The Middle Stone Age of West Turkana, Kenya

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Research on the origins of *Homo sapiens* and the development of our species' unique behavior is focused on the Middle Stone Age (MSA) period in Africa (in comparison with the European Upper Palaeolithic). Although archaeological and paleontological fieldwork in the Turkana Basin in northwestern Kenya has contributed greatly to our understanding of human evolution in Africa, the Basin's MSA archaeological record remains poorly known. We report on a reconnaissance of MSA sites in West Turkana, Kenya, which included known archaeological/paleoanthropological localities at Eliye Springs and Kabua Waterhole (Kadokorinyang). A newly-discovered site, Nakechichok 1 (GdJh 5), preserves MSA tools stratified beneath Late Stone Age assemblages. The MSA lithic artifacts from Nakechichok 1 differ from those known from other MSA localities in nearby regions, and, they expand the known scope of MSA variability in the Turkana Basin, demonstrating that the MSA is not "missing" in this region, but just hard to find.

Keywords: Africa, Kenya, Middle Stone Age, Lake Turkana, Palaeolithic

Introduction

The Middle Stone Age (MSA) in eastern Africa encompasses the latter part of the Middle Pleistocene and the early part of the Late Pleistocene (ca. 300–50 kya) (McBrearty 2003). This important phase of African prehistory witnessed the origin of *Homo sapiens*, and our species' initial dispersal beyond Africa into Eurasia (Stringer 2002; Willoughby 2007). For some researchers, the MSA also marks the origin of "modern" human behavior (Henshilwood and Marean 2003; McBrearty 2007; McBrearty and Brooks 2000). The Turkana Basin (FIG. 1) features one of the longest and best-documented paleoanthropological sequences in the world, stretching from the earliest phases of hominin evolution to the later phases of prehistory (Harris et al. 2006; Isaac and Isaac 1997; Robbins 2006). Nevertheless, this record is far from complete. The MSA is conspicuously under-represented (Kelly and Harris 1992; Shea 2008), and researchers who work in the Kenyan part of the Turkana Basin complain about the "missing MSA."

In 2007, we initiated the Later Prehistory of West Turkana Project (LPWT) in order to investigate the archaeology of hunter-gatherers and herders from 20 kya to the present. Because Pleistocene hominin fossils and surface finds of earlier (MSA) tools had been found by previous researchers near places we planned to survey, such as Eliye Springs and the Kabua/Kadokorinyang waterhole (Bräuer and Leakey 1986; Whitworth 1960, 1965a, 1965b), we were aware that *in situ* MSA sites might be present, which proved to be the case.

The Middle Stone Age of Lake Turkana

Northeastern Africa preserves a rich and complex MSA archaeological record (Clark 1988), but in the Turkana Basin, known MSA sites are sparse when compared to the rich archaeological record for the Plio-Pleistocene and early Holocene periods. In the northern reaches of the Turkana Basin, the Kibish Formation of the Lower Omo Valley (Ethiopia) preserves numerous fossil and archaeological sites (FIG. 1). Three MSA localities dating to 104–195 kya were excavated in 2002–2003: KHS and AHS (in Member 1 of the Kibish Formation) and BNS (on the top of Member 2/base of Member 3) (Shea et al. 2007). The MSA assemblages from these sites are associated with the oldest known fossils of *Homo sapiens* (McDougall et al. 2005, 2008). The Kibish Formation extends south from the Lower Omo Valley along the northwestern side of Lake Turkana into the Ilemi Triangle (a part of Sudan administered by Kenya) (FIG. 1) (Brown and Fuller 2008). There are probably MSA sites preserved in this area, but unfortunately security concerns currently prevent them from being investigated. The eastern side of Lake Turkana preserves several Middle Stone Age sites (Kelly 1996; Kelly and Harris 1992). Three (FwJi 1, FwJi 2, and FwJi 3) are located near Ileret (FIG. 1). Two (FxJj 61 and FxJj 66) are near the southern end of the Karari Ridge. One additional site (GaJj 17) is near Koobi Fora. None of these sites are dated, and unfortunately the town of Ileret has expanded and encompassed the areas where the FwJi 1–3 sites are located, hindering further investigations.

