■ MOZAMBIQUE

Middle and Later Stone Age Sites from Sofala, Gorongosa (Central Mozambique)

Julio Mercader
University of Calgary
Department of Archaeology
2500 University Drive, NW. Calgary
2N 1N4, Alberta, Canada
Email: mercader@ucalgary.ca

Peter Sillén
Uppsala University
Department of Archaeology and Ancient History
Box 626, 75126 Uppsala, Sweden
E-mail: peter.sillen.8105@student.uu.se

Introduction

Environmental palaeoanthropology studies the effect of climate and landscape variability on the biological, cultural, and social development of hominins to understand our adaptive capabilities in the distant past. Cast a glance at any map of Africa and it is obvious that Mozambique has a critical geographical location linking southern, central, and east Africa (Figure 1). The Mozambican Rift Valley offers a promising setting for the study of adaptations and habitat choice in response to millenia of climatic variability, often of extreme magnitude. Bound by the Pungue and Rovuma watersheds, the study area captures the unique climatic, ecological, and biological features that correspond with the intersection of Southern Africa's temperate and tropical zones, and it was a likely route for animal and human populations traveling north-south along the African Great Lakes. It is today a rich, diverse biological haven -- a living evolutionary laboratory where different ecosystems interdigitate ranging from arid-adapted, open grasslands to woodlands to patches of Guineo-Congolian rainforest.

During the last decade, palaeoclimatic, palaeodemographic, and palaeolithic research in southern Africa have focused on coastal sites under the assumption that these were refugia for human populations during periods of environmental change, drought, loss of tree cover, the near-extinction of our species, and the presumed abandonment of the interior in favor of the coast (e.g., Carto *et al.* 2009). Recent work in the Niassa and Malawi basins has also explored the effects of climatic variability and landscape diversity on human occupation of the interior during the severe climate fluctuations of the late Pleistocene and, along with this survey, show an abundance of occupation sites inland; an ideal region to test the validity of coastal-centric environmental and demographic hypotheses. Although the archaeology of the northern Niassa / Malawi rift (Mercader *et al.* 2009, 2012; Thompson *et al.* 2012) has revealed a preliminary chronology and understanding of technological variability during the late Pleistocene of the interior zone along the East African Rift System, the culture history of the southernmost rift basins (e.g., Urema/Save) remains entirely unknown.

Context

The Urema Rift Region is new to paleoanthropology, and no previous work prior to our pilot research in 2010 had been conducted here. It falls within the Mozambican province of Sofala, in Gorongosa National Park (10000km^2) (Figure 1). The park's most salient physiographic feature is the Rift Valley Floor: a 40km wide, low-lying corridor along a graben bordered by midland scarps and highlands (Beilfuss *et al.* 2007). The hydrological network flowing through this passage constitutes Lake Urema's watershed (Beilfuss *et al.* 2007; Böhme *et al.* 2006; Steinbruch and Macario 2007; Steinbruch and Merkel 2008). A long geological sequence that includes Proterozoic, Mesozoic, Cenozoic, and Quaternary formations

