

was ornamented with two flanking pillars, beside which were the postholes of a more flimsy closure. The roof had been supported by a central post. The floor of the apse had originally been carefully covered with a wash of red ochre. The floor contained traces of stakes, whose function could not be ascertained.

After careful study of this building, we interpreted it as a place for meetings and cult activities. Even today, family members will meet each evening in a building (*el messiid*) set slightly apart from their house, in order to discuss their problems and to pray.

**The Meroitic Cemetery of the Ancient Town**

Remains of mud brick pyramids were discovered for the first time at Kerma. The three that were found had square foundations with sides of, respectively, 3 m, 4.5 m and 9 m. Access to the funerary chambers was by means of a descending passage leading to a door in a large wall. The burial chambers were fairly large and vaulted. Several holes made by tomb robbers were found at the corners of the pyramids and explained the almost complete absence of finds. The only remains were fragments of jars found in the fill, which gave a date to the tombs of between the end of the first century B.C. and the first century A.D.

It must be stressed that the robbing of the Meroitic tombs varies greatly in extent from one tomb to another. It seems likely that these three tombs had once contained a rich assemblage of grave goods, since even the human remains had been removed.

■ **TANZANIA**

**Paleoanthropological Exploration in the Manonga Valley, Northern Tanzania**

*Terry Harrison  
Department of Anthropology  
New York University  
25 Waverly Place  
New York, NY 10003 U.S.A.*

The Wembere-Manonga Paleontological Expedition (WMPE) initiated a paleoanthropological field program in the Manonga Valley of northern Tanzania during the summer of 1990. The geographical location of the research area is depicted in Figures 1 and 2. The aim of the expedition was to explore the potential of the area for future paleontological and archeological research relating to the earliest stages of human evolution. This paper provides a preliminary account of the paleontological and geological investigations that were conducted in the Manonga Valley during August of 1990.

Fossil sites in the Manonga Valley were first discovered at the site of Tinde by Grace and Stockley during the late 1920s (Grace and Stockley 1930). The fossiliferous deposits at the site were referred to in initial reports as the Tinde Bone Beds (Stockley 1929, Grace and Stockley 1930). Hopwood (1931) published a brief note describing the early collections of fossil mammals from the Manonga Valley, and based on his study of a jaw fragment of a primitive elephantid, Hopwood estimated that the site was equivalent in age to that of the Kaiso Formation in Uganda (i.e., Pliocene in age). A similar fossil assemblage to that found at Tinde was later reported from the locality of Kiloleli, just to the north of Tinde (Williams and Eades 1938, Quennell et al. 1956), but no details of the fauna were provided. In 1959, Kleindienst and Haldemann carried out a brief geological survey at Tinde and Kiloleli, during which time they collected additional