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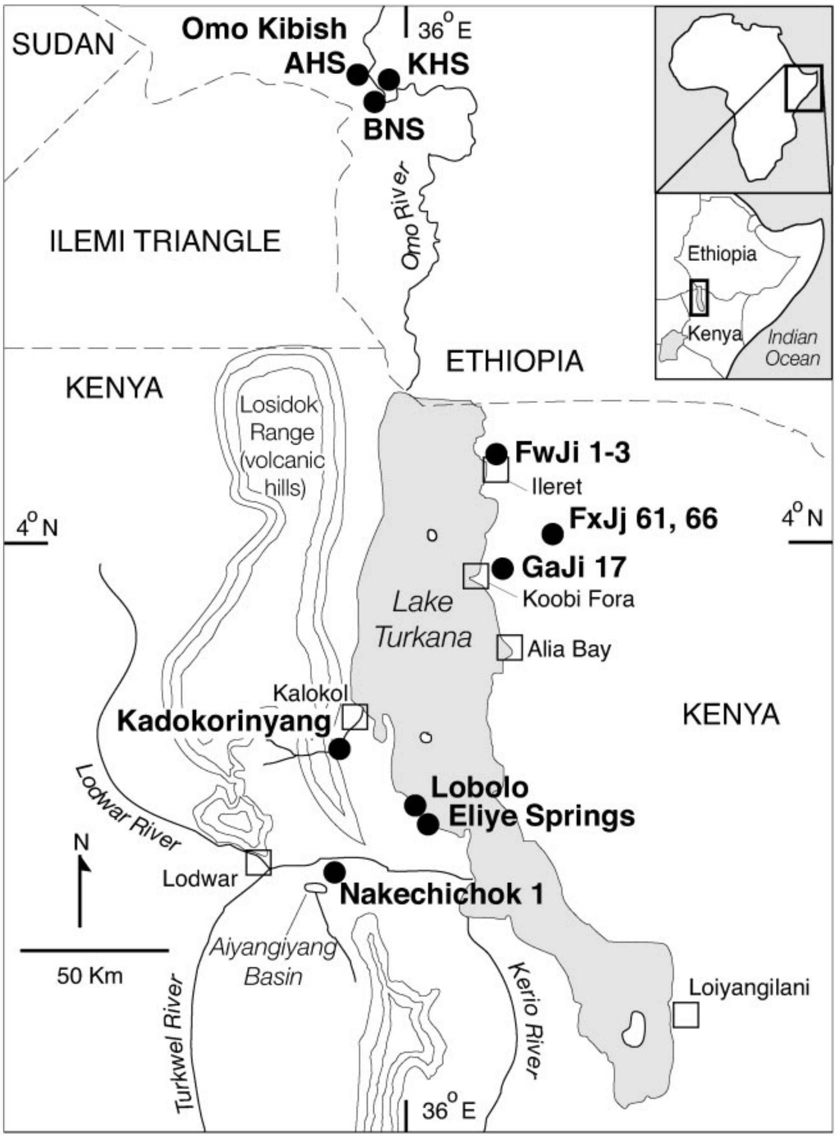

Figure 1 Map of the Turkana Basin showing Middle Stone Age sites. Filled black circles are archaeological sites. Hollow squares are modern towns and villages.

Kabua/Kadokorinyang waterhole

On the western side of Lake Turkana (Central Turkana District) near the "Kabua" waterhole, Whitworth (1960, 1965a, 1965b) reported finding characteristic MSA foliate points, Later Stone Age (LSA) crescents, and a robust (but probably pathological) human mandible from "Pleistocene" deposits (FIG. 2). This waterhole (N 3.45° E 35.73° at 417 masl) lies along the Kalokol River, a seasonal watercourse that cuts through the Losidok Hills. Although Whitworth described this place as "Kabua," local Turkana residents report its name as "Kadokorinyang." Kabua is the name of another town, about 20 km inland and upstream, on the western side of the Losidok Hills. The deposits Whitworth identified as "Pleistocene" are now regarded as early- to mid-Holocene in age, part of a larger complex of deposits known as the Galana Boi Formation (Owen et al. 1982). Our reconnaissance of the Kadokorinyang waterhole and the surrounding area found geometric microliths and pottery characteristic of LSA and Pastoral Neolithic occupations, but it did not find in situ MSA deposits. We did find an

Figure 2 Kabua/Kadokorinyang waterhole. View to the west from the Kalokol River. Photograph by John Shea.

Figure 3 View to the east of gravel "drape" covering Galana Boi Formation sediments (foreground) at Kabua/ Kadokorinyang. Photograph by John Shea.

Figure 4 South-facing views of siltstone deposits being eroded by wave action at Lobolo Springs. Photograph by John Shea.

Acheulian handaxe (at Kadokorinyang) and a cleaver from somewhat further afield in the gravel "drape" that covers many exposures of the Galana Boi Formation (FIG. 3). These artifacts may come from Pleistocene deposits (now eroded) that were formerly present at higher elevations.