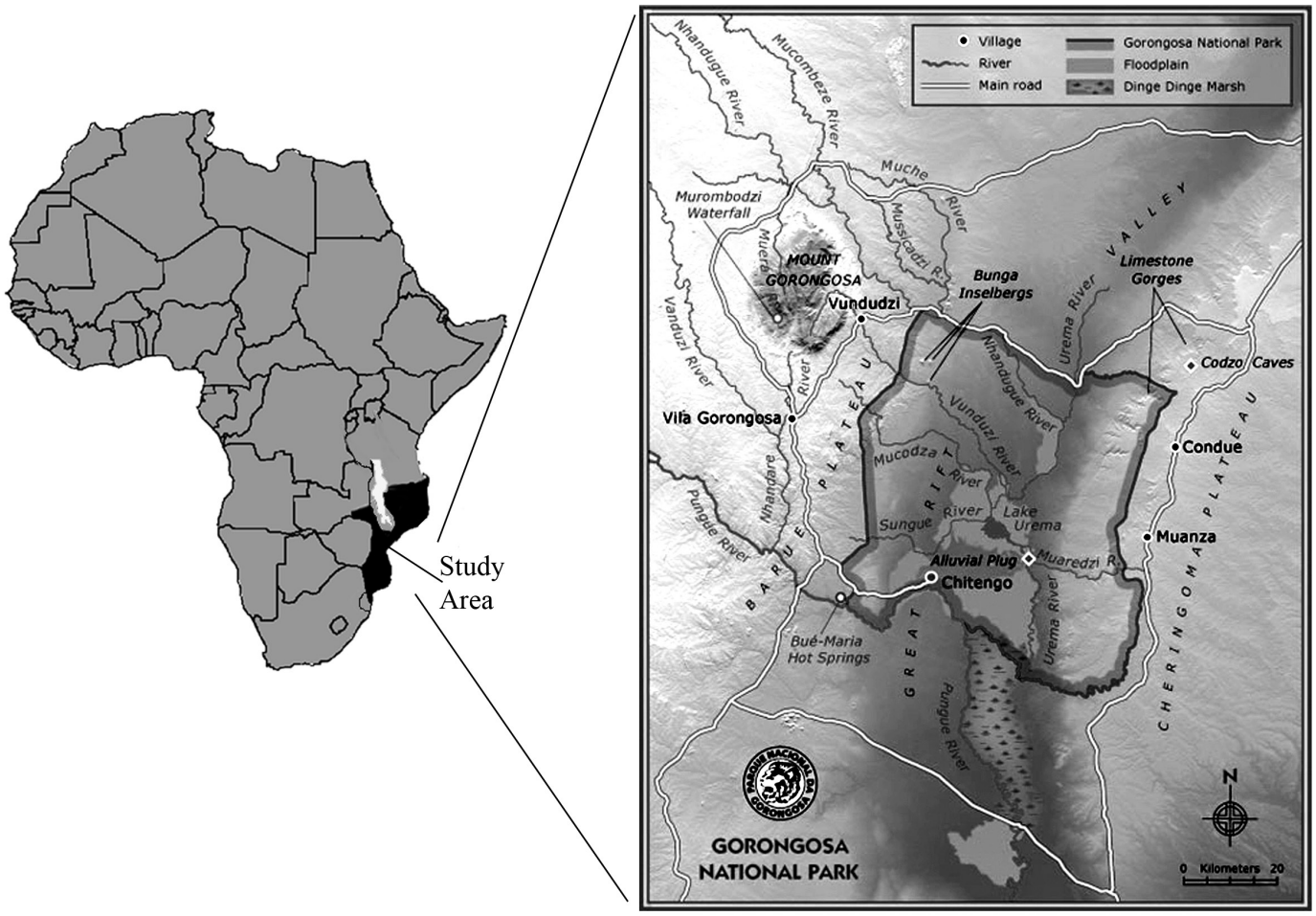

Figure 1: Map of Africa and study area (Gorongosa National Park Scientific Services).

yields terrains of diverse lithologies (Steinbruch and Macario 2007); capped by soils that exist under various temperature and rainfall regimes. There are extensive quartz, quartzite, rhyolite, trachyte, dacite, flint, and basalt outcrops. The complex interplay of geology, topography, soil, and climate supports a staggering diversity of local landscapes in which 15 different plant communities (e.g., Coates Palgrave *et al.* 2007) inter-digitate and thus create multiple ecotones across five territorial units (Beilfuss *et al.* 2007): 1) the rift floor, 2) the Gorongosa massif, 3) western midlands, 4) the Cheringoma Limestone plateau, and 5) the Rift Valley flanks. The Rift Valley floor is known to have supported one of the highest concentrations of large mammals and biodiversity anywhere in East Africa (Anderson *et al.* 2008) with a carrying capacity ranging from very high for the grasslands to medium for Zambezian woodlands. In summary, the Gorongosa region is a natural passage and biological haven that today supports the two ecosystem types where much of early human evolution occurred: woodlands and grasslands.

