# KENYA

Renewed Survey and Excavations in the Lake Magadi Basin, Southern Kenya

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# Introduction

Recent archaeological excavations at Lake Magadi in the southern Kenya rift valley have demonstrated the area was occupied by hunting and gathering populations during the middle to late Pleistocene as well as the Holocene. These occupations are associated with significantly wetter environmental conditions extending back to the middle Pleistocene when Lakes Magadi and Natron were fresh water and joined forming a single Magadi-Natron Basin. The unification of both lakes is evidenced by widespread lacustrine and fluvial sediments which were deposited during periods of increased rainfall. The middle Pleistocene lake is represented by the Oloronga Beds while the late Pleistocene - early Holocene deposits are termed the High Magadi Beds. Seven radiocarbon dates spanning from 11,000 BP to 1000 BP have been obtained from ostrich eggshell and human and bovid tooth apatite (Table 1). These dates, along with preliminary analysis of stone artifacts, permit the reconstruction of a broad chronology and cultural-historical sequence of the Lake Magadi Basin beginning with the Early Stone Age (ESA) through the Middle Stone Age (MSA), Later Stone Age (LSA) and probable Pastoral Neolithic (PN) grave cairn and burial near Olkena.

In June of 2006 and 2007 archaeological excavations were conducted at Lake Magadi in southern

Kenya by faculty and students from St. Lawrence University and the State University of New York at Potsdam in the United States and Kenyatta University in Kenya. As part of our ongoing field course, 'Archaeology in Kenya: In Search of Our Ancestors', students are trained in field archaeology, geology and paleontology within an interdisciplinary perspective that focuses on Kenyan archaeology and human evolution in Eastern Africa. Specifically, students learn the basic field procedures of site survey, stratigraphic analysis, map making and excavation techniques as well as laboratory analysis of stone artifacts and faunal remains. Fieldwork has been based at Lenderut, a Lower to Middle Pleistocene Acheulean site located southeast of Lake Magadi (Barthelme 1991, 1993 a, b, 1995, 1997 a,b), Olkena, a LSA occupation situated east of the present lake (Barthelme et al. 2000, 2002, 2004; Barthelme and Murimi 2001) and in 2006 and 2007 at Oloololo, a possible LSA site located within a river drainage five kms west of Olkena (Barthelme et al. 2007, 2008). The field course has now been offered on six occasions since 1997 while one of us (Barthelme) has conducted field research at Lake Magadi since 1987. We continue to be impressed with the academic quality and enthusiastic participation of the students. We believe the key objective of the field course, offering undergraduate students from American and Kenyan Universities the opportunity to learn fieldwork skills taught by American and Kenyan researchers, has been most successful.

Lake Magadi, 20 km wide, 100 km long and at an altitude of 600 m, is located within the southernmost and deepest depression of the east African rift system, just north of the Tanzanian border (Figure 1). To the west, the Nguruman escarpment outcrops repeated layers of basaltic lava, while further west in the Loita Hills, exposure of Precambrian basement schists and gneisses are present. South of the lake lies a series of extinct Miocene and Pliocene volcanoes, including Lenderut and Shombole, composed primarily of andesite, trachyte and phonolite (Baker 1958, 1986; Jones and Ashley 2003). The still active carbonatite volcano, Ol Doinyo Lengai, is a dominant visible landmark in northern Tanzania. Lake Magadi is a sodium carbonate - bicarbonate lake that is intermittently dry. It is fed primarily by hydrothermal springs and seasonal runoff and is covered by an extensive trona crust up to 30 meters thick (Renaut and Ashley 2002). The modern hyper-saline

Table 1: Lake Magadi AMS C-14 Dates*										
1998	Base of High Magadi Beds	Ostrich eggshell	9940±60 BP	Beta Analytic - 114554						
2000	Olkena (GxJi 4)	Ostrich eggshell 10,300±100 BP		Beta Analytic - 141041						
2005	Human Burial (GxJi 2)	Human tooth apatite	990±30 BP	Illinois State Geological Survey - A0579						
2007	Human Burial (GxJi 2)	Human tooth apatite	1,010±20 BP	Illinois State Geological Survey - A0793						
2007	Olkena (GxJi 4)	Ostrich eggshell	10,640±25 BP	Illinois State Geological Survey - A0800						
2007	Oleololo (GxJi 8)	Bovid tooth apatite	10,405±45 BP	Illinois State Geological Survey - A0791						
2007	Oloololo (GxJi 8)	Bovid tooth apatite	10,165±25 BP	Illinois State Geological Survey - A0792						
*all dates	C-13 corrected									

#### Table 1: Lake Magadi AMS C-14 Dates\*.

lake has an average annual rainfall of 409 mm concentrated between October and May. The climate is semi-desert with a mean annual maximum air temperature of 350C.