Eliye Springs and Lobolo Springs

In 1985, tourists visiting Eliye Springs discovered a hominin cranium (KNM ES-11693) that is viewed as intermediate between *Homo sapiens* and African *Homo heidelbergensis* (Bräuer and Leakey 1986). The Eliye Springs fossil is undated, but comparisons with other African Middle Pleistocene fossils suggest a likely age of ca. 300 kya (Bräuer et al. 1997; Pearson 2008). Robbins (1980) also reported stone tools eroding from underwater deposits near Eliye Springs. Richard Leakey (personal communication 2007) informed us that during an overflight of the area, he observed lowered lake levels (currently 360 masl) had exposed sedimentary deposits from which these stone tools and the hominin fossil might have

Figure 5 Siltstone terraces at Lobolo Springs out of which stone tools were eroding; view to the south. Photograph by John Shea.

originated. Because our goals for the 2008 field season included a search for Holocene sites in the sand dunes north of Eliye Springs, we secured permission to conduct a reconnaissance at Eliye Springs and northwards along the lakeshore. Consolidated siltstone beds at Lobolo Springs are being exposed and eroded by wave action (FIGS. 4, 5). At Eliye Springs itself (N 3.25° E 36.02°), local Turkana residents displayed large terrestrial vertebrate fossils (hippopotamus, equids, and various bovids) they had collected from a shingle beach that had formed as water receded. No lithic artifacts were observed among these collections. At Lobolo Springs, located about 10 km north of Eliye Springs (N 3.34° E 35.95°), we observed rare fossils of vertebrates (fish, hippopotamus, and crocodile) embedded in the sandstone matrix on a shingle beach. A few small flakes of indeterminate typological affinity were embedded in recently-exposed mudstone; no distinctively MSA archaeological remains were observed at Lobolo.

Aiyangiyang and Nakechichok 1

Aiyangiyang is an inland delta located southeast of Lodwar and south of the Turkwel River (FIG. 1). Seasonal streams flow north into Aiyangiyang from the western slopes of the Napadet Hills. Sediments have accumulated at the distal end of the delta, forming a slight ridge that separates Aiyangiyang from the Turkwel River Valley. Our surveys in 2008 and 2009 identified numerous concentrations of stone tools (including geometric microliths), ceramics, and ostrich eggshell beads among the sand dunes on the north and eastern sides of the Aiyangiyang Basin. Rare finds among these dune fields of minimally-eroded MSA artifacts (Mousterian points, Levallois flakes) hinted at possible underlying MSA deposits.

Nakechichok 1 (GdJh 5) (N 3.15° E 35.80°, at 490 masl) is located at the northern end of this ridge

Figure 6 Nakechichok 1 sediments preserving Middle Stone Age artifacts; view to the southwest. Photograph by John Shea.

overlooking the Turkwel River (FIG. 1). The site is immediately west of a major fault in underlying Pliocene sandstones (Lonyumun Formation) along which a *laga* (gully) is incising south towards Aiyangiyang (FIG. 6). Vertebrate fossils and stone tools, including refitting flakes, are eroding from the steep walls flanking this laga and from sand deposits about 150 m to the west. The localized nature of these finds is important because it suggests similarities in site formation processes between Nakechichok and MSA localities in East Turkana. According to Charles Nelson (personal communication 2008), who has extensive experience surveying in the region, hydrostatic springs formed around faults in Pliocene sandstones when the level of Lake Turkana dropped during Pleistocene times. Such springs would have supported plant growth and attracted both humans and animals, particularly during dry periods. The presence of hippopotamus remains and rich rhizolith (fossilized casts of plant roots) components of several strata (see below), both point to a water source at Nakechichok 1 around the time of the MSA occupation.

A stratigraphic profile of the inner northeast-facing side of the canyon shows eight major lithostratigraphic units (FIG. 7, TABLE 1). The base of the Nakechichok 1 sequence is a layer of large (20–30 cm long) sandstone blocks that cap the Pliocene Lonyumun Formation, which is faulted to a depth of at least 5 m to the east of the site. The sands that comprise the MSA component