Early reconnaisance laid foundations, secured research permits, and established rapport with local communities and authorities. Archaeological research required ample time for traveling, political logistics, surface survey, and archaeological testing. From a logistical perspective, during a given field season we travelled 3360km from the provincial capital of Sofala to the city of Beira. In terms of hours allocated to each one of the research components, travel time was 40%, followed by

testing (30%), survey (15%), and logistical matters (15%). The total number of sites discovered much underestimates the number of actual archaeological sites in the area we preliminarily explored: there always is a strong correlation between rapport with local groups, length of stay in their homeland, and disclosure of cave locations.

The Cheringoma Plateau is composed of nummulitic limestone and glauconitic gres from the Tertiary (Direcção Nacional de Geologia 2006). This carbonate formation is rich in caves; including some of the longest karst passages known to date in Southern Africa (Lächelt 2004; Laumanns 2001; Vachamuteco 1982; Van Solen 1928). The six watersheds that cut through the Cheringoma plateau (Mazamba, Nhanfizi, Kundwe, Mazikidze, Muanza, and Muaredze) were surveyed from 2010-2012, resulting in the discovery of 70 sites representing the Middle Stone Age (MSA), Later Stone Age (LSA), and the Iron Age (IA).

Results

We documented occupation sites in four parts of the landscape (Table 1), from the regional divide to the rift floor. The slopes linking the Urema graben with the limestone plateau contain rainwash and gravity-assisted creep sediments housing multiple MSA assemblages in the Mazamba (*Nhamatope*), Muanza (*Pedreira*), and Muaredze basins. The upper escarpment supports stratified cave sites overlooking the valleys and giving access to hilltops (e.g., the sites of *Nhamissimbiti* and *Nkoto*). The hilltops show artifact accumulations in small dissolution basins located across the ridges (e.g., *Nhagutua*). It also comprises shafts that received surface-derived sediments, formed a talus cone at the bottom of the shaft, and give access to large caverns; all of which houses palaeohydrological, climatic, and archaeological records in both detrital and chemical sediments (e.g., *Nhamababwa* -see below, and *Konga* cave in the Kundwe basin).

During 2010-2011 we focused on the sites of *Nhamissimbiti* and *Nhamababwa*. They are located in the Mazamba Basin, and belong to contrasting ecozones as well as positions on the landscape. This difference is likely to have had an impact on focality, spatial distribution of archaeological remains, site formation, and preservation.

Nhamissimbiti (Figure 2) is located in the locality of Khodzue at 200m above sea level (asl) (S18˚31'56.6" / E34˚53'33.2"). Its longest axis measures ~30m, with a mouth oriented 310˚ northwest. The archaeological potential of the region is illustrated in the following description of *Nhamissimbiti*'s stratigraphic profile: briefly, from top to bottom: Layer 6 consists of a sandy silt matrix containing Iron Age ceramics. Layer 5 contains hearths and stone tools from the Later Stone Age dated by to 9250±40 BP conventional radiocarbon years (Beta-304953). Layer 4 is windborne and represents a hiatus that partly separates Layers 5 and 3. Layer 3 is 2.5m thick. The top 0.5m yielded diminutive tools, small blades, and points of LSA affiliation. The 2m of sediment beneath this horizon yielded prepared cores, scrapers, drills, points, fossilized bones, and teeth that belong with the MSA. Table 2 lists the techno-typological

1. Stone tool accumulations at places where slope inflection allowed for gravitational and slopewash build-up at times of water table and sea level drop.
2. High relief, stratified cave sites providing access to the rift floor, valleys, ridges, and hilltops,
3. Former pond basins across the high plateau ridges where prehistoric artifacts from temporary campsites near the water's edge fell in after abandonment,
4. Stratified shafts leading into large caverns.

Table 1: Description of landscape settings where archaeological evidence has been found.

Figure 2: Left: View of excavation trench at Nhamissimbiti. Right: Nhamabawa.

