Quaternary International 300 (2013) 244–266

Contents lists available at SciVerse ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Nubian Complex reduction strategies in Dhofar, southern Oman

Vitaly I. Usik [a], Jeffrey Ian Rose [b,*], Y.H. Hilbert [b], P. Van Peer [c], A.E. Marks [d]

[a] Archaeological Museum, Institute of Archaeology, National Academy of Sciences of Ukraine, Kiev, Ukraine
[b] Institute of Archaeology and Antiquity, University of Birmingham, Egbaston, Birmingham B15 2TT, UK
[c] Prehistoric Archaeology Unit, University of Leuven, Leuven, Belgium
[d] Department of Anthropology, Southern Methodist University, Dallas, USA

ARTICLE INFO

Article history:
Available online 8 September 2012

ABSTRACT

Between 2010 and 2012, the Dhofar Archaeological Project has located and mapped 260 Nubian Complex occurrences across Dhofar, southern Oman. Many of these lithic assemblages are technologically homologous to the Late Nubian Industry found in Africa, while others may represent a local industry derived from classic Nubian Levallois technology. The purpose of this paper is to describe the various reduction strategies encountered at a sample of Nubian Complex sites from Dhofar, to explore inter-assemblage variability, and, ultimately, to begin to articulate technological units within the "Dhofar Nubian Tradition." To achieve this aim, we have developed an analytical scheme with which to describe variability among Nubian Levallois reduction strategies. From our analysis, we are able to discern at least two distinct industries within a regional lithic tradition. Demographic implications of the enduring Dhofar Nubian Tradition are considered in light of new evidence found throughout the Arabian Peninsula.

1. Background

1.1. The Afro-Arabian Nubian Technocomplex

The "Afro-Arabian Nubian Technocomplex" encompasses the African and Arabian Nubian Traditions, which, in turn, consist of a series of technologically related lithic industries that are distinguished by the presence of the Nubian Levallois core reduction strategy (Guichard and Guichard, 1965; Marks, 1968; Van Peer, 1992; Rose et al., 2011). Nubian Levallois technology was first recognized in northern Sudan in the 1960s, and has since been discovered throughout the Middle and Lower Nile Valley (Van Peer, 2000; Van Peer et al., 2003, 2010; Chiotti et al., 2009; Olszewski et al., 2010), eastern Sahara oases (Wendorf et al., 1994; Smith et al., 2007a), and the Red Sea hills (Van Peer et al., 1996). To a much lesser extent, this technology appears in the Horn of Africa at K'One Crater (Kurashina, 1978) and Gorgora Rockshelter (Clark, 1988) in Ethiopia, and Hargeisa (Clark, 1954) in northern Somalia.

Nubian Levallois technology is also found extending across southern Arabia. Nubian Complex occurrences are reported from the Hadramaut Valley in central Yemen (Inizan and Ortlieb, 1987; Crassard, 2009; Crassard and Thiébaut, 2011) and Dhofar, southern Oman, where a dated assemblage at Aybut al Auwal confirms the presence of the Nubian Complex in Arabia over 100,000 years ago (Rose et al., 2011). Given its wide geographic spread across Northeast Africa and South Arabia and its variability over time, these sites can now be designated, in broadest terms, as belonging to a coherent Afro-Arabian Nubian Technocomplex (or "complex" for short; see Clarke (1978) for a discussion of lithic techno-typological units).

African Nubian Complex toolmakers were most likely anatomically modern humans (AMHs), although only a single skeleton has been found associated with such an assemblage. An AMH child was discovered at the chert quarry of Taramsa 1 in the Lower Nile Valley in Egypt, dated to 68.6 ± 8 ka. The skeleton is associated with a Late Nubian assemblage belonging to Activity Phase III at the site (Van Peer et al., 2010). Also compelling is the apparently exclusive presence of AMH remains in North Africa from approximately 150 ka onward (Smith et al., 2007b; Hublin and McPherron, 2012), since no alternatives to AMH have been found in this part of Africa. In contrast, skeletal and genetic evidence raise the possibility of late-surviving archaic populations in sub-Saharan Africa (Hammer et al., 2011; Harvati et al., 2011; Lachance et al., 2012). In light of these findings, Balter (2011: 20) speculates that North Africa was the, "original home of the modern humans who first trekked out of

* Corresponding author.
E-mail addresses: vitaly.i.usik@gmail.com (V.I. Usik), jeffrey.i.rose@gmail.com (J.I. Rose), philip.vanpeer@ees.kuleuven.be (P. Van Peer), amarks@mail.smu.edu (A.E. Marks).