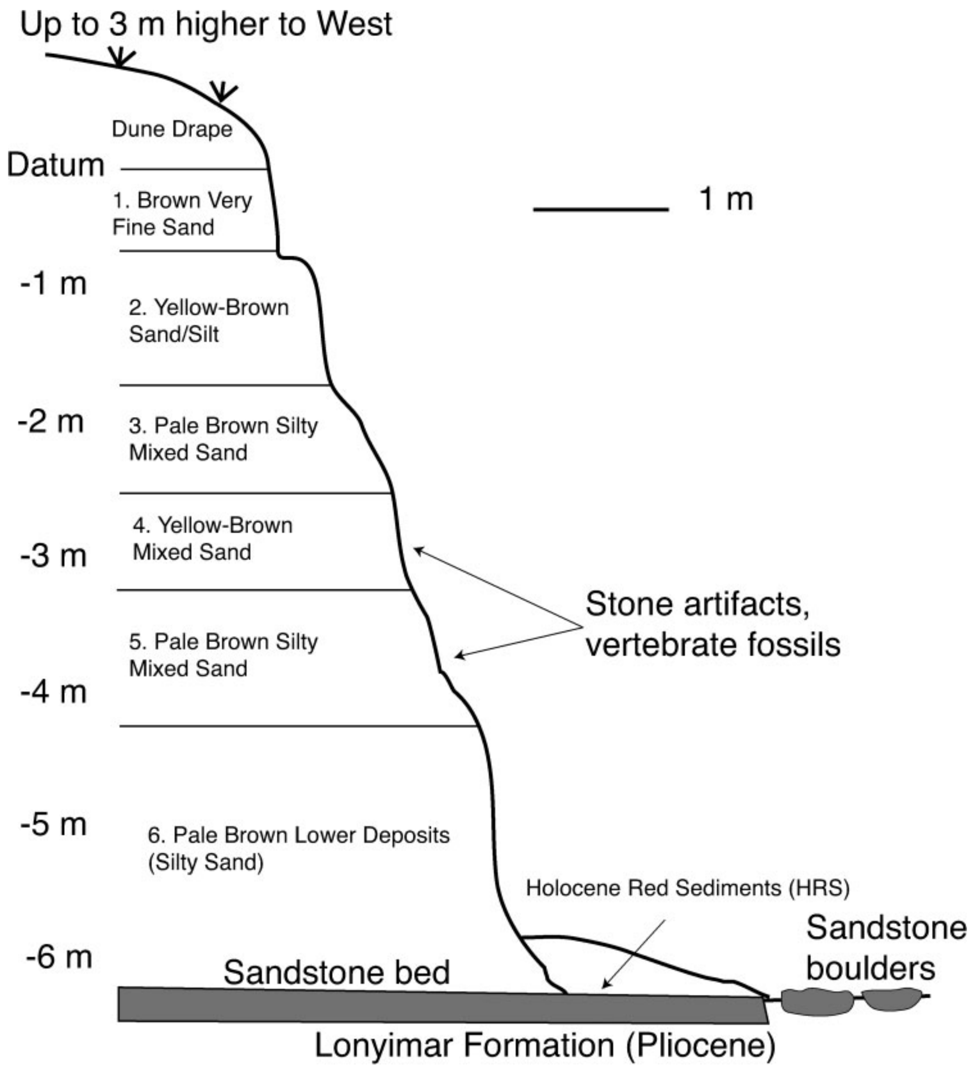

Figure 7 Schematic drawing of stratigraphy at Nakechichok 1.

of Nakechichok 1 seem to have accumulated in a graben formed by this fault.

The main artifact- and fossil-bearing deposits are Layer 5 and to a lesser extent Layer 4 (TABLE 1). The entire sequence (Layers 1–6) is mainly sand with subrounded quartzose and subangular basalt particles, moderately compacted, with variable silt components. Pebbles, cobbles, and larger rocks are absent throughout. There are variable concentrations of rhizoliths in the different units; more in Layers 2, 4, and the upper part of Layer 5, and fewer in other layers. East of the site, these sand deposits are eroded to the top of the Lonyumun Formation. Lower portions of Layer 6 and the top of the Lonyumun Formation are covered by a more recent fill deposit composed of reddish sandy silt containing LSA lithics (microblade cores, backed microliths) but no ceramics. We designated this Layer HRS (Holocene Red Sediments); similar sediments (also with LSA lithics, ceramics, and fauna) occur throughout much of the Aiyangiyang Basin.

The uppermost stratified layer of the site, Layer 1, is covered by a "dune drape" of loose sands and more silty sands (FIG. 7, TABLE 1). No archaeological remains are visible in the dune drape adjacent to the MSA locality, but erosional basins located 100–200 m to the south feature LSA artifacts. These include unifacially backed microliths (crescents and triangles), as well as microblade cores and informal cores made primarily out of cryptocrystalline silicates (jasper, chalcedony, and quartz). There are also rare sherds of undecorated pottery and fragments of ostrich eggshell beads (FIG. 8). It is possible that these deposits are the source from which Layer HRS was derived.

As stated above, *in situ* lithic artifacts and fossils occur mainly in Layer 4 (rare quartz fragments) and Layer 5 (basalt and phonolite artifacts and fossils). Most of the artifacts and fossils observed in the field and described here were either found suspended in the matrix of the canyon walls or among a complex of alluvial fans and small gullies that formed where Layer 5 sediments are exposed by erosion. As with all the sites LPWT surveyed, surface finds of both LSA and MSA artifacts were left in place in order to preserve site visibility for future surveys.

Table 1 Nakechichok 1 stratigraphy. The uppermost point is at approximately 498 masl. See also Figure 7.

