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Martin PICKFORD Cainozoic Paleontological Sites of Western Kenya

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und
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Cainozoic Paleontological Sites of Western Kenya

by

Martin PICKFORD*

ABSTRACT

The West Kenya fossil deposits have yielded well over 100,000 fossils from more than 300 discrete fossil sites over a period in excess of seventy years of scientific research. These fossils and the sites from which they came have been the subject of over 500 scientific articles. In short, the data base has reached a point where it could be in danger of becoming too large to handle, especially if details concerning provenience of fossils, details of the location of sites and other factors are forgotten or misreported. Indeed, there has been a long history of uncertainty with regard to some of the fossils and the sites from which they came.

This volume is the result of 10 years research aimed specifically at recording all the known fossil sites in West Kenya and to determining the provenience of the fossils housed in various institutions in the world. There remains some doubt about the detailed provenience of some of the fossils, but many of the old collections could, with reasonable confidence, be placed back into their proper localities. A wide range of problems was encountered during the research, and these have been enumerated in the text in order that future researchers may avoid making the same mistakes, or of propogating errors already in the literature. Since the locality from which a fossil was collected is the departure point for all palaeontological studies, it is hoped that this volume will find wide readership among those scientists interested in the Miocene and Plio–Pleistocene fossil record of Western Kenya.

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KURZFASSUNG

Während einer Periode von gut siebzig Jahren intensiver wissenschaftlicher Erforschung haben die Fossillagerstätten West Kenyas über 100,000 Fossilien aus mehr als 300 verschiedenen Fundstellen erbracht. Diese Fossilien und ihre Fundstellen waren Gegenstand von mehr als 500 wissenschaftlichen Bearbeitungen. Kurzum, die Datenfülle hat einen Punkt erreicht, an dem es sein könnte, daß sie zu umfangreich wird, als daß man noch damit umgehen könnte, vor allem wenn Details bezüglich der Herkunft der Fossilien, Details der Lokalisierung der Fundstellen und ähnliche Faktoren vergessen oder falsch dokumentiert werden. Es gibt in der Tat bereits jetzt eine lange Geschichte von Unsicherheiten in Bezug auf einige der Fossilien und ihre Fundorte.

Der vorliegende Band ist das Ergebnis von 10 Jahren Forschungsarbeit mit dem speziellen Ziel, alle bekannten Fossillagerstätten in West Kenya zu registrieren und die Herkunft der Fossilien zu bestimmen, die weltweit in verschiedenen Instituten aufbewahrt werden. Obwohl die genaue Herkunft einiger dieser Fossilien unklar bleibt, konnte der ursprüngliche Fundort vieler der alten Aufsammlungen mit ziemlicher Sicherheit festgelegt werden. Eine Reihe von Problemen tauchte während dieser Forschungsarbeit auf, die hier aufgezählt werden, um zu vermeiden, daß zukünftige Forscher dieselben Fehler machen, oder daß sich Fehler weiter ausbreiten, die man bereits in der Literatur antrifft. Da der Ort, an dem ein Fossil gefunden wurde, der Ausgangspunkt für alle paläontologischen Studien ist, bleibt zu hoffen, daß dieser Band eine große Leserschaft unter all den Wissenschaftlern finden möge, die an den einzigartigen Fossilnachweisen im Miozän und Plio–Pleistozän von West Kenya interessiert sind.

RÉSUMÉ

Les dépots fossilifères du Kenya Occidental ont livré plus de 100,000 pièces provenant de près de 300 sites prospectés pendant plus de 70 ans par de nombreux chercheurs. Ces fossiles et leurs gisements ont fait l'objet de plus de 500 publications scientifiques. En fait, l'information de base est si abondante qu'il est difficile de faire une synthèse, surtout que les détails sur le localisation des sites, la provenance exacte des spécimens et d'autres donnés ont été oubliés ou simplement mal interprétés. Il y a eut; en effet, de nombreuses incertitudes concernant certains fossiles et leur provenance.

Ce volume est l'aboutissement de 10 annés de recherches destinées à inventorier tous les sites fossilifères du Kenya Occidental et à déterminer la provenance des fossiles conservées dans diverses institutions autres que le National Museum of Kenya. Il reste un doute sur la provenance exacte de certains fossiles, main de nombreuses pièces faisant partie de vieilles collections ont pu été replacées dans leur localité d'origine avec un raissonable. Au cours de notre travail, nous avons été confrontés à divers problèmes qui ont été signalés dans le texte pour permettre aux futurs chercheurs d'éviter certaines fautes, ou propager des erreurs déjà publiées dans la littérature. Comme la localité d'origine d'un fossile est le point de départ pour tous travaux paléontologiques, nous espérons que cet ouvrage trouvera une bonne presse parmi les scientifiques intéressés par les fossiles du Miocène et du Plio–Pleistocène du Kenya Occidental.