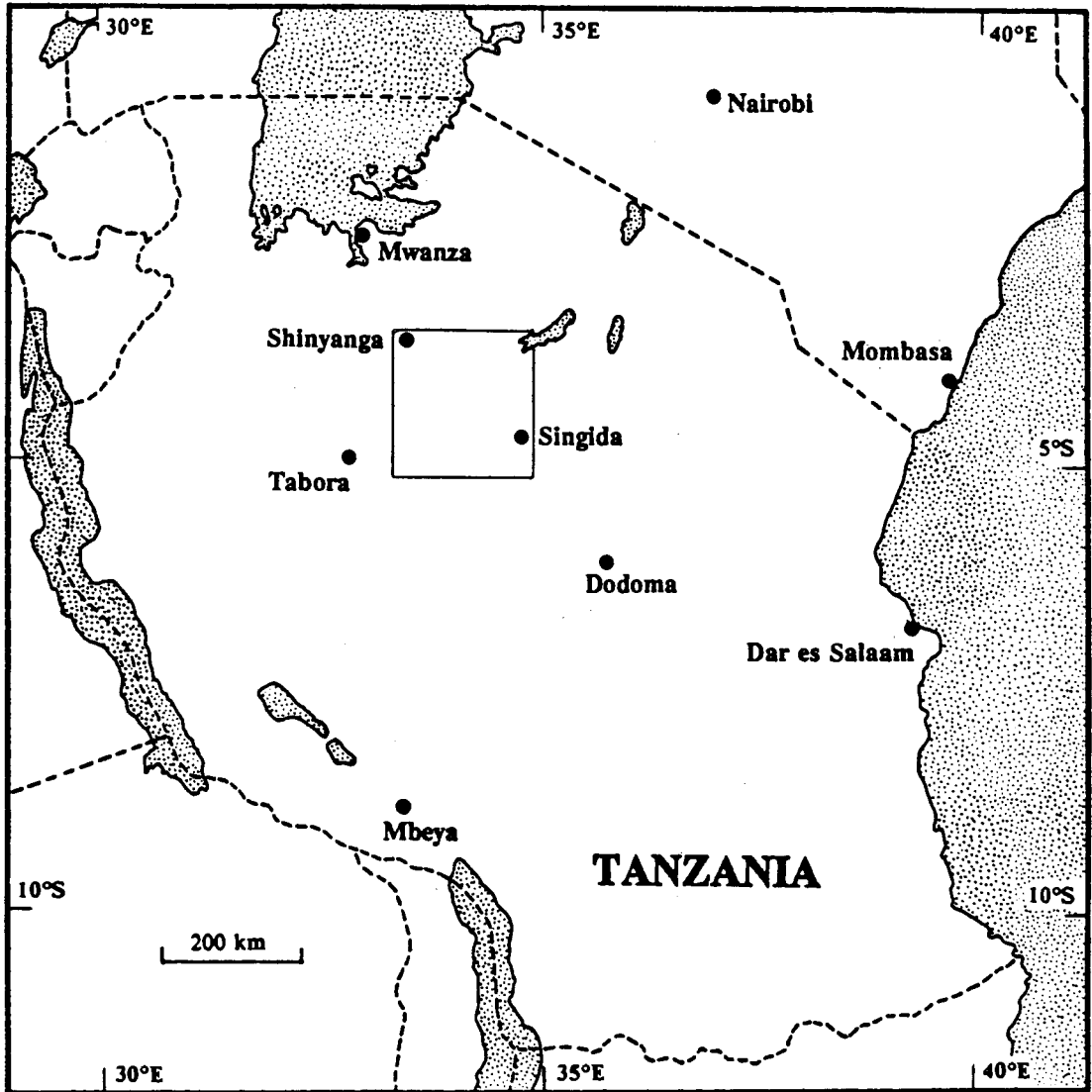


Fig. 1. Map of Tanzania showing the location of the research area (see Fig. 2 for detail of inset).