Layer	*Thickness, Munsell color*	*Sediment description*	*Artifacts/ecofacts*
Dune drape	<4 m, wedging northward 7.5YR 5/4 Wet 7.5YR 4/4 Dry	Loose dune sands with abundant rhizoliths	Microliths, ceramics, modern Turkana artifacts on surface, 100–200 m from profile
1. Brown very fine sands	0.6 m 7.5YR 5/4 Wet 7.5YR 4/4 Dry	Fine sand with minor silt components; mostly quartzose with a few basalt flecks; most particles <1 mm; fairly compact	
2. Yellow-brown sand/silt	1.0 m 10YR 5/4 Wet 10YR 5/4 Dry	Well-sorted very fine sandy silt; subrounded quartzose particles with strong subangular basalt component; very compact; numerous intact rhizoliths (most are cylindrical, 20 mm long and <3 mm in diameter)	
3. Pale brown silty mixed sand	0.8 m 10YR 6/3 Wet 10YR 5/4 Dry	Sand with minor silt component, mainly fine but with a few moderate-sized subrounded quartzose particles and subangular basalt particles; loose to fairly compact	
4. Yellow brown mixed sand	0.7 m (2.4–3.1 m bd) 10YR 5/4 Wet 10YR 5/4 Dry	Silty sand with particle sizes ranging from silt to medium sand; more medium sand than in Layer 3; subrounded quartzose particles and subangular; basalt particles; basalt is more common than in Layer 3; fairly compact; dendritic, rounded, and columnar rhizoliths, intact and very abundant	Rare non-diagnostic quartz lithics (angular fragments)
5. Pale brown silty mixed sand	1.0 m 10YR 6/3 Wet 10YR 5/3 Dry	Silty sand, similar to Layer 4, but with higher proportion of silts, and a slight clayey component; quartzose more prevalent; fairly compact, rhizoliths abundant (subangular and subrounded) at the top, but with no preferred orientation and becoming less common towards the bottom	Large basalt/phonolite MSA lithics, sparse vertebrate fossils
6. Pale brown lower deposits	2.0 m 10YR 6/3 Wet 10YR 4/3 Dry	Silty sand, similar to Layer 5; loosely-compacted; contains dry, plate-like micro-surface with finer (clayey) components	
Holocene red sediments (HRS)	<0.5 m 10YR 5/4 Wet 10YR 4/3 Dry	Sandy silt, with lightly-compacted quartzose inclusions; overlies the lower 0.5 m of Layer 6 and Pliocene Lonyumun Formation	LSA lithics

Figure 8 Late Stone Age surface finds of stone and pottery at Nakechichok 1. Photograph by John Shea. Scale is in centimeters.

Faunal remains are sparsely preserved on the surface of Nakechichok 1. Most of the fossils observed in 2009 were those of hippopotamus (several teeth, one rib, one astragalus, several phalanges, and a vertebra). A bovid maxilla and two molar teeth likely dislodged from it were also observed. An unidentifiable mass of bone, most likely the remains of a bovid or equid pelvis, was found eroding from the sides of one gully. No mollusks were observed. Some ostrich eggshell fragments were noted on the surface near the contact point of the dune drape with the MSA deposits, but these eggshells could be recent. No hominin remains were observed.

A total of 26 lithic artifacts observed on the surface of the site were photographed and drawn (FIGS. 9, 10, TABLE 2). Most (n = 16) of the tools were made of a pale blue-grey volcanic rock, most likely phonolite or basalt. The nearest bedrock sources are approximately 10 km to the north in the Losidok Hills and 10 km to the south in the Napadet Hills. A smaller number of tools (n = 8) were made of a grey quartzite. Most of the quartzite artifacts were found within a few meters of one another, though none of them refitted. Quartzite also occurs as a bedrock source near the margins of volcanic formations in the Losidok and

