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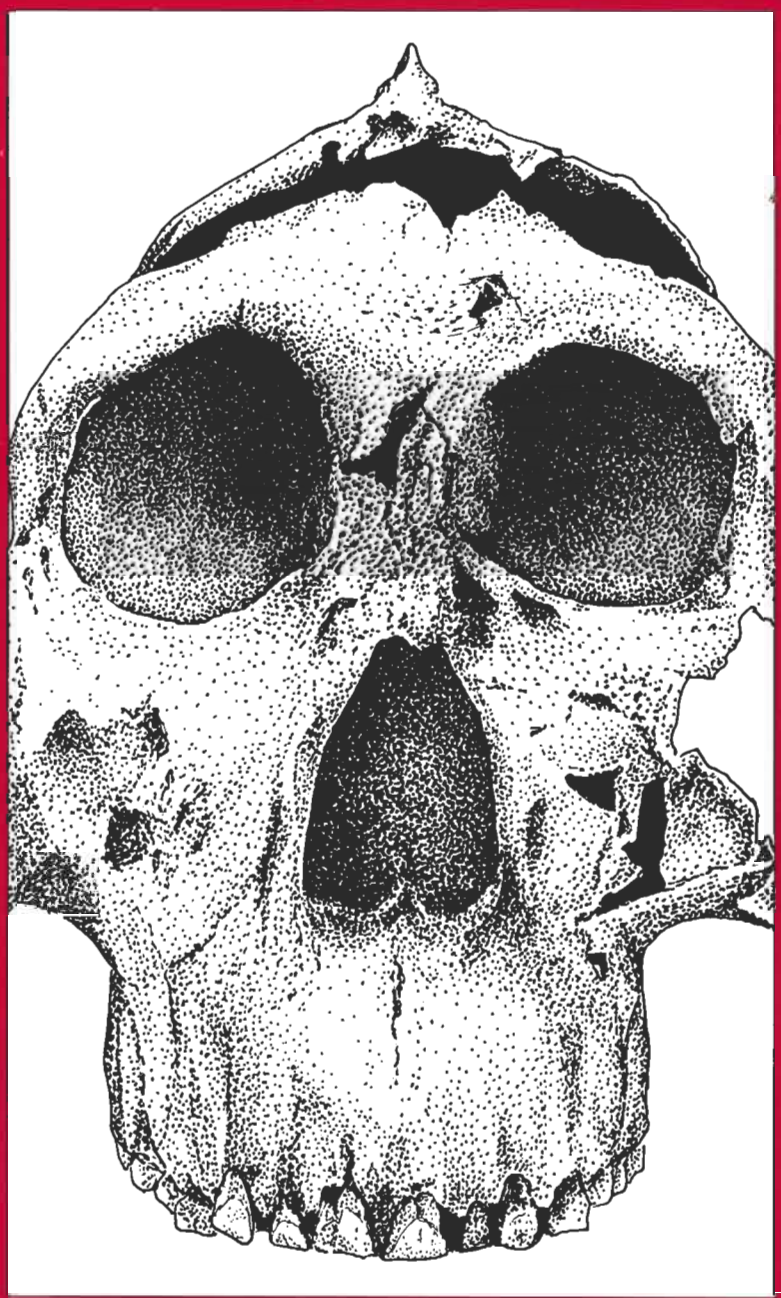

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Four Million Years of Hominid Evolution in Africa: Papers in Honour of Dr. Mary Douglas Leakey's Outstanding Contribution in Palaeoanthropology

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Stratigraphy and Vertebrate Palaeontology of Late Neogene Sites in the Manonga Valley, North-Central Tanzania