Evidence of two large precursor paleolakes is widespread in the basin indicating Lake Magadi in Kenya and Lake Natron in northern Tanzania were joined to form a single body of water (Roberts et al. 1994; Surdam and Eugster 1976). The older paleolake is represented by the Oloronga Beds (Baker 1958), composed primarily of lacustrine silts, clay and reworked tuffs, which have been dated by K-Ar measurements to at least 780,000 years BP (Fairhead et al. 1972). The more recent lacustrine deposits are represented by the High Magadi Beds (Baker 1958 and 1963) which have been 14C dated to the late Pleistocene and early Holocene (Butzer et al. 1972; Barthelme 1999 and 2003). Fieldwork, based primarily on mapping stromatolites, diatoms and geochemistry has indicated that between 12,450 and 9,650 BP, Lakes Magadi and Natron formed a single lake 50-60 m deep (Hillaire-Marcel et al. 1986). Recent comparative studies have shown broad synchroneity with the late Pleistocene-Holocene transgressive-regressive sequence at Lake Magadi, other East African lakes and the last European deglaciation (Roberts et al. 1994).

#### Oloololo (GxJi 8) (1° 49' 68" S - - 36° 13' 47" E)

At the end of the 2004 field season we discovered an area approximately 50 m by 30 m notable for

its extremely well preserved and abundant bone assemblage and low density scatter of associated LSA lithics. The material was eroding from a moderately well sorted silty sand located in a major river drainage 5 kms west of Olkena. Collected faunal elements included an eland/buffalo size humerus and terminal phalanx, wildebeeste astragalus, porcupine incisors (2) and a leopard humerus. Numerous other elements, primarily zebra and medium size (II) bovids, were identified but not collected. The association of well preserved, abundant and species diverse faunal material with LSA artifacts was potentially significant. Previous LSA faunal material situated on the lake floor, including from Olkena, experienced poor bone preservation due to fluctuating water tables (Barthelme et al. 2004). Oloololo appeared to be different and to represent a possible Late Pleistocene-Holocene butchery locality or occupation area.

During the 2006 field season, thirty-two surface collecting squares, each 5 m by 5 m, were laid out in a continuous grid and all lithics and faunal material were collected from each square. Identifiable bones were individually plotted and collected. Five excavation units, each  $1 \frac{1}{2} m^2$ , were located on a moderately steep erosional exposure within both excavation squares. Surface artifacts included LSA microlithic shaped tools, angular fragments, quartz hammerstones and, unlike the 2004 collection, ostrich eggshell fragments. Also recovered were redeposited water abraded and partly desilicified large chert flakes and angular fragments most probably from nearby MSA localities. Two whole flakes – chert and obsidian – were discovered *in situ* along



Figure 1: Map of the southern Kena rift indicating the locations of Olkena and Oloololo.

the erosional margins of the western outcrop. Excavation also yielded over 30 other LSA lithics but no shaped tools. Discrete activity areas were not recognized.

Surface faunal material was extremely rich and included primarily zebra and bovidae ranging in size from dik dik - duiker to eland-buffalo (Table 2). Over 580 specimens were collected. Except for several heavily water abraded shaft fragments, again most probably redeposited MSA material, all other faunal material was well mineralized and unabraded. Excavated fauna was found throughout the ~35 cm deposit but was especially concentrated at the unit's base, 1- 4 cm above the underlying Oloronga Beds

#### Table 2: Oloololo Species List

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Dik Dik-Duiker (Size 1 Bovidae) Thomson's Gazelle (Gazella thomsoni) Grant's Gazelle (Gazella granti) Wildebeeste (Connochaetes taurinus) Common Eland (Taurotragus oryx) Burchell's Zebra (Equus burchelli) Leopard (Panthera pardus) Ratel (Mellivora capensis) Porcupine (Hystrix cristata) Lagamorph-NID Reptile-NID Pisces-NID

(Figure 3). While deepening the excavation unit for a stratigraphic profile, we uncovered a zebra distal radius, wildebeeste metapodial (complete) and an articulated wildebeeste radius (complete) and ulna (broken) near this contract. Other identified elements, excavated above the stratigraphic contact, included a zebra second phalange and porcupine metapodial. However, the total number of excavated bones totaled only 28 specimens. On both the surface collected and excavated bone assemblage butchery marks were not observed. However, a number of bones showed distinctive evidence of rodent gnawing and especially hyena canine

 Table 3: Olkena ostrich eggshell.

depressions and chewing marks. All species were identified as modern.