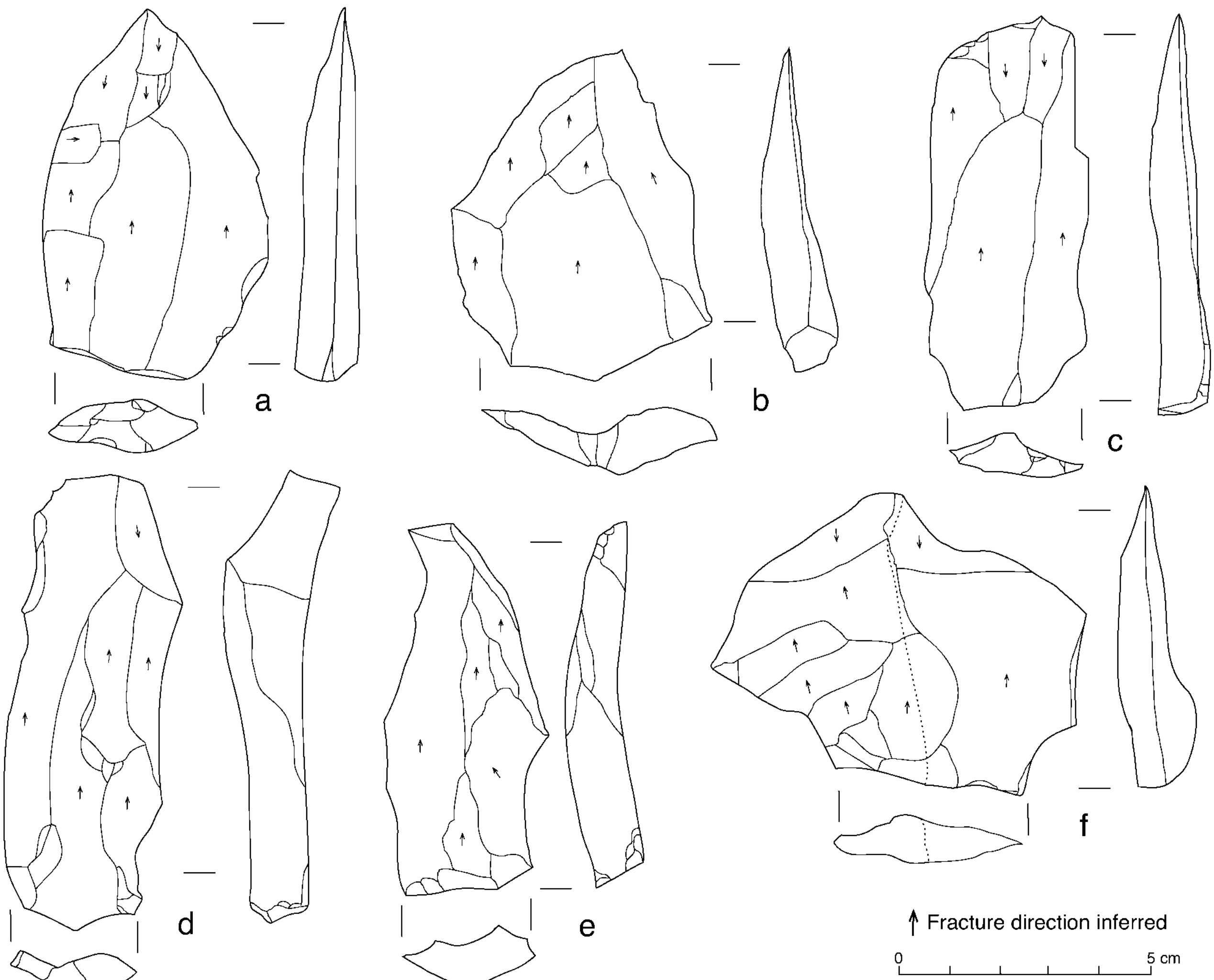

Figure 9 Nakechichok 1 artifacts. A–B) Levallois points; C) Levallois blade; D–E) Overshot/core-trimming blades; F) Two conjoining lateral flake fragments. Raw materials: A–F = basalt/phonolite.