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Abstract

During the summers of 1992 and 1994 the Wembere-Manonga Palaeontological Expedition (WMPE) continued its long-term programme of palaeontological and geological research in the Manonga Valley of north-central Tanzania. The expedition expanded preliminary investigations initiated during 1990. Three seasons of exploration in the Manonga Valley have shown that the region has great potential for further palaeontological research. The extensive lake basin (estimated to cover an area of 10,000 km^2), with its fossil-rich sediments dating back to the late Miocene or early Pliocene, can now be considered to be one of the most promising palaeontological research areas in eastern Africa. The region is of evident importance for the study of human origins. In particular, the possible recovery of fossil hominid remains from sites estimated to be 4–6 million years in age – a time period from which very few hominoid specimens are currently known, but one inferred by many palaeoanthropologists to be that during which the hominid lineage may have differentiated from the basal African hominoid radiation – would have a profound impact on interpretations of the phylogeny and palaeobiology of the earliest hominids. In addition, the recovery of a sizeable fauna from the later Neogene sediments might contribute valuable new clues to help explain the ecological factors underlying the differentiation, habitat preference and geographic distribution of the earliest hominids.

Introduction

In 1990, a long-term programme of palaeontological and geological research was initiated in the Manonga Valley of north-central Tanzania by the Wembere-Manonga Palaeontological Expedition. Two further seasons of palaeontological and geological exploration in 1992 and 1994 have shown that the region has great potential for further palaeontological and palaeoanthropological research (Harrison 1991, 1993a, 1994; Harrison & Verniers 1993; Harrison et al. 1993): The large lake basin, covering an area in excess of 10,000 km^2, with its fossil-rich sediments estimated to be 4–6 Ma in age, can now be considered to be one of the most promising palaeontological areas in East Africa.

The region is of special importance for the study of human origins. The recovery of fossil hominid remains from the late Miocene – a period from which few hominoid specimens are currently known, but inferred by many palaeoanthropologists to be that during which the hominid lineage differentiated from the basal African hominoid radiation – would have a profound impact on interpretations of the phylogeny and palaeobiology of the earliest hominids. In addition, the recovery of a sizeable fauna from later Neogene sediments might contribute valuable new clues to help explain the ecological factors underlying the differentiation, habitat preference and geographic distribution of the earliest hominids (Harrison 1992, 1994).

Fossil sites were first discovered in the Manonga Valley in the late 1920s (Stockley 1929; Grace & Stockley 1930), and several brief surveys have been conducted subsequently, but no intensive exploration of the lake basin has previously been undertaken. Prior to 1990, the only published report concerning the palaeontology of the region is a brief note by Hopwood (1931) describing material collected by Grace and Stockley in 1929.

Renewed work in the Manonga Valley has shown, however, that the area is remarkably productive. Our recent expeditions have prospected less than 50% of the estimated extent of the potentially fossiliferous sediments in the basin, but nevertheles the expedition has recorded over 30 productive palaeontological localities and has succeeded in recovering more than five thousand taxonomically identifiable mammals as well as representative samples of fossil reptiles, fish and invertebrates. In addition, almost all new areas prospected in the Manonga Valley have yielded abundant remains of fossil vertebrates (Harrison 1991, 1993a, 1994; Harrison & Verniers 1993; Harrison et al. 1993).