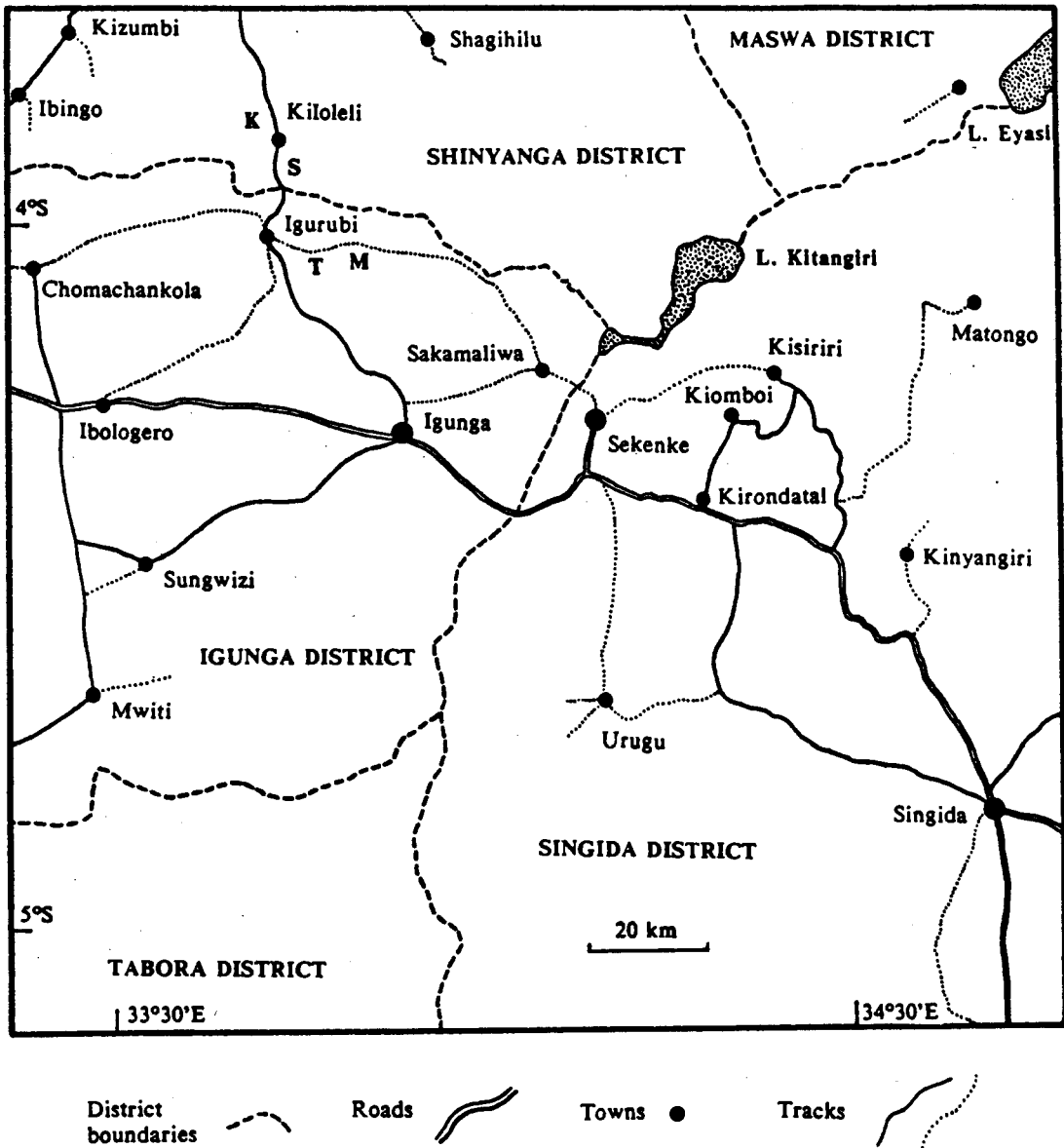


Fig. 2. Detailed map of the research area in northern Tanzania. Fossil sites: K, Kiloleli; M, Mwambiti; S, Shoshamagai; T, Tinde.

fossils. They also recovered fossils to the east of Tinde, at a locality called Nyawa. More recently, in 1976 Philip Leakey and Mark Monahan visited Tinde and made a small paleontological collection (Mary Leakey, personal communication).

The main objective of the 1990 exploratory expedition was to investigate the potential of the fossil localities in the region for further paleontological and paleoanthropological research. The expedition was able to relocate the previously recorded sites of Tinde and Kiloleli (probably corresponding to WMPE locality Kiloleli 2). In addition, three further sites were discovered in the Kiloleli area (Kiloleli 1, 3, and 4), as well as several sites at Shoshamagai (Shoshamagai 1 and 2) and Mwambiti (Mwambiti 1 and 2). Many of the localities proved to be richly fossiliferous, especially those at Tinde and Kiloleli, and the expedition succeeded in recovering thousands of fossil vertebrates, including over 800 taxonomically identifiable mammals. The estimated late Miocene to late Pliocene age of the sites (c 6–3 Ma), in conjunction with their close geographical proximity to other major hominid-bearing localities, makes the Manonga Valley a region of great potential importance for the study of human origins.

### **The Geological Context**

During the Tertiary, the Precambrian basement covering most of the area west of Singida was subject to peneplanation. This resulted in the accumulation in shallow depressions of extensive deposits of terrestrial sands and gravels (Eades and Reeve 1938, Williams and Eades 1938). The erosional cycle continued to mature throughout the Tertiary, eventually resulting in a terrain of relatively uniform topography. The major elevated features were low, rounded, and isolated monadnocks that were formed from the more resistant Precambrian outcrops (Williams 1939).

