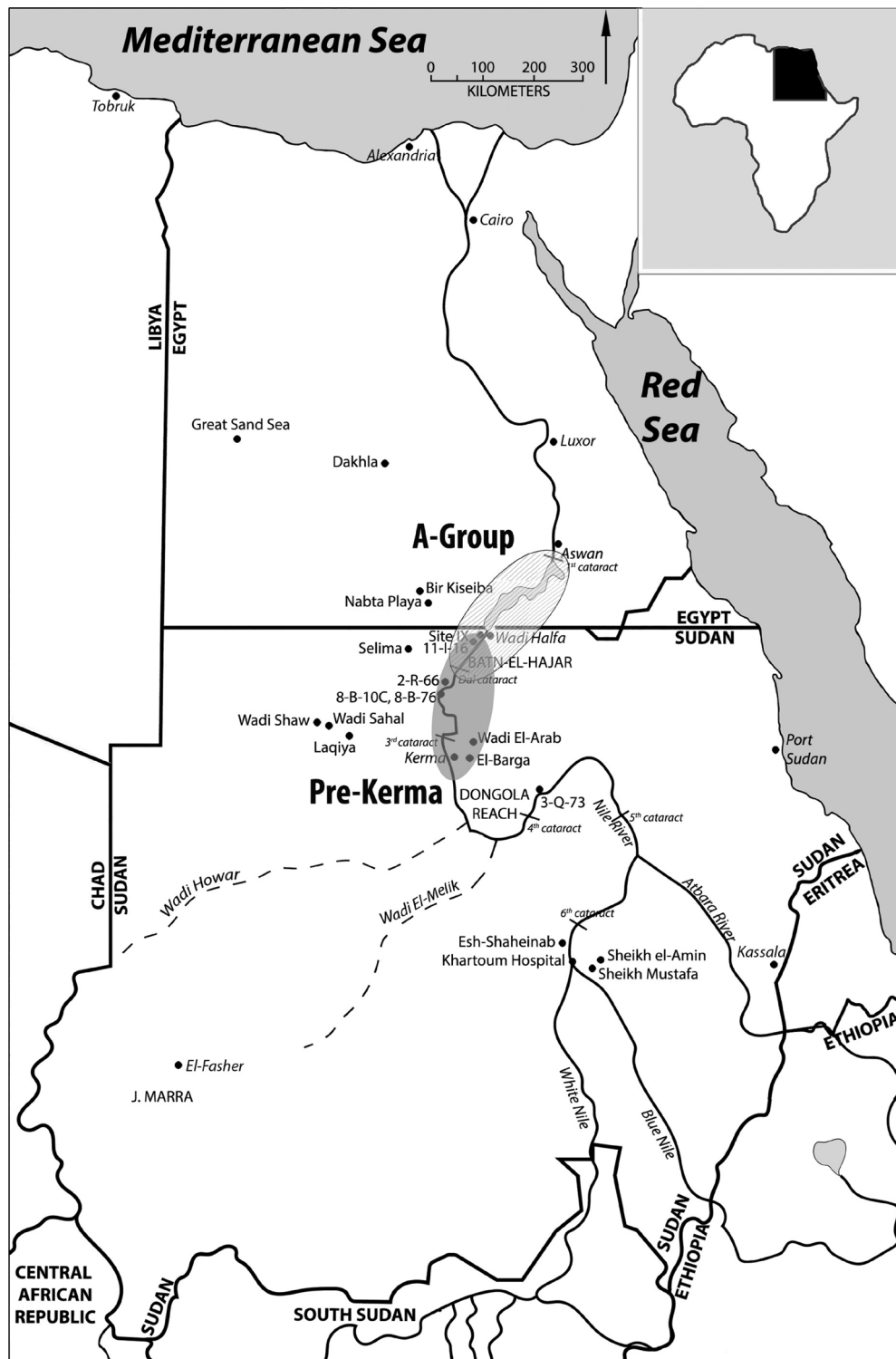


Fig. 8 Map of A-Group and Pre-Kerma cultural orbits

2006, 2014, 2019). Chronologically, the Pre-Kerma partly overlaps the A-Group period but lasts longer and represents a retreat for the Egyptian communities who abandoned Lower Nubia when A-Group populations surrendered to Egypt's royal power and mixed with local Upper Nubian populations. Evidence of trade of A-Group artifacts, namely beads and fine bowls and vessels, was recorded at Pre-Kerma sites, including Sai Island (Garcea & Hildebrand, 2009; Geus, 2004; Gratien, 1986). The Pre-Kerma pottery is also dung-tempered as well as vegetal-tempered (Fig. 2b). From a petrographical and chemical point of view, it is still quite similar to Abkan productions, suggesting unchanged manufacturing processes since Neolithic times (D'Ercole et al., 2017a, b). It consists of coarse and fine wares (Honegger, 2004). Coarse wares are often decorated with herringbone and geometric motifs, as well as dotted and plain rocker zigzags (Fig. 9b). Fine wares are typically red-burnished and black-topped.

The presence of A-Group pottery at Pre-Kerma sites shows that the geographical ranges of these two cultures intersected. This is particularly evident during the Middle Pre-Kerma phase (c. 3000 cal BCE) when it clearly overlapped with the final stages of development of the A-Group culture. During this period, the ceramic assemblages exhibit the largest number of similarities in stylistic choices and surface treatments. These include black-topped and ripple wares, both of which are a legacy of the Abkan tradition. It has even been proposed that the Middle Pre-Kerma and A-Group were not merely contemporary but constituted an integral part of the same cultural orbit (Gatto, 2021). On the other hand, the geometric, criss-cross, and herringbone decorative structures, which are typical of the Late Pre-Kerma phase (c. 2700–2600 cal BCE), as exemplified at Boucharia II, near Kerma (Honegger, 2014: 23, Plate 1), as well as in certain ceramic types from 8-B-52A and 8-B-10A at Sai Island (D'Ercole, 2017, 88, Plate 3.17, 90, Plate 3.19), and the Mahas region (Edwards & Osman, 1993, 29, Plate XIV), are markedly distinct from those of the A-Group ceramic assemblages. These latter productions suggest that beginning from this time, the Pre-Kerma culture was a distinct and separate entity from the A-Group orbit (Gatto, 2021), encompassing the fundamental stylistic characteristics of the emerging Kerma culture.