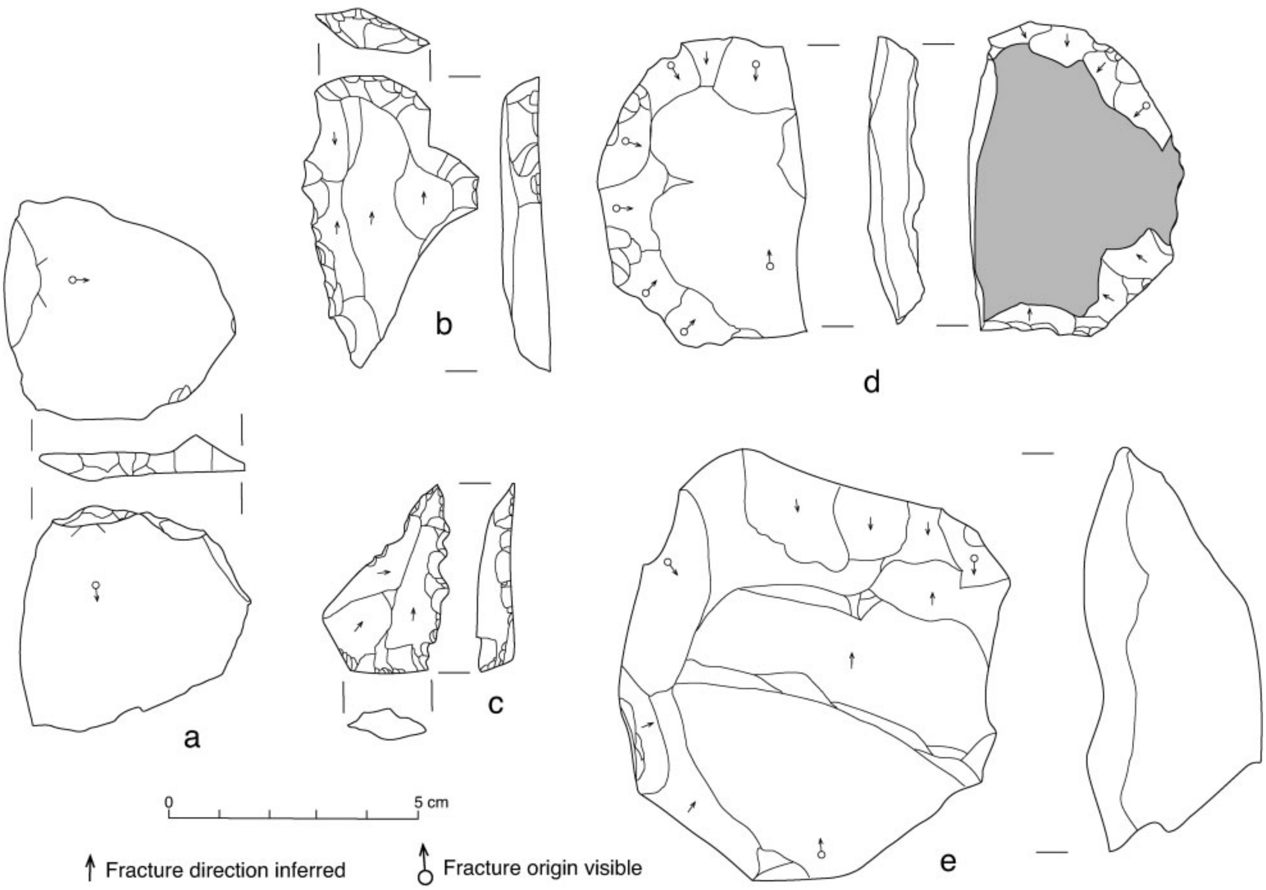

Figure 10 Nakechichok 1 artifacts. A) Kombewa flake; B) Shouldered endscraper; C) Point/canted scraper; D–E) Levallois cores. Raw materials: A, E = quartzite, B = basalt/phonolite, C = yellow jasper, D = chert.

Napadet Hills. Two artifacts, a chert core fragment and a retouched jasper flake, were made of cryptocrystalline silicates available as cobble-sized gravels on the top of Pliocene deposits throughout much of the Turkana Basin.

Three cores were recovered, all Levallois, and all with radial/centripetal preparation and large central "preferential" flake removal scars (Inizan et al. 1999). Among the cores, only the one made of chert preserves a cortical surface. This appears to be the result of the original chert cobbles having been relatively broad and flat.

There is a markedly laminar aspect to the complete and unretouched flakes. None of the flakes preserve cortex on their dorsal surfaces. Levallois points, Levallois blades, and proximal ends of Levallois blades/points are common. There are several "overshot" blades, which are more properly viewed as core-trimming elements, i.e. as blades struck in order to remove distal convexities from the surface of a core. One "Kombewa" flake was also recovered. Common among MSA assemblages, Kombewa flakes are struck from the ventral surfaces of larger flakes in such a way that they appear to have two ventral faces.

The sample contains five retouched tools. These include a shouldered endscraper, a simple concave side scraper with a convex edge, a denticulate/multiple notch made on a proximal blade fragment

Table 2 2009 Nakechichok 1 lithics surface collection.

Artifact type	*Volcanic (basalt/phonolite)*	*Quartzite*	*Cryptocrystalline silica*
Levallois core	1	1	1 (lateral fragment)
Levallois point	2	–	–
Levallois blade	2	–	–
Core trimming flake	1	1	–
Overshot blade	3	–	–
Whole flake	1 (2 pieces)	1	–
Proximal flake fragment	1	3	–
Medial flake fragment	–	1	–
Distal flake fragment	–	1	–
"Kombewa" flake	1	–	
Retouched tools	4	–	1
Total	16	8	2

by the application of ventral retouch, and a piece with a thinned back made from a distal fragment of a core-trimming flake. A canted (*déjeté*) scraper was the only retouched tool made from cryptocrystalline silica (yellow jasper).

Two conjoining lateral flake fragments (basalt) were found several meters apart. The fracture that split them, a shear fracture growing out of a Hertzian cone fracture, occurred when the flake was struck from the core. These two artifacts have remained close to one another suggesting a high degree of stratigraphic integrity to the MSA deposits at Nakechichok 1. A cluster of quartzite debitage occurring around the findspot of the large core made of the same material (FIG. 10E) further supports this inference.

Nakechichok 1 in Regional Context

The lithic sample from Nakechichok 1 is small, but it is sufficient to allow some tentative comparisons with other assemblages. The MSA artifacts from Nakechichok 1 differ from those known already in the Turkana Basin. The East Turkana MSA assemblages are made mostly from pebble-sized cryptocrystalline silicates. Cores have radial/centripetal preparation, and there are relatively small flakes and retouched tools (Kelly 1996). Tools made of basalt and other coarse-grained volcanic rocks are rare. These qualities contrast with the Nakechichok 1 sample, among which volcanic rocks predominate, flakes are relatively large, and the dorsal surfaces of flakes show mostly laminar preparation.