By the close of the Miocene, crustal instability, associated with the initiation of regional rifting, led to the warping of the basement complex. This produced a

shallow, but extensive lake basin in the Manonga depression (Stockley 1929, Williams and Eades 1938). The Precambrian hillocks of the Tertiary peneplain remained sufficiently elevated to form a complex of small, low-lying islands on the lake. During the late Miocene and Pliocene, fine calcareous lake sediments were deposited towards the center of the basin, while coarser sandy and pebbly facies were produced along the gently graded shoreline (Eades 1936, Williams and Eades 1938, Williams 1939). These Mio-Pliocene lake deposits preserve the fossilized remains of vertebrates and invertebrates that lived around the lake shore during the Neogene.

During the Pleistocene, the Lake Eyasi graben and the Wembere graben to the east of the Manonga depression were initiated by continued tectonic activity of the Gregory Rift. As a consequence, Lake Manonga drained towards the northeast into the deeper Eyasi trough (Williams and Eades 1938, Williams, 1939).

Since the Pleistocene, erosion of the underlying Neogene sediments has been active. A broad, shallow valley about 10–20 km wide, and bordered by low cliffs up to 20 m in height, has been cut in an east-west direction through the Manonga depression. The valley has a low topography, ranging in elevation from 1000 m to 1200 m. The presence of a number of low hills, formed by persistent remnants of the Precambrian basement, has created a slightly undulating surface to the general area. Formation of the valley was initiated by the action of the ephemeral Manonga River, but its continued retreat is due to active erosion at the free faces of the cliffs by heavy seasonal rainfall. These actively eroding cliff faces provide the main exposures of the Neogene lake sediments in the Manonga Valley today, and they are associated with the most productive fossil localities.

### **Paleontological Sites in the Manonga Valley**

During 1990, about 15 km<sup>2</sup> of the Manonga Valley was prospected. Based on evidence from aerial photographs and from a preliminary reconnaissance of the area,

this probably represents less than 1% of the estimated total potentially productive exposures of the Manonga Lake beds. Nevertheless, WMPE recovered vertebrate fossils from ten different localities at Tinde, Killeli, Shoshamagai and Mwambiti.

## Tinde

The site of Tinde, first described by Stockley (1929) and Grace and Stockley (1930), is located in Igunga District, Tabora Region, 7 km southeast of the village of Igurubi (Fig. 2). It is situated in the center of the Manonga depression, about 10 km south of the Manonga River. The site consists of two low bluffs (less than 10 m high) separated by a narrow gap, 110 m wide. Owing to the spatial separation of the fossil-producing beds at Tinde, it was considered convenient to divide the former site into two distinct fossil localities, Tinde East and Tinde West, situated on the eastern and western sides of the gap respectively.

The fossils were found eroding out of a light gray calcareous clay impregnated with a honeycomb-like calcite matrix, as well as the light gray to almost white clay layers immediately above and below the calcite layer.

The fauna from Tinde, which is not particularly diverse, includes bovids, hippopotamids, suids, giraffids, elephantids and carnivores. The most common mammals at the site are *Kobus* sp. and *Hexaprotodon* cf. *harvardi*. In addition to mammals, fish and turtles are extremely abundant, and the remains of crocodiles are quite common. The faunal evidence indicates that Tinde is older than Olduvai Bed I, and is probably slightly older than the Omo Shungura Formation and Laetoli. The sites are therefore broadly comparable in age to Langebaanweg, Lothagam, Lukeino, Chemeron, Kanapoi, Kanam East, the lower Kaiso Formation, the Omo Mursi Formation and the Sagantole Formation of the Middle Awash. The presence of *Hexaprotodon harvardi*, *Nyanzachoerus* cf. *kanamensis*, *Mammuthus subplanifrons* and a primitive species of *Kobus* suggests that the site is early Pliocene in age, probably about 4–5 mya.