During the 2007 field season, we decided to lay a surface grid over the entire site and to individually plot all MSA and LSA lithics, identifiable bones, teeth and ostrich eggshell fragments. Sixteen surface squares, each 10 m by 10 m, were gridded. Due to our extensive surface collection in the 2006 field season, comparatively few identifiable whole bones/teeth were collected in 2007. Specimens identified included a complete zebra second phalange, an immature zebra proximal phalange, suid metapodial, and a carnivore caudal vertebrae (hyena size). Shaped tools included a broken weathered MSA projectile point and LSA material included an obsidian backed blade, two chert scrapers, eight cores and over 200 pieces of debitage. Twenty-one ostrich eggshell fragments were either plotted or collected in the squares. Outcrop 2, the topographically highest area on the site, was selected for excavation principally because three LSA lithic artifacts were in situ along the southern exposure. An initial 3 m x 4 m excavation area was subdivided into two excavation squares each 1 1/2 m x  $1 \frac{1}{2}$  m. Excavation progressed in either 5 or 10 cm arbitrary levels. All sediment was sieved through a 4 mm wire mesh. Our 2007 excavation produced very few specimens. Only 9 examples of LSA debitage (no shaped tools) were recovered. Faunal material consisted of 43 specimens mostly small unidentifiable bone fragments. One zebra broken metapodial was excavated at the unit's interface with the underlying Oloronga Beds. The metapodial was spirally frac-

	<u>19</u> sf	999 ex	<u>20</u> sf	0 <u>2</u> ex	<u>20</u> sf	<u>04</u> ex	<u>2006-2007</u> sf	<u>Total</u>
Beads	3	9	17	12	18	5	25	89
Preforms			41	41	48	8	19	157
Fragments	48	62	186	88	252	30	193	859
								1105



Figure 2: Chert borers from Olkena.

tured and showed significant carnivore chewing. No fragments of ostrich eggshell were recovered during excavation.

Oloololo is located within a major drainage system on the first fault escarpment west of Lake Magadi. Oloronga and High Magadi Beds occur in the drainage area and were deposited during Lower-Middle Pleistocene and early Holocene high lake levels. These sediments were laid down as the expanded lakes flooded valleys and low lying escarpments. The artifact unit consists of a horizon of 25 - 45 cms of light brown partially cemented silty sand with subrounded to sub-angular rock fragments 1 - 2 cms in diameter. Occasional rock fragments reached 2 - 4 cms. The artifact layer is associated with overbank sediments lateral to widespread valley fluviatile sands and cobbles. The site's floodplain sediments were partially buried under more recent stream and overbank activity, primarily by large rounded and sub-angular volcanic cobbles. Most of this overlying material is concentrated on the southern flanks of the site nearest the modern erosional stream. Recent slope erosion of a fault scarp to the north has also produced an irregular layer of large volcanic boulders that partially cover the outcrop.

The geological context at Oloololo at present can be interpreted two very different ways. The first interpretation suggests the low density of LSA artifacts and numerous bone materials may represent a discrete and spatially limited occupation area and/or butchery of numerous prey species. The site was subsequently abandoned and at some point, hyenas repeatedly ravaged the bones leaving diagnostic canine depressions and chewing marks. The site was situated adjacent to a major river system on a fault scarp eroding Oloronga and High Magadi Beds. Subsequent erosion and flooding buried the site under overbank silty sands. More recent erosion exposed the artifactual horizon and cultural material. This interpretation suggests the site would date to post-Holocene approximately 9500-5000 BP.

A second interpretation argues that Oloololo is part of a complex sedimentary sequence consisting of fluviatile sediments deposited prior to the Holocene High Magadi Beds and followed by erosional cut and fill channel and overbank deposits (Figure 3). The "site" was situated lateral to an incising channel and was subsequently buried by early Holocene High Magadi Beds. Subsequent erosional activity removed the overlying High Magadi Beds and recent depositional activity contributed overlying river cobbles, gravels and escarpment boulders. This second interpretation suggests similarity to Lanyamok, a Middle Pleistocene site excavated some 40 kms to the south of Oloololo (Potts et al. 1984). The abundant fauna at Oloololo would, like Lanyamok, represent a natural accumulation of bone most probably by hyenas and porcupines. Taphonomically, the wide diversity of species, abundant gnawing/chewing evidence and clear hyena canine puncture marks are all indicative of animal accumulation and non-human modification. Associated low density LSA lithics (some heavily weathered) reflect redeposition of upstream archaeological occupations and therefore are not directly associated with the bones. If this interpretation is correct Oloololo is not an archaeological site.