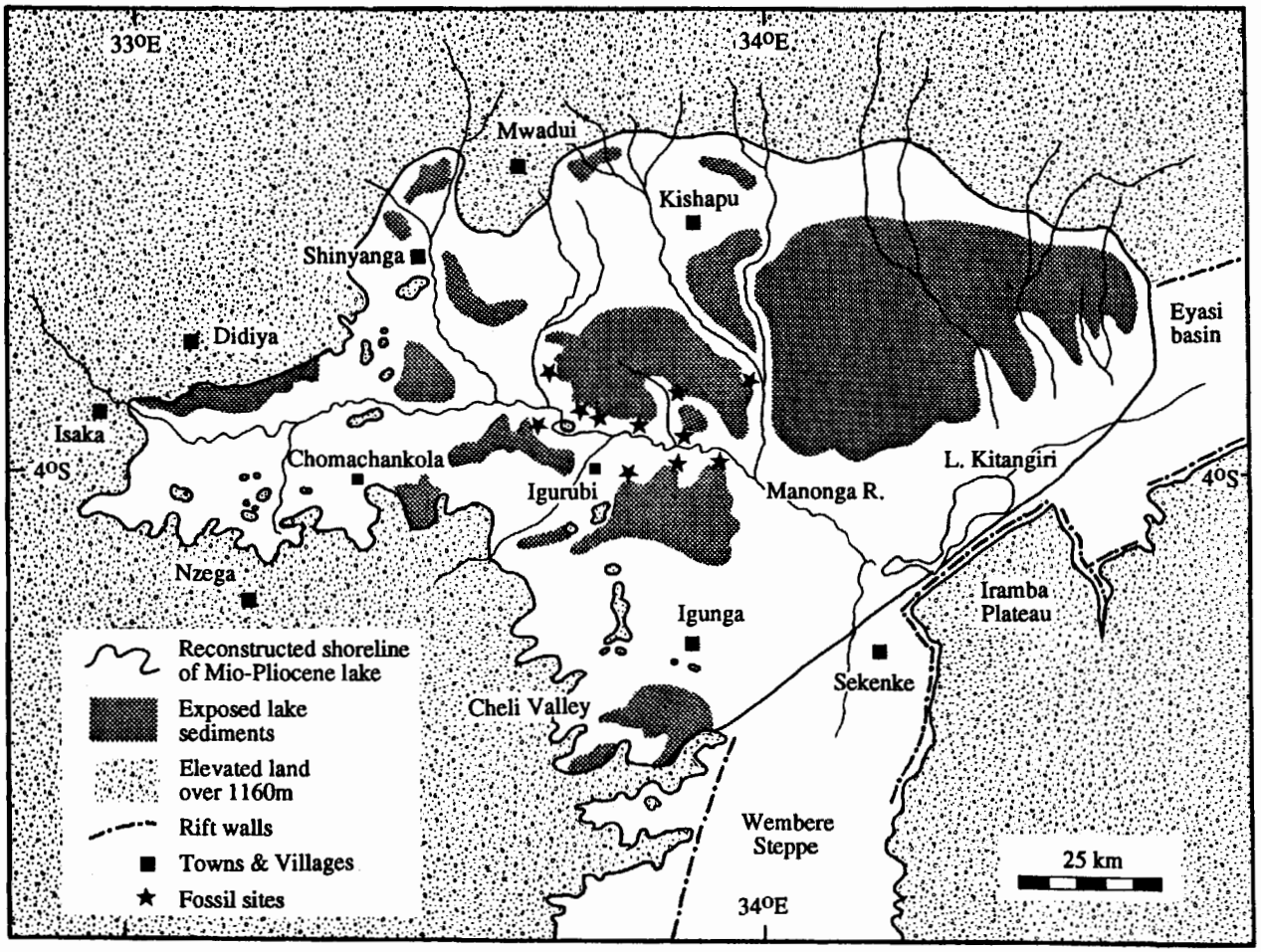

Fig. 1: Reconstruction of the possible extent of the lake in the Manonga Valley during the late Neogene (from HARRISON 1993a).

Regional geology

Based on preliminary work by Jacques VERNIERS of the University of Gent in Belgium and Bereket HAILEAB of the University of Utah, we have been able to reconstruct the geological history of the basin and to produce a generalized stratigraphic sequence (HARRISON & VERNIERS 1993; HAILEAB & HARRISON 1993; see Fig. 1).

Towards the end of Miocene, warping of the Precambrian basement produced a shallow but extensive lake basin in the Manonga region (STOCKLEY 1929; WILLIAMS & EADES 1939; HARRISON & VERNIERS 1993). A number of Precambrian outcrops remained sufficiently elevated to form a complex of low-lying islands. A reconstruction of the possible extent of the lake, and the major exposures of the lacustrine sediments are presented in Figure 2 (HARRISON 1993a, 1994; HARRISON & VERNIERS 1993). During the late Miocene and early Pliocene, fine calcareous lake sediments were deposited and these have yielded abundant vertebrate fossils. The lacustrine sediments are unconformably overlain by a series of fluvial deposits, presumably laid down by a major river system that cut through the Manonga Valley subsequent to the draining of the depression. It would seem that, with the formation of the Eyasi trough, Lake Manonga drained towards the northeast, thereby initiating the development of the present day Wembere-Manonga drainage system (WILLIAMS & EADES 1939; WILLIAMS 1939; GRANTHAM et al. 1945; HARRISON & VERNIERS 1993). Like the lake beds, these have also yielded abundant remains of fossil mammals (HARRISON 1993a, 1994; WINKLER 1993). Since the mid-Pliocene, erosion of the underlying sediments has been active. In some places, the lacustrine and fluvial sediments are overlain by quite extensive layers of alluvial sands and mbuga clays of Quaternary age (WILLIAMS & EADES 1939; HARRISON & VERNIERS 1993).