Culture	Raw material	Techno-typology
LSA	Almost exclusively quartz	Small blades, points, scrapers
Late MSA	Quartz dominant, not exclusive	Scrapers, drills, points (discoidal)
Earlier MSA	Chert, basalt, rhyolite, some quartz	Prepared cores, points, bifaces

Table 2: Differences between Middle and Late Stone Age stone tools.

differences between the MSA and LSA artifacts. The faunal assemblage contains mammalian bones, teeth from carnivores, bovids, primates, and pigs; all groups adapted to woodlands. Bones from rodents and small mammals abound. Layer 2 was deposited in a low energy environment in which calcified silts alternate with grit. The presence of unconsolidated sediments alternating with cemented chemical calcite indicate the existence of an ancient roofed cave that originally extended 20m beyond the modern cave mouth. The dating of two calcite samples from a stratified fossiliferous speleothem (Figure 3) by Dr. Larry Edwards' Geochronometry Lab at the University of Minnesota suggests an initial late Pleistocene age for this part of the sequence (^{230}Th age yr BP, corrected: 113625±770 / 105672±1030).

The faunal assemblage recovered from this dated deposit included the well-preserved fossilized mandibles, molars, and long bone fragments of pigs, bovids, and primates. The discovery of 355 vertebrate fossils from Layer II (e.g., those in Figure 4) broadens the palaeoanthropological and environmental potential of these caves, for they are the first fossiliferous layers from the Mozambican Quaternary. Bone preservation is optimal, and the pieces retrieved from a test area <1/2m^2 include mandibles, molars, and long bone fragments. The interstratification between clastic and chemical sediments, the fact that these bones yield a clean contact with the surrounding calcite matrix (Figure 4), and their geometrical position within the rock are indicative of an ancient roofed cave and sinkhole environment. Layer 1 is made up of sticky clays coating a floor covered with cemented broken fragments and chemical cave sediments.

The *Nhamababwa* site (S18°32' 58.7" / E34°52' 43.7") is a sink hole leading down into a cavern (Figure 2) that is located approximately 4km from the rift floor, in an area currently covered by Guineo-Congolian rainforest. The cap (Layer IV) consists of layered scree thicker than 4m, steeply sloping into the cave mouth. (Layer III) contains MSA lithics techno-typologically comparable to those from *Nhamissimbiti*'s Layer III in a sandy silt matrix 3.5m thick. Layer II comprises clastic weathering detritus with abundant faunal remains. Layer I contains collapse boulders in silty clay. The number of stone pieces retrieved is 278, but the concentration per m^2 is higher than at *Nhamissimbiti*. The site is rich in mammalian teeth (n=115), macrofaunal (n=2888), and microfaunal remains (n=1104). The total composite sedimentary accumulation is in excess of 9m.

Other sites include:

- *Nkoto Rockshelter*: (S18° 38' 5.8" / E34° 48' 30.8"). Elevation: 201masl. Ceiling height is 5m. The area under overhang protection covers 340m^2 and surface archaeological evidence includes IA ceramics (n=16), charcoal (n=15), and bone (n=2). Excavation yielded an additional 154 remains that include more pottery, bone, lithics, beads, shell, and teeth. The talus is >3m thick and forms a subhorizontal platform that seems ideal for inhabitation. Testing here unearthed ceramics (n=18), bone (n=12) shell (n=20) and lithics (n=4) from stratified deposits. Ancient forest fires documented at 1.3m of depth suggest good potential for palaeocological research.

- *Nhagutua (Antigo Posto do PNG)*: (S18° 38' 36.7" / E34° 48' 48.7"). Elevation: 224m asl. This open air site documents that MSA hominins were also attracted to the pooling water that filled up many of the small sinkoles and micro-basins from the uppermost ridges of the limestone plateau. After occupation, the cultural remains rolled into small basins, where they are preserved today. Surface evidence consisted of quartz and rhyolite tools, and excavation exposed 242 lithics, including classic indicators of MSA affiliation such as radial technologies (5c), large geometrics (Figure 5d), core scrapers, and levallois flakes. This type of archaeological context deserves immediate protection: local mining companies in this kind of setting have a prime target because of the ease with which dolomite and limestone crop out.

- *Nhangona* (S18° 41' 30.5" / E34° 46' 37.3"). Elevation: 210masl. Rockshelter by the river Kundwe with an overhang facing northeast. Area covered by shelter is 95m^2. Estimated talus thickness is 2m. Ceiling height is 3m. Surface archaeological evidence includes 3 microlithic tools including a geometric and a drill from the Later Stone Age.