We favor the second interpretation for the following reasons: First, geological studies in 2007



Figure 3: Composite stratigraphic section of Oloololo sediments.

revealed the Oloololo horizon lay stratigraphically more than 3 metres <u>below</u> nearby remnant outcrops of early High Magadi Beds and hence is older than ~9,800 BP. Second, taphonomic analyses indicated abundant bones with evidence of hyena chewing and puncture depressions on cranial and post cranial fragments. Gnawing by porcupines was also conspicuous. As well, the wide diversity of species identified from Oloololo (often from a single bone), including bovids ranging in size from dik-dik to eland as well as zebra, leopard, ratel, a small unidentified carnivore, lagamorph, tortoises and bird, argue for scavenger accumulation. Third, butchery marks were absent on all faunal specimens (over 600 in number) and no discernable archaeological levels were recognized. Lastly (and most importantly) two recent AMS <sup>14</sup>C dates on bovid tooth apatite show the Oloololo unit, like Olkena, has an age of over 10,000 BP and hence was deposited <u>prior</u> to the High Magadi Beds. In summary, while Oloololo yielded a wealth of well preserved and taxonomically diverse late Pleistocene species, it is not a primary archaeological site.

# Olkena (GxJJ 1) (1° 50' 103'' S — 36°13' 270'' E)

During the 2006 and 2007 field seasons we continued to surface sample the LSA site of Olkena (Barthelme et al. 2003). Twelve surface units, each 5 m by 5 m, were gridded on Watene's outcrop. All lithics, bone and shell fragments were collected, washed and analyzed in camp and again by one of us (Barthelme) at the National Museum. We were especially interested in expanding the collection of diminutive chert borers and associated ostrich eggshell beads. Table 3 indicates over 1,100 ostrich eggshell pieces have been recovered at Olkena including 89 unbroken beads (combined surface and excavation totals). Roughly 15% of the total eggshell was burned. Associated with the ostrich eggshell beads we recovered 51 diminutive cryptocrystalline silica borers (Figure 2). All were manufactured from local white Magadi chert and, except for one example, all borers were double ended. Most pieces had rounded to sub-rounded ends often showing microflaking and blunting, most probably evidence of ostrich eggshell drilling and perforation. A sample of 28 borers indicated relatively small mean length, breadth and thickness values of 19.12 mm, 6.92 mm and 3.48 mm respectively. While obsidian, lava, quartz and other cryptocrystalline raw materials were available (especially Magadi green chert) only white chert was selected for borer manufacture. Other reports of associated ostrich eggshell beads and lithic borers are relatively rare in East Africa but include the Pastoral Neolithic Jarigole Piller Site at Lake Turkana (Nelson 1995; Vuruku 1997) as well as a series of LSA sites in South Africa (Orton 2008). Most of the South African LSA sites are, however, associated with iron tools for bead perforation. Lithic borers have also been reported from South America and are associated with marine shell disc beads (Mascucci 1995). An experimental project by a St. Lawrence University student (Chartier 2003) revealed the perforation of ostrich eggshell and bead manufacture was clearly functional using hand held, hafted and bow drill Magadi chert borers. A forthcoming report on the Lake Magadi chert borers and ostrich eggshell beads will examine their relationship in greater detail. Finally, a second AMS <sup>14</sup>C date on ostrich eggshell confirmed an age of 10,450 + 75 BP for the age of Olkena (Table 1).

# Human Burial (GxJJ 2) (1° 49' 58" S — 36° 13' 35" E)

During the 2002 field season, a potential burial cairn was discovered several hundred meters northwest of Olkena (Barthelme et al. 2003). The structure, primarily of vesicular lava, was 3m in diameter with a maximum height of 77 cm. We initially were hopeful the cairn might be associated with the LSA occupation at Olkena. Excavation proceeded by sectioning the cairn in half and removing the fill in 10 cm spits. At 55 cm below ground level the human burial was discovered. The body was interred in a flexed position, facing 330° NW, bone was poorly mineralized and burial goods were absent. Initial attempts at 14C analysis of bone were unsuccessful due to leaching of bone collagen by carbonate rich groundwater. However, two subsequent AMS 14C dates on human tooth apatite yielded dates of 1000 BP (Table 1). The radiocarbon dates were unexpected as they indicated probable early second millennium pastoralist populations in the basin. Very little archaeological material has yet been identified with pastoralist (or agricultural) groups of this age. The burial was only partially excavated and will be fully removed in future field seasons by students at Kenyatta University.

#### **Future Research**

In 2009 our field research will focus on the LSA site of Olkena. Professor Murimi and students will continue their studies of the site's microstratigraphy and sedimentary environments. Excavations will focus on enlarging the sample of stone artifacts and fossiliferous bone. In particular we will investigate possible ostrich eggshell bead manufacturing areas as well as microlithic tool workshops.

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