Vertebrate palaeontology and biochronology

The most productive sites in the Manonga Valley are those at Tinde and Kiloleli. However, significant collections have also been recovered from Shoshamagai, Inolelo, Ngofila and Beredi South

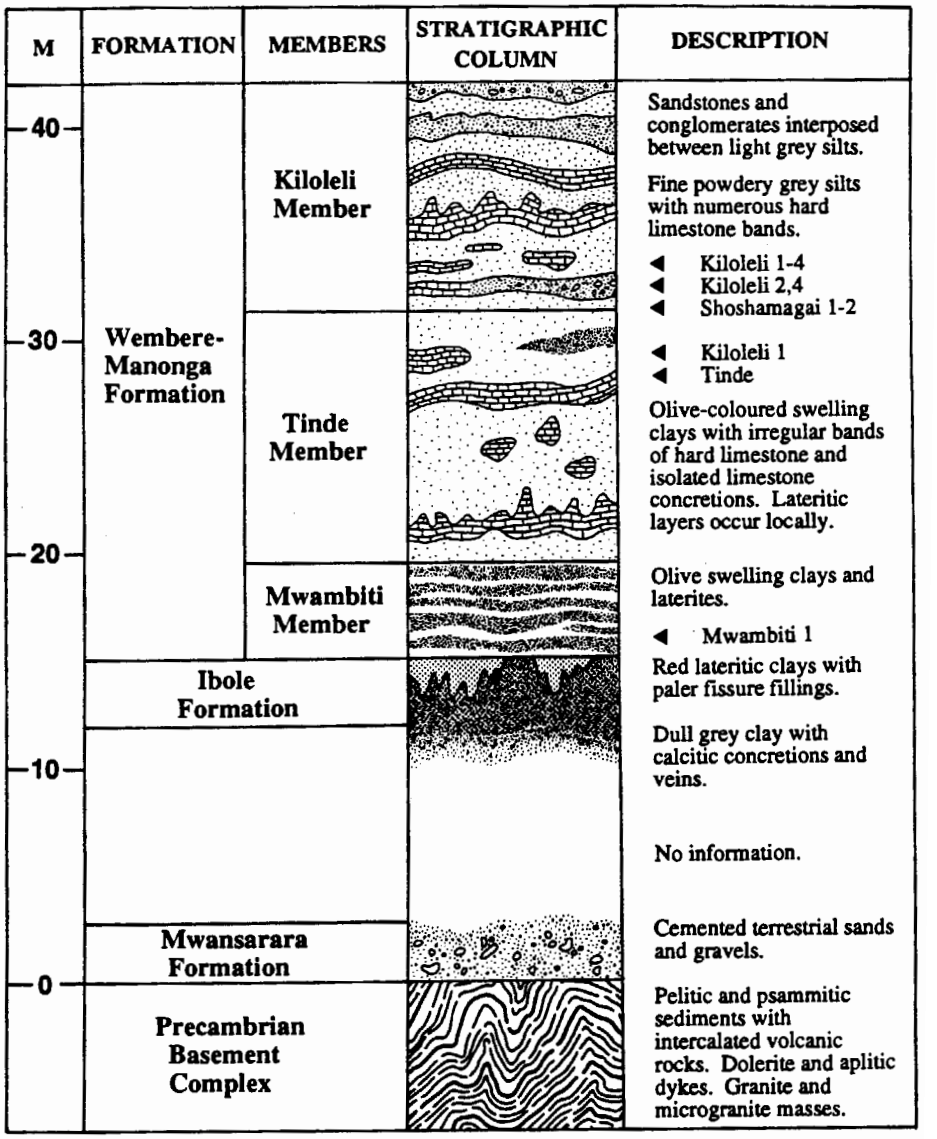

Fig. 2: Schematic stratigraphic section of the Manonga Basin (from HARRISON & VERNIERS 1993). The statigraphic position of key fossil localities is indicated by arrows in the left hand column.