The MSA artifacts from Nakechichok 1 differ from the MSA Kibish Industry from the Lower Omo Valley, in Ethiopia (Shea 2008). Cryptocrystalline silicate rocks dominate the Kibish MSA assemblages. Basalt and other volcanic materials are relatively rare, and when seen, are used mainly to make large tools. The emphasis on laminar core preparation among the Nakechichok 1 tools contrasts with the mainly radial/centripetal and preferential patterns of core reduction seen in the Kibish assemblages. Kibish MSA assemblages also feature bifacial core-tools, including handaxes, lanceolates, and foliate points; similar bifacial tools are found in other Ethiopian MSA assemblages, such as those from the Middle Awash Valley (Yellen et al. 2005) and from Gademotta and Kulkuletti (Wendorf and Schild 1974). Neither bifacial tools nor biface manufacturing débitage were observed at Nakechichok 1.

Recently discovered MSA occurrences in the Kapedo Tuffs (located at the southern end of the Suguta Valley, between the Baringo and Turkana Basins) preserve stone tool assemblages made from volcanic raw materials, like those from Nakechichok 1 (Tryon et al. 2008). Unlike Nakechichok 1, however, the Kapedo MSA samples contain tools with cortical surfaces, suggesting they were made from clastic sources. No cortical surfaces are present on the volcanic or quartizite tools from Nakechichok 1.

The Nakechichok 1 artifacts are similar, in raw materials (coarse grained volcanics) and in preserving evidence for blade production, to ones from the middle and lower Kapthurin Formation in the Lake Baringo Basin (McBrearty 2005; Tryon 2006), and to those from Muguruk in western Kenya assigned to the Pundo Makwar Industry (McBrearty 1981). The Nakechichok 1 assemblage differs from the Kapthurin and Muguruk assemblages mainly in lacking evidence for bifacially-retouched tools.

It would be tempting to see this pattern of lithic variation as indicating cultural connections among MSA assemblages from West Turkana and western Kenya. However, much of the similarity may reflect the influence of lithic raw materials. As Tryon and colleagues (2008) have recently shown, major aspects of lithic variation among eastern African MSA assemblages seem to be correlated with their position in relation to raw material sources. Assemblages near the edges of the Rift Valley are dominated by larger tools struck from locally-abundant volcanic rocks (i.e. basalt, phonolite, and obsidian). Assemblages closer to the center of the Rift are dominated by cryptocrystalline silicates, which are more common near those localities. We are not yet in a position to test this hypothesis with data from Nakechichok 1, but it may be possible to do so after more extensive excavations and survey for raw material sources. Gauging the variability of MSA assemblages within West Turkana must await the discovery of additional sites.

Conclusions

Our research in West Turkana shows that the MSA is not "missing;" it is just difficult to find. To some degree, the scarcity of MSA sites may simply reflect their poor preservation. Alternatively, it may reflect settlement patterns more closely tethered to perennial water sources than the settlement patterns of recent hunter-gatherers, herders, and farmers (Barham and Mitchell 2008: 265; Clark 1984: 323). If this is correct, the MSA sites that formed near the edge of Lake Turkana during arid phases in eastern African prehistory may now lie underwater. Careful and periodic monitoring of fossiliferous deposits like those near Eliye and Lobolo Springs may allow this hypothesis to be tested by future surveys. Other pockets of Middle and Late Pleistocene sediments may be preserved in West Turkana. Faults in underlying Pliocene beds accompanied by evidence for fossil springs seem to be good places to seek additional MSA sites.

Much recent debate about the origins of modern human behavior in Africa and the nature of behavioral modernity relies on comparisons between the African MSA and the European Upper Palaeolithic (for an exception, see Shea 2007). Such comparisons can be problematic because they involve not only potential evolutionary differences among the human populations being compared but also potential differences reflecting contrasting temperate and tropical ecozones. Sites like Nakechichok 1 offer potential data for comparisons between ancient and recent *Homo sapiens* populations in African tropical habitats.

Nakechichok 1 is an attractive site for future research on an under-investigated period in the prehistory of West Turkana, Kenya. The presence of LSA assemblages stratified above the MSA component described here presents an opportunity to contrast Middle and Later Stone Age settlements, technology, subsistence, and other aspects of human behavior in the same place, even though environmental conditions may have differed between these periods. Our future plans for research at the Nakechichok 1 site include geological test-trenching and efforts to recover samples for geophysical dating. Survey in the site environs will also be conducted in order to clarify the stratigraphic relationship between the LSA and MSA components at Nakechichok 1 as well as to seek out other MSA sites.

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