- *Kundwe* (S18° 41' 26.9" / E34° 46' 27.7"). Elevation: 204masl. Karstic cave with a main axial chamber measuring 30m southwest. Three tangential chambers run northeast. Maximum corridor width is 3m. Ceiling height is 5m. Dry speleothems. The floor is

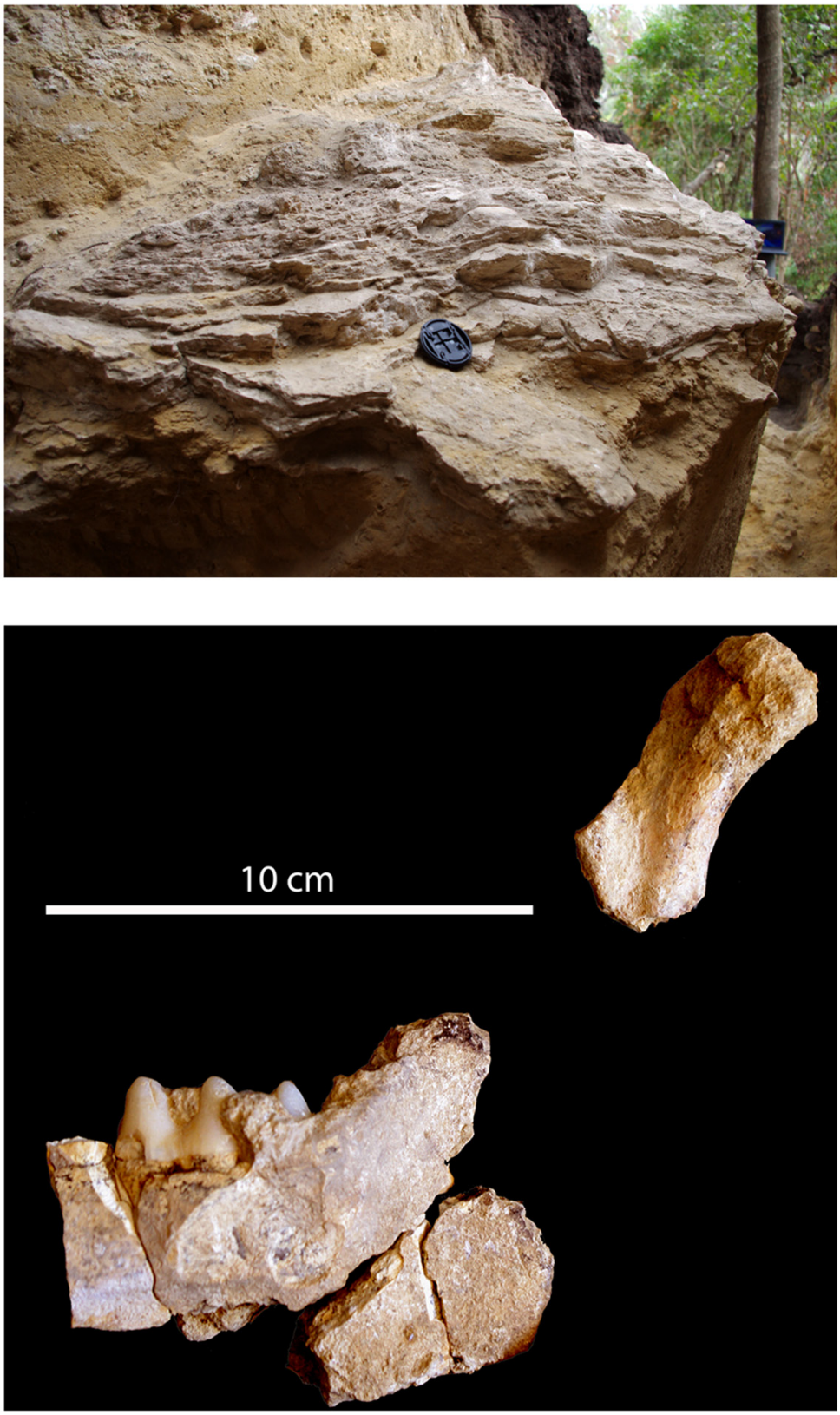

Figure 3: Upper: Stratified fossiliferous speleothem from Nhamissimbiti. Camera cap shows the location of calcite sample employed for U-series dating by Dr. Larry Edwards at the Geochronometry Lab at the University of Minnesota. Lower: Fossilized suid mandible.