The preponderance of aquatic and hydrophilic vertebrates in the fauna confirms the geological evidence of a lake-fringe setting. The fossil site appears to be situated on a slightly elevated portion of the lake floor, in close proximity to a low island chain in the center of the lake. It probably represents the remains of a spit of land that graded into a shallow lake shelf, which may have provided an attractive locus for the congregation of aquatic and lake margin animals. Preliminary taphonomic evidence indicates that the animals died in the lake, or were introduced into the lake as whole carcasses. Disarticulation may have occurred as the organism decomposed, or as a result of random spreading of the individual bones subsequent to decomposition. Damage due to transportation of the bones appears to have been minimal, and none of the bones shows any signs of carnivore or crocodile activity.

## Kiloleli

An important cluster of sites was recognized along a line of low bluffs situated just west of the main Igurubi-Shinyanga road (Fig. 2). The sites have been subdivided geographically into four separate fossil localities. Kiloleli 1 is located just north of the village of Kiloleli, while Kiloleli 2, 3, and 4 are located south of the village. The sites are located in Shinyanga District (Shinyanga Region), about 4 km north of the Manonga River, and about 10 km NNW of Tinde. Williams and Eades (1938) made reference to a fossil site in the vicinity of Kiloleli, but its precise location was not given. From the evidence available, however, it seems likely that their site is equivalent to Kiloleli 2.

The exposures at Kiloleli consist of low slopes and cliffs, less than 10 m high. Careful examination of the surface exposures has revealed that three separate fossil layers are represented at Kiloleli. The main fossil layer is a densely-packed and poorly sorted conglomerate that becomes increasingly coarse as it passes south from Kiloleli 1 to Kiloleli 4. The nature of the sediments indicates that the depositional environment was located in close proximity to a shoreline, presumably of a small island

towards the center of the lake, perhaps represented today by the Precambrian base of Shoshamagai Hill.

Preliminary analysis of the fossils from Kiloleli indicate that the faunas from the different horizons are closely similar in their general composition, and that they all can be considered as penecontemporaneous. The most common mammals from Kiloleli are an elephantid, a hippopotamid and several species of bovids. Other mammals include suids and equids. In addition, the remains of turtles and fish are ubiquitous, and crocodiles are relatively common. The faunal resemblance between Kiloleli and Tinde, with the presence of *Mammuthus subplanifrons*, *Hexaprotodon harvardi*, *Nyanzachoerus* cf. *kanamensis* and *Kobus* sp. at both sites confirms their broad contemporaneity. However, the occurrence of *Hipparion* with prominent ectostylids on the lower molars at Kiloleli, and the fact that the main fossiliferous horizon is located slightly higher in the stratigraphic sequence, suggests that Kiloleli may be slightly younger than Tinde, possibly late Pliocene in age. In addition to the inferred temporal distinction between the two sites, there may also be an important facies difference. The greater abundance of elephantids in relation to hippopotamids, and the presence of equids at Kiloleli, support the geological evidence that the depositional environment may have been in closer proximity to an emergent land surface than was the case at Tinde.

### Shoshamagai

Two fossil sites were located close to Shoshamagai Hill, about 2 km south of Kiloleli Village (Fig. 2). Shoshamagai 1 is located west of the main Igurubi-Shinyanga road, while Shoshamagai 2 is located on the east side of the road. A long line of well-exposed cliffs extends eastwards beyond Shoshamagai 2, and although there was insufficient time to prospect this area in 1990, it is likely that additional fossil localities will be found in the region in the future.

Shoshamagai Hill is formed by an outcrop of the Precambrian basement and

probably represents the remnant of a small island that existed in Lake Manonga during the Neogene. The two sites consist of low, undulating surfaces at the base of the southern slope of Shoshamagai Hill. The superficial sediments consist of a thick layer of olive- or gray-colored clay covered with coarse, angular nodules of banded ironstone and other detritus derived from the basement rocks. The two sites are poorly fossiliferous in comparison to Kiloleli and Tinde, and the material is much more fragmentary. Fossils from Shoshamagai 1 consist mainly of proboscidean remains, while only a single fossil, a tooth fragment of an equid, was recovered from Shoshamagai 2. The fauna is too poorly represented for adequate comparison, but, based on stratigraphic correlation, it is likely that Shoshamagai is equivalent in age to Kiloleli.