(HARRISON 1991, 1993a, 1994; HARRISON & VERNIERS 1993; HARRISON et al. 1993). The discovery of fossils at Shoshamagai and Inolelo is of particular importance for several reasons. These fossils are the oldest known from the basin, and they are the best preserved, with specimens ranging from isolated teeth of small rodents to jaws and partial skeletons of large mammals such as suids and elephantids (HARRISON 1993a, 1994; WINKLER 1993).

By integrating the preliminary results from investigations of the geology and palaeontology, it is possible to draw some tentative conclusions about the biostratigraphy and biochronology of the sediments in the Manonga Valley (HARRISON 1993a, HAILEAB & HARRISON 1993).

The oldest fossil-bearing stratigraphic unit in the Manonga Valley is the Ibole Formation which is succeeded in turn by the Mwambiti Member and the Tinde/Kiloleli Members of the Wembere-Manonga Formation (HARRISON 1991, 1993a, 1994; HARRISON & VERNIERS 1993; HARRISON et al., 1993; see Fig. 3). The faunas from these three stratigraphic units are very similar and there does not appear to be a major temporal separation between them. Because of lack of tephras, it is not possible to correlate the stratigraphic units to an absolute timescale. However, comparisons of the fauna with other East African localities show that it is very similar to that from Lothagam in northern Kenya, which is dated to 5–7 Ma (PATTERSON 1970; SMART 1976, BEHRENSMEYER 1976; HILL & WARD 1988; HARRISON 1993a, 1994; HARRISON & VERNIERS 1993; HARRISON et al. 1993; M.G. LEAKEY pers. comm.; J.M. HARRIS pers. comm.).

Over 30 species of mammals have now been recovered from sites in the Manonga Valley. Bovids

Estimated Age	Stratigraphic Unit		Key Fossil Localities
Late Pleistocene - Holocene	Mbuga Clay Layers		Ngofila 2, Nyawa, Ipembe
Late Miocene - Early Pliocene	Wembere-Manonga Formation	Beredi Member	Ngofila 2-4, Beredi South 1
		Tinde/Kiloleli Member	Tinde East & West, Kiloleli 1-4, Shoshamagai 1-2, Mwambiti 1-2, Ngofila 1-5, Ipembe
		Mwambiti Member	Beredi South 4, Mwambiti 1, Nyawa
	Ibole Formation		Shoshamagai 2, Inolelo 1-3, Mwambiti 3-4

Fig. 3: Preliminary correlation of the major stratigraphic unit and fossil localities in the Manonga Valley (after HARRISON 1993a).

which comprise at least 8 different species are by far the most common mammals throghout the sequence (GENTRY pers. comm.). Hippopotamids, elephantids, suids and equids are also well represented, while carnivores, giraffids, rhinos, primates and micromammals are quite rare (HARRISON 1993a, 1993b, 1994; WINKLER 1993). It is anticipated that a detailed systematic analysis of the fauna to be published in the near future will contribute significantly to a much better appreciation of the community structure and palaeobiology of late Miocene mammals which are currently poorly understood.

A diverse fauna has also been recovered from the mbuga clays overlying the Neogene sediments. These fossils are probably late Pleistocene to Holocene in age. Most importantly, the fauna contains a single fragment of a human occipital bone and the remains of mammals showing evidence of human activity in form of cut marks (HARRISON 1993a, 1994). These remains are associated with Late Stone Age lithic artifacts.

Conclusions

In conclusion, three seasons of exploration have shown that the Manonga Valley is one of the most promising new areas in East Africa for future palaeontological research. The late Miocene to early Pliocene age of the sediments in conjunction with their palaeontological productivity makes the sites in the Manonga valley of special importance for investigations into human origins. Nevertheless, the extensive lake basin remains largely unexplored and the development of a long-term programme of systematic prospecting, surveying and mapping is underway.

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