Figure 4: Fossil specimens from speleothem at Nhamissimbiti's layer 2.

coated with cobbles. Archaeological surface materials include three IA ceramics, and four lithics. Chamber morphology suggests an ancient mine, with typical adit shape. There is a large resident bat population and guano resources.

- *Kundwe* "machibombo" (S18° 41' 19.7" / E34° 46' 23.8"). Elevation: 197masl. Rockshelter covering 200m^2. Surface evidence: 41 lithics. Testing yielded an additional 1128 stone tools of typical LSA affiliation. Poorly preserved bone and teeth. No ceramic occupation.

- A group of four open air sites located between the Chuaua basin and Maziquidze village with classic MSA indicators (Figure 5f). Surface evidence totals 32 lithics. Location of these four sites: S18° 46' 24" / E34° 45' 11" (188masl), S18° 45' 51.3" / E34° 45' 16.9" (210masl), S18° 45' 25.5" / E34° 45' 35.1" (210masl), and S18° 44' 51.4" / E34° 45' 38.9" (182masl).

- *Pedreira*: This is the central lime exploitation site by CIMPOR, around coordinates S18° 48' 58.3" / E34° 44' 14.1" (153masl). The archaeological open air site here is aerially very extensive, and lime exploitation has already damaged 15000m^2 of it. The archaeological layer is part of a diamicton package that unconformably caps the limestone exploited by CIMPOR. Thickness of archaeological package is in excess of 2m. Total number of LSA lithics collected from the destroyed portion of the site is 45.

- *Pedreira Cave* is located in the proximities of the modern quarry site, 7m away from the Muanza river (S18° 48' 41.9" / E34° 44' 11.8" at 125masl). Initially documented by Steinbruch (2011). The cavity opens to the southeast (180°) and shelters 60m^2. Ceiling height is 5m.