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http://dx.doi.org/10.1016/j.quaint.2012.08.2111

the continent." Hence, the spread of the Nubian Complex into Arabia may correspond with an AMH dispersal out of North Africa (Rose et al., 2011).

Different industries are recognized within the Nilotic Nubian Tradition, including an Early Nubian Industry falling within MIS 5e (~130–115 ka) and a Late Nubian Industry dated to MIS 5a, between ~85 and 74 ka (Vermeersch et al., 1998; Mercier et al., 1999; Van Peer et al., 2010). The Early Nubian Industry is defined by the predominance of Nubian Levallois cores with bilateral preparation (Type 2) in conjunction with Lupemban bifacial foliates (Guichard and Guichard, 1968; Van Peer et al., 2003), while the Late Nubian Industry shows a much higher frequency of Nubian cores with distal divergent preparation (Type 1), and the absence of bifacial tools (Van Peer and Vermeersch, 2007). An Early Nubian assemblage was found in stratigraphic succession overlying a series of Late Sangoan/Lupemban horizons dated to MIS 6 at Sai Island in northern Sudan (Van Peer et al., 2003). In the Early Nubian level, Lupemban bifacial tools were found together with Nubian cores, leading the excavators to conclude that the Early Nubian Industry developed locally from the Lupemban in the Middle Nile Valley. The same co-occurrence of Lupemban bifacial tools and Nubian Levallois cores was noted at Arkin 5, also in northern Sudan (Chmielewski, 1968).

There is a Late Nubian horizon overlying an Early Nubian level at Sodmein Cave (Van Peer et al., 1996; Mercier et al., 1999). At Taramsa 1, exploitation pits containing both Early and Late Nubian assemblages were found stratigraphically isolated from one another by an MIS 5d sand layer with an OSL age of 117 ± 10 ka (Van Peer et al., 2010). In both cases, the two industries are separated by a long chronological hiatus extending from MIS 5d through MIS 5b (~115–85 ka). It is noteworthy that, although there are no known Late Nubian sites during this time span in Africa, the Nubian Complex assemblage at Aybut Al Auwal in Dhofar, southern Oman was dated to 106 ± 9 ka (Rose et al., 2011).

After MIS 5, there are a variety of new industry types found throughout the Nile Valley such as the Khormusan (Marks, 1968) and the Taramsan (Van Peer et al., 2010). Both show diverging technological trajectories, yet appear to stem from a common Nubian Levallois base. In the case of the Taramsan Industry, the preferential Nubian Levallois method developed into a reduction strategy of continuous blade production, while the Khormusan exhibits a decrease in Nubian Levallois, accompanied by an increase in preferential centripetal Levallois cores. Despite this shift in Levallois method, Khormusan cores tend to maintain the same morphology as the preceding Late Nubian Industry, their distinctive triangular and sub-triangular shapes clustering with these assemblages. As such, these industries are considered part of a long-term Nilotic Nubian Tradition.

1.2. Geography and climate of Dhofar

The Governorate of Dhofar occupies the southwestern corner of the Sultanate of Oman, stretching across an area of roughly 100,000 km^2. The region is divided into four general ecological zones: 1) Salalah coastal plain, 2) Jebel Qara escarpment, 3) Nejd Plateau, and 4) Rub' Al Khali desert (Fig. 1A).