### Mwambiti

Two new fossil localities, Mwambiti 1 and Mwambiti 2, were discovered 15 km east of Igurubi along the Igurubi-Sakamaliwa road, about 3 km east of Mwambiti Village (Fig. 2). The two sites are situated on the northwestern and eastern slopes of Mwambiti point, respectively. Mwambiti is a more elevated portion of the long line of cliffs that extend eastwards as a lateral extension of the Tinde bluffs. Mwambiti 1 has yielded the remains of a hippopotamid, an elephantid, an equid, and a bovid, as well as abundant remains of turtles and fish. Most of these specimens were recovered from the surface debris, so their precise provenience is unknown. However, it is likely that the majority of the fossils were derived from a fossil-bearing horizon that is probably the lateral equivalent of the bone bed at Tinde. In addition, a second fossiliferous layer was identified at Mwambiti 1. This bed represents the lowest of the fossil horizons so far identified in the Manonga sequence, and is possibly as old as late Miocene in age.

### Conclusion

The Manonga Valley, which has been almost completely unexplored previously,

has tremendous potential for future paleontological, paleoanthropological, and archeological research. The estimated late Miocene to late Pliocene age of the sites, in conjunction with their close geographical proximity to major hominid-bearing localities, such as Laetoli and Olduvai Gorge, makes the Manonga Valley a region of evident importance for the study of human origins. Hominid fossils from East Africa dated between 6 and 4 million years are scanty, isolated occurrences that provide only a sketchy impression of the anatomy and paleobiology of the earliest hominids. Sizeable samples of undoubted early hominids occur only at localities dated at less than 4 mya (e.g., Laetoli in Tanzania and Hadar in Ethiopia). Clearly the Manonga Valley, with its productive fossil sites that appear to predate Laetoli, has the potential to yield new fossil and archeological evidence that could be very important in more fully documenting the anatomy, paleobiology, and ecological context of the earliest stages in human evolution.

**Acknowledgements**

I would like to thank the Government of Tanzania, the Tanzania Commission for Science and Technology, and the Department of Antiquities, Dar es Salaam, for permission to conduct research in the Manonga Valley. The following colleagues in Tanzania provided invaluable assistance and support: S. A. C. Waane (Director, Department of Antiquities), P. Msemwa (Department of Antiquities), M. L. Mbago (Director, National Museums of Tanzania), W. Bongo (National Museums of Tanzania) and the late J. N. Kyaruzi. I would like to thank the 1990 expedition members, J. Verniers, M. Mbago, J. Krigbaum, C. Kiyembe and A. Tonondo, for their untiring efforts in the field. This project was supported by grants from the New York University Research Challenge Fund and the Boise Fund, Oxford University.

**References**

Eades, N. W.  
 1936 The geology of the Iramba Plateau. *Short Paper of the Geological Survey of Tanganyika* 15: 1-35.

Eades, N. W., and Reeve, W. H.  
 1938 Explanation of the geology of Degree Sheet No. 29 (Singida). *Tanganyika Geological Survey Bulletin* 11.

Grace, G., and Stockley, G. M.  
 1930 Geology of the Usongo area, Tanganyika Territory. *Journal of the East African Natural History Society* 37: 185-92.

Hopwood, A. T.  
 1931 Pleistocene mammalia from Nyasaland and Tanganyika Territory. *Geological Magazine* 68: 133-35.

Quennell, A. M., McKinlay, A. C. M., and Aitken, W. G.  
 1956 *Summary of the Geology of Tanganyika. Part I: Introduction and Stratigraphy.* Dar es Salaam: Government Printers.

Stockley, G. M.  
 1929 Tinde Bone Beds and further notes on the Usongo Beds. *Annual Report of the Geological Survey of Tanganyika* 21-23.

Williams, G. J.  
 1939 The Kimberlite Province and associated diamond deposits of Tanganyika Territory. *Tanganyika Geological Survey Bulletin* 12: 28-31.

Williams, G. J. and Eades, N. W.  
 1938 Explanation of the geology of Degree Sheet No. 18 (Shinyanga). *Tanganyika Geological Survey Bulletin* 13: 5-20.