Not Only Spatial Borders: Assimilation and Replacement Across Temporal Boundaries

Fuzzy boundaries and sharp borders do not only regard spatial dimensions of archaeological material cultures but also concern temporal boundaries, which are not necessarily sharp and clear-cut. Sai in northern Sudan provides an exemplary case of chronological and cultural overlapping within the restricted space of a small island. Here, the Abkan occupational phase at Site 8-B-76, beginning in the second half of the sixth millennium BCE (5515–5382 cal BCE), overlaps for several centuries with the late Khartoum Variant phase at Site 8-B-10C, dating to the end of the sixth/beginning of the fifth millennium BCE (5030–4880 cal BCE, Fig. 2a) (Garcea, 2020; Garcea et al., 2016). The coexistence of hunting-gathering and herding groups was also reported elsewhere in northern Sudan. At Site 2016, between Abka and Wadi Khor Musa in the Wadi Halfa region, Shiner (1968b, 778) had reported on the presence of Khartoum Variant pottery associated with the Abkan industry to “believe that the Khartoum Variant and the Abkan industry were contemporaneous and in, at least, occasional contacts.” While this statement seems plausible in light of the recent evidence from Sai Island, it is possible that Shiner (1968b) confused or misinterpreted the assemblages from the two cultural complexes.

The sites at Sai Island and those in the Wadi Halfa region are not isolated cases. Comparable instances occur in other parts of the country (Garcea, 2016; Vella Gregory & Brass, 2021), as well as in the Sahara. For example, in central Sudan, the Neolithic site of Sheikh El-Amin, on the Blue Nile Valley, was occupied during the second half of the fifth millennium BCE (4519–4270 cal BCE) and chronologically overlapped with the late Mesolithic phase at the nearby site of Sheikh Mustafa (4503–4237 cal BCE) (Fernandez et al., 2003a, b). In the Sahara, an extensive comparative analysis of zooarchaeological remains, organic residue analysis from pottery, and palaeohydrological mapping demonstrated that the shift to animal herding was sporadic and gradual and spread within fragmented, mosaic-like habitats (Manning et al., 2023; see also di Lernia, 2013, 2022). All these sites demonstrate that the inception of new cultural and economic traditions does not always replace previous ones everywhere and may occur before these traditions end, even within restricted areas.