Dhofar encompasses a unique microclimate within Arabia; moisture brought by the Indian Ocean Monsoon accumulates along the Jebel Qara–Jebel Samhan escarpment, resulting in relatively high precipitation in the mountains (200–350 mm per annum) and cool temperatures between the months of June and September. The high grasslands atop the escarpment reach 1000 m in elevation and are mantled in a dark brown clay soil that supports a subtropical cloud forest belonging to the Somalia–Masai center of endemism, while date and coconut palms, bananas and other tropical fruits, and grasses are cultivated along the coastal plain (Platel et al., 1992; Ghazanfar and Fisher, 1998).

Northwards, past the current watershed divide, the escarpment levels off onto a deeply incised limestone plateau called the Nejd, which is the eastern margin of a one thousand-kilometer-wide plateau that spans central Yemen to southern Oman, extending some 150–300 km from the coast to the interior Rub' Al Khali basin. Around its southern border, the Omani Nejd is a barren scabland marked by an intricate series of minor wadis dissecting the plateau. These smaller drainage systems converge into larger and more deeply incised canyons that run northward across the central plateau, roughly parallel to one another. As they reach the northern Nejd, the wadis empty onto a gently undulating plain of Quaternary alluvium that flanks the Rub' Al Khali desert.

The drainage channels incising the Nejd Plateau formed during periodic pluvial phases throughout the Quaternary (Platel et al., 1992). While much of Arabia presently experiences an arid/hyper-arid climatic regime, the palaeoenvironmental record indicates that northward migrations of the Inter Tropical Convergence Zone, and associated monsoon rains, brought increased precipitation to large portions of the Arabian Peninsula over the course of MIS sub-stage 5e (~130–115 ka), sub-stage 5c (~110–100 ka), and sub-stage 5a (~90–70 ka). Terrestrial evidence for such humid episodes is found throughout the Peninsula within fluvio-lacustrine deposits (Maizels, 1987; Sanlaville, 1992; Preusser et al., 2002; Preusser, 2009; Petit-Maire et al., 2010; Waldmann et al., 2010), speleothems (Burns et al., 1998, 2001; Bar-Matthews et al., 2003; Fleitmann et al., 2003, 2011; Vaks et al., 2006, 2010; Fleitmann and Matter, 2009), and deep sea cores from the Arabian Sea (Rostek et al., 1997; Saraswat et al., 2005; Saher et al., 2009; Govil and Naidu, 2010). Recently discovered terrestrial archives from central and eastern Arabia indicate a later pluvial across eastern and central Arabia between roughly 60 and 50 ka (McLaren et al., 2008; Parton et al., 2013).

There are three separate Eocene chert-bearing formations found across the Nejd (Platel et al., 1992). Fine-grained, large, banded chert slabs and smaller plaquettes occur within the Mudayy member, which is the highest quality on the plateau, outcropping in the southern and central regions. Mudayy chert ranges from tan to dark brown and is typically free of inclusions. Chert nodules, spheroids, and plaquettes are all found embedded within the overlying Rus formation, which has scattered exposures constrained within the southern Nejd. The Rus formation includes two distinct members: the lower chalky Aybut member and upper Gahit member. Aybut chert is yellowish orange, outcrops in rounded nodules and seams of varying sizes, and is often poor quality due to mineral inclusions and post-depositional displacement that has left much of it highly fractured. Thin, high quality grey chert plaquettes are found within the Gahit member, typically occurring as flat spheroids embedded in a marly-carbonate matrix.

In three seasons of survey, 260 occurrences were mapped in Dhofar that bear evidence of Nubian Levallois technology. At present, Nubian sites have only been found in the interior – on the Nejd Plateau and the southern margins of the Rub' Al Khali (Fig. 1A). No evidence of Nubian technology has been found south of the Nejd; not on the Salalah coastal plain, the seaward slopes of the Jebel Qara–Jebel Samhan escarpment, nor the high grasslands atop the escarpment. The continental shelf off the coast of Dhofar is particularly narrow, not exceeding five kilometers. Lower sea levels during the Late Pleistocene would not have exposed any significant new landmass, and therefore the possibility that such sites are now submerged can be rejected.

Nubian occurrences are typically found on desert gravel plains and just back from dry riverbeds. While the sites are distributed across the entire Nejd Plateau, the greatest concentration was