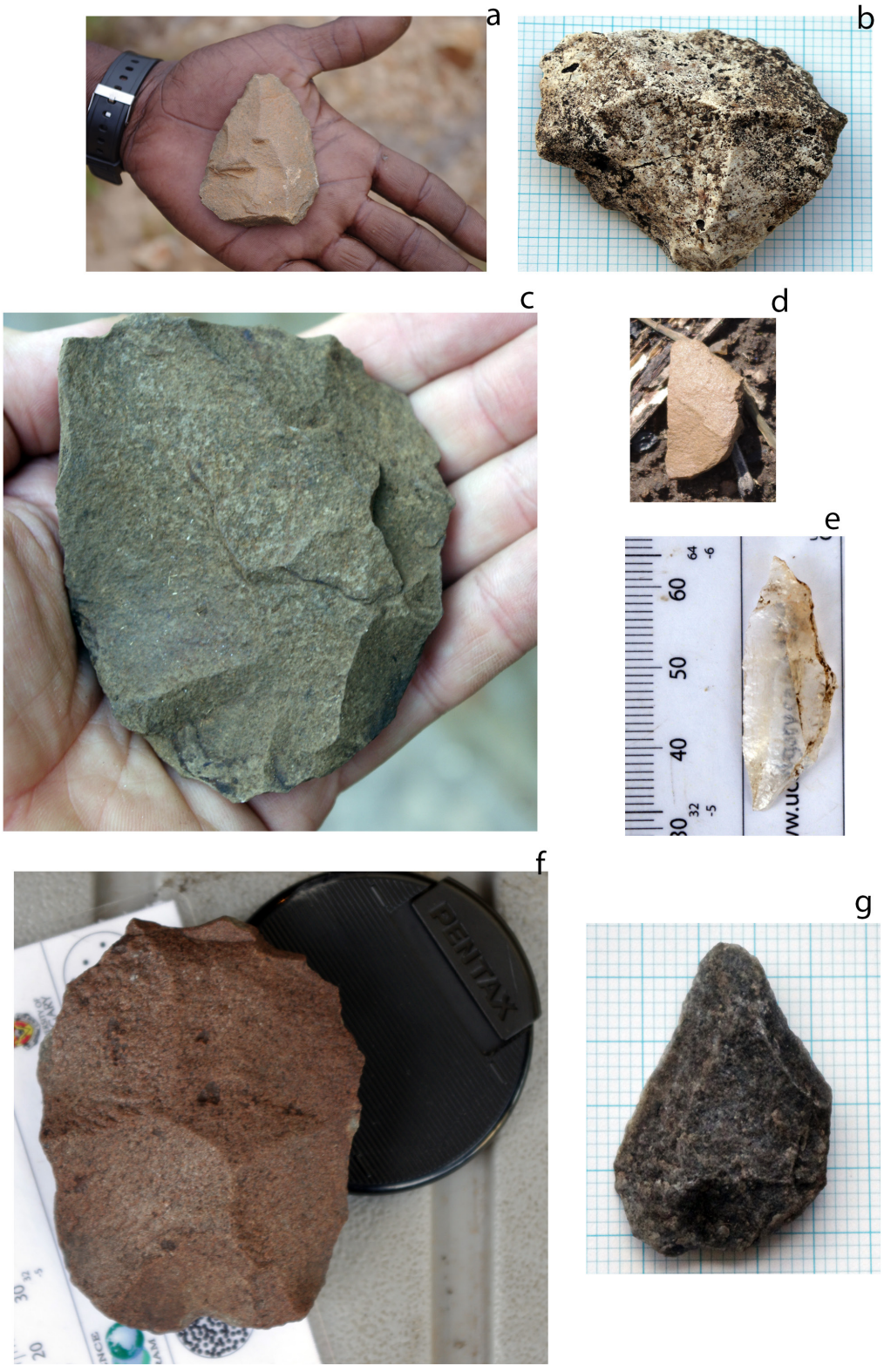

Figure 5: a) Levallois point from road site at Nhamatope; b) large Levallois flake from the open air site at Muaredze; c) discoidal technology from Nhagutua; d) large lunate, Nhagutua; e) quartz lunate from Konga; f) levallois core from open air site located near Maziquidze (S18˚ 41' 35.1" E34˚ 46' 49.8"); g) discoidal point from the open air site at Muaredze.

- Another site in the Muanza valley inside CIMPOR's concession is an open air locus in the proximities of Nhamatica, yielding Middle to Later Stone Age materials. Located at S18˚ 46' 44.7" / E34˚ 40' 21.6". Elevation: 90masl. This site is adjacent to the old lime concession boundary marker from the 1960s.

- Within walking distance there is *Konga* (S18˚ 48' 46.3" / E34˚ 41' 02.8"); by the Muanza River, at 125masl. This place is inside the mining concession. It has special relevance for locals, and like some other larger caves in the region, it is perceived to be the place where ancestral spirits (Mizimu) reside and take the form of hybrid magical creatures half human, half lion / cobra. Konga's main chamber extends >375m^2 and two adjacent galleries extend an additional 35 linear meters. Ceiling height is >8m. Archaeological evidence on the surface consists of 23 artifacts that include MSA radial technologies in metacherts as well as large crystal geometrics (Figure 5e). Fossil animal bone and teeth were also recovered. The site was partly damaged by guano collectors in recent times, who removed the archaeological deposits from the main chamber's central sector.

- The open-air sites from the Muaredze basin are formed by stone tool accumulations at places where slope inflection allowed for gravitational and slopewash build-up at times of water table and sea level drop. These materials compare to those from *Nhamissimbiti* (layers 3 and 2) and the road-side, open air site at *Nhamatope* (Figure 5a). The *Muaredze* sites are located in the proximities of the rift floor and near a flint outcrop called Monte Mangere, where stone tools in stratified deposits can be seen in gullies extending a distance of >150m. Raw materials show a heavy reliance on sedimentary, volcanic, and metamorphic rocks such as metachert, basalt, quartzite, and rhyolite (Figure 5b,g). The three main open air sites are bracketed by these two sets of coordinates: S18˚ 57' 06.9" / E34˚ 36' 17" and S18˚ 57' 06.1" / E34˚ 36' 26" at 50 to 70masl. All sites combined spread >2500m^2 and possess special archaeological significance for having yielded MSA technologies that, from a techno-typological perpsective may represent, along with those from Nhamatope (Figure 5a), an earlier MSA phase. From a purely scientific perspective this area is precious because it represents the geological boundary between the limestone plateau and the rift floor. From a natural / scenic point of view it is an area of extraordinary beauty typified by the karst canyons of the Muaredze (touristic potential and cultural significance). Locus 1: 101 lithics. Locus 2: 39 lithics. Locus 3: 30 lithics.