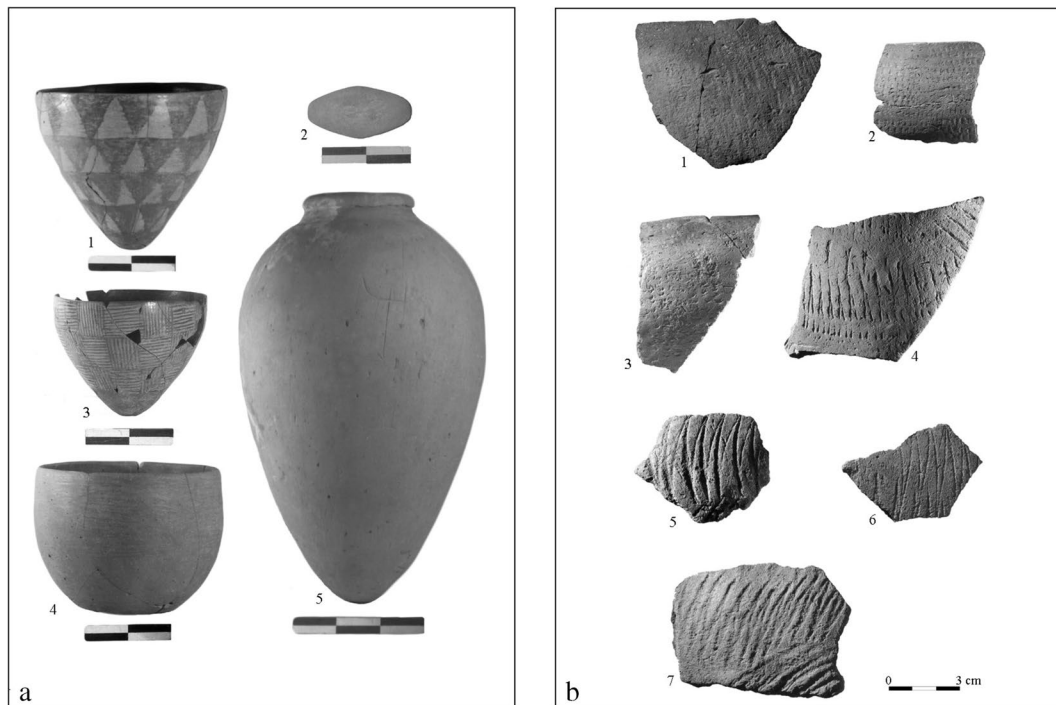


Fig. 9 **a** A-Group pottery (From <https://oldnubia.com/a-group-sites>); **b** Pre-Kerma pottery (from Garcea, 2020, Fig. 7.5, with permission from Springer Nature)

The circumstances depicted at Site 8-B-76 on Sai Island with different cultural groups—namely Khartoum Variant and Abkan—living temporarily in close geographical proximity but using different stylistic traditions and techniques for making their ceramic containers, evoke a scenario of technological polarization rather than social interaction, being “the main consequence of technological polarization the failure of technical traits to spread between technologically marked groups” (Roux et al., 2017, 321). Although at Sai Island (and possibly also elsewhere), the Khartoum Variant and Abkan people overlapped for a certain period, living close to each other and sharing the same landscape and the spatial dimension of identity/memory of place, they maintained very different cultural, economic, and social identities with the persistence of clear-cut technological boundaries (i.e., ceramic manufacturing) between the two groups. When the stint of the Khartoum Variant faded on the island and the Abkan culture overcame, Abkan people did not absorb any technological or stylistic traits from the previous cultural sphere. On the contrary, they rejected every stylistic and technological

tradition of the Khartoum Variant tradition. This scenario, with the lack of any learning network and transmission process of the technological knowledge from the Khartoum Variant to the Abkan cultural units, suggests a break in a pattern of phylogenetic continuity and a likely replacement of population (e.g., D’Ercole, 2017, 172; Roux & Courty, 2013).

There are potentially complex and multiple reasons that could explain the failure of knowledge transmission and population replacement. Firstly, it is possible that effective communication between Khartoum Variant and Abkan groups was missing, as well as that they had a different awareness of the local landscape and naturally available resources. This may have influenced the “relative perception” (sensu Roux et al., 2017) of the technological qualities of the raw materials and the traditional instances of paste preparation and pottery production. Khartoum Variant and Abkan ceramics were technologically and stylistically fundamentally different, as were their economic targets and functional purposes. Therefore, the same landscape could have been perceived differently because the two groups used it differently.

Concluding Remarks

Archaeology and cultural anthropology share the obsession of abstractly and arbitrarily encasing the behavior of human groups in rigid and fixed identity cages, in which those who belong to them do not always recognize themselves. Accordingly, human cultures are often rigidly defined as organized systems of distinct cultural entities or monothetic categories disconnected from other contemporary cultural entities in space and time.

Like archaeology and cultural anthropology, also, history is not exempt from this attitude. Linear and progressive conceptions of time and cultural developments mark numerous historical sequences. Consequently, human civilizations and cultures are described as following one another according to linear categorizations of events. Affirming what is considered “new” implies the abandonment, if not the dismissal, of what is perceived as “old.” However, more careful and critical observations show that cultures can coexist, although some may prevail at times and give their imprint on the historical conception of an entire epoch.

The archaeology of the early and middle Holocene in Sudan warns us to give correct weight to spatial intersections as well as chronological overlaps between distinct cultures. Specifically, our case studies show that the cultural and material identity of the Khartoum Variant, Abkan, A-Group, and Pre-Kerma cultures of northern Sudan has been mainly shaped by the assumption that they are a “cultural substance,” which can be either akin or divergent (both geographically and materially) from other cultural identities along the Nile Valley. This has resulted in the formation of rigid conceptualizations of these cultural complexes that are frequently presented in a one-dimensional perspective. For example, the Khartoum Variant is often regarded as an impoverished “variation” or “deviation” from the Early Khartoum. These interpretations also conceal intra-cultural complexity.

The Khartoum Variant cultural orbit is chronologically (at least three millennia-long) and geographically (along the Middle Nile Valley and in the neighboring hinterland) extensive, encompassing a multitude of facets and exhibiting overlaps along both spatial and temporal axes. These complexities can only partly be simplified into schematic representations through traditional binary models such as

center/periphery, and a more nuanced understanding of the cultural dynamics involved should be envisioned. The ceramic evidence allows for a more thorough reconsideration of the role of the so-called central region of the Wadi Halfa-Second Cataract area as a place of aggregation or through-route for multiple Khartoum Variant groups from both Nilotic and non-Nilotic areas (e.g., Nabta Playa in the Egyptian Western Desert). Conversely, insular settings such as Sai Island were likely enclaved, resulting in a stylistic monotony of ceramic types.

During the middle Holocene, we can speculate that the insular character of Sai negatively affected the permeability and transmission of knowledge between the indigenous Khartoum Variant groups and the incoming Abkan herders. Likely, the small size of the island and the paucity of raw materials and resources may not have allowed the coexistence of groups with different economies in the long term.

The picture would have changed in the following period, which is characterized by a greater blending and permeability of cultural boundaries and material traditions. This can be seen in the overlapping decorative and technological styles of ceramics in the emerging phases of the A-Group and Pre-Kerma cultural orbits. During this period, Sai Island would probably have assumed a new pivotal strategic role in the cultural dynamics along the Nile Valley. At this time, strict boundaries should be ruled out, and cultural boundaries were ephemeral and provisional and could overlap. While discrete geographical areas existed in the Neolithic, overlaps were more common in the A-Group and Pre-Kerma periods, and the adoptions, assimilations, or incorporations of certain elements of material cultures seem to increase with social complexity.

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Declarations

Conflict of Interest The authors declare no competing interests.

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