- *Ndendera*: Iron Age cave site initially discovered by Steinbruch (2011) in a locality of cultural relevance to local groups for their traditional exploitation of honey resources. (Ndendera is the name of a tool for dislodging honeycombs from the 12m steep, picturesque cliff faces that abound in the Muaredze's canyon.)

Acknowledgements

This work could not have been conducted without Dr. F. Steinbruch, the Department of Archaeology and Anthropology at Eduardo Mondlane University, Gorongosa National Park, Baptista Chimbatata, Fernando Chindio, Zito Maleva, the Dept of Archaeology at the University of Calgary, and the Canada Research Chairs Program.

Bibliography

Anderson, J., R. Beilfuss, C. Lopes Pereira and R. Zolho

2008 *Proposed strategy to reintroduce and supplement wildlife populations in Gorongosa National Park, Mozambique*. Carr Foundation.

Beilfuss, R., F. Steinbruch and R. Owen

2007 *Long-term plan for hydrological research: adaptive management of water resources at Gorongosa National Park*. Carr Foundation.

Böhme, B., F. Steinbruch, R. Gloaguen, H. Heilmeier and B. Merkel

2006 Geomorphology, hydrology, and ecology of Lake Urema, central Mozambique, with focus on lake extent changes. *Physics and Chemistry of the Earth* 31:745-752.

Carto, S., A. Weaver, R. Hetherington, Y. Lam and E. Wiebe

2009 Out of Africa and into an ice age: on the role of global climate change in the late Pleistocene migration of early modern humans out of Africa. *Journal of Human Evolution* 56: 139-151.

Coates Palgrave, M., A. Van Wyk, M. Jordaan, J. White, and P. Sweet

2007 A reconnaisance survey of the woody flora and vegetation of the Catapu logging concession, Cheringoma district, Mozambique. *Bothalia* 37:57-73.

Direcção Nacional de Geologia

2006 Map sheet "Gorongosa". Maputo.

Lächelt, S.

2004 *Geology and mineral resources of Mozambique*. Direcção Nacional de Geologia.

Laumanns, M.

2001 *Mozambique. Report on the European speleological project Cheringoma 1998*. Berlin: Berliner Hohlenkundliche Berichte.

Mercader, J., Y. Asmerom, T. Bennett, M. Raja and A. Skinner

2009 Initial excavation and dating of Ngalue Cave: a Middle Stone Age site along the Niassa Rift, Mozambique. *Journal of Human Evolution* 57(1):63-74.

Mercader, J., J. Gosse, T. Bennett, A.J. Hidy and D.H. Rood

2012 Cosmogenic Nuclide Age Constraints on Middle Stone Age Lithics from Niassa, Mozambique. *Quaternary Science Reviews* 47: 116-130.

Steinbruch, F., and L. Macario

2007 Linking databases of different sources and scales for groundwater research in the Urema River Basin/Central Mozambique. *Water Resources Management* 21: 171-184.

Steinbruch, F., and B. Merkel

2008 Characterization of a Pleistocene thermal spring in Mozambique. *Hydrogeology Journal* 16: 1655-1668.

Steinbruch, F.

2011 Muanza-Muaredzi Karst River Reconnaissance Trip. Unpublished report to Gorongosa National Park.

Thompson, J., A. Mackay, D.K. Wright, M. Welling, A. Greaves, E. Gomani-Chindebvu and D. Simengwa

2012 Renewed investigations into the Middle Stone Age of northern Malawi. *Quaternary International* 270: 129-139.

Vachamuteco, A.

1982 *Relatorio das actividades de inventariação de guano de morcegos 1979-1981*. Direcção Nacional de Geologia.

Van Solen, S.

1928 *Relatorio geral sobre os resultados de trabajo geologico-visita a Inhaminga*. Direcção Nacional de Geologia.