Acknowledgements

It would be a difficult task to list all the people and organisations who have helped me in realising this project. It began in 1975 with initial help from Professor W.W. Bishop, although in a very real sense my interest in Western Kenya dates from 1966 when Dr. L.S.B. Leakey made me responsible for registering the vast collection of fossils made in that year at Songhor. Since 1975, I have spent several months each year in Western Kenya, eventually visiting every known locality and mapping most of them and their surroundings. This long project was funded by various agencies. In the early days by the Boise Fund, Oxford, and later by the L.S.B. Leakey Foundation and the L.S.B. Leakey Trust. The National Museum of Kenya provided an invaluable base and much support, both in the field and in the lab, for which I am grateful.

I was joined in the field at various stages by many colleagues who participated in collecting and the subsequent description of fossils. The »West Kenya Project« as it eventually became known was effectively a multi–disciplinary one, and this volume represents only one aspect of that project. It is hoped that by making available this basic data concerning the sites, that I am in some small way repaying their confidence in the project. Among those who have joined me in the field are Peter and Libby Andrews, Terry and Terri Harrison, Lawrence and Wendy Martin, Wendy Bosler, Sue Bassett, Rick Weyerhauser, Cyril Walker, Percy Butler, Norbert Schmidt–Kittler, Elmar Heizmann, Bob Drake, Margaret Collinson, Enoch Owiti, Benson Mboya, Hilde Schwartz and Jo MacQuaker.

I cannot end without mentioning the very great help given to me throughout the project by Kiptalam Cheboi, my field assistant and great friend. I would also like to thank Zackary Otieno, Duncan Otiende, Asha Owano, Rose Nyamgero and Wambua Mangao as well as all the other staff at the National Museum of Kenya.

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FOREWORD

This monograph deals with ten years work in Western Kenya by the author, and 75 years work in the same region by other scientists. The Western Kenya fossil sediments were brought to the notice of science in 1909, and they therefore represent one of the first fossiliferous deposits recorded in Central Africa. Ever since their first discovery they have continued to provide data of interest to the broad fields of geology and palaeontology. There is no doubt that they will continue to yield information especially at those sites which are suitable for excavation and screening, which have up to now not been studied in detail.

The present report provides a general summary of all the known sites, their history of discovery and study, their faunal content, geographic and stratigraphic positions and where possible, the quantities of fossils known to have been collected. Since there are more than 300 separate fossil localities known in Western Kenya, it is obvious that there is much scope for future work. Some of the localities are exceptionally rich in fossils, with the result that well over 50% of the fossils from Kenya come from this region. The value of this fossil record is greatly enhanced by the fact that many of the fossiliferous levels are intercalated between volcanic units which can be dated by K/Ar or Fission Track methods. In addition, the sites span a considerable period of time during which much evolution took place. Faunal changes due to immigration and emigration can also be detected, with the result that a biostratigraphic framework can be worked out within the confines of a relatively small area. The frequent co–occurrence of terrestrial gastropods and mammalian faunas has permitted the studies of palaeoenvironments to proceed, while geological context can be satisfactorily investigated.

At present a number of faunal groups await revision, while field investigations are still continuing in selected regions. Undoubtedly the results of future work will modify some aspects of this work, just as the studies of the past ten years by the author have resulted in profound changes in the perception of the West Kenya fossil record. Many of the advances made during the past ten years could not have been made had not one person examined all the localities. Detailed, but parochial, studies yielded different views of the fossil record which were difficult to synthesise into a coherent whole.

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CHAPTER 1

INTRODUCTION

The purpose of this work is to provide a complete listing of all known fossiliferous localities in Kenya, (fig. I–1) with details of their locations, history of work, geological, stratigraphic and biostratigraphic context, brief details of what was found at each locality and faunal inventories for each site. Bibliographies are also appended for each major fossiliferous region.

The Sites and Monuments Documentation Department which produced this volume has worked hand in glove with the Palaeontology Department so that the site designation entered on specimen labels should accord with entries made herein.

The basic philosophy of the work is that the place a fossil was found is of the greatest importance. This data is less a matter of personal opinion than any other, for example, its age, stratigraphic position or zoological grouping. The geographic co-ordinates of the fossil or its site are therefore the foundation from which all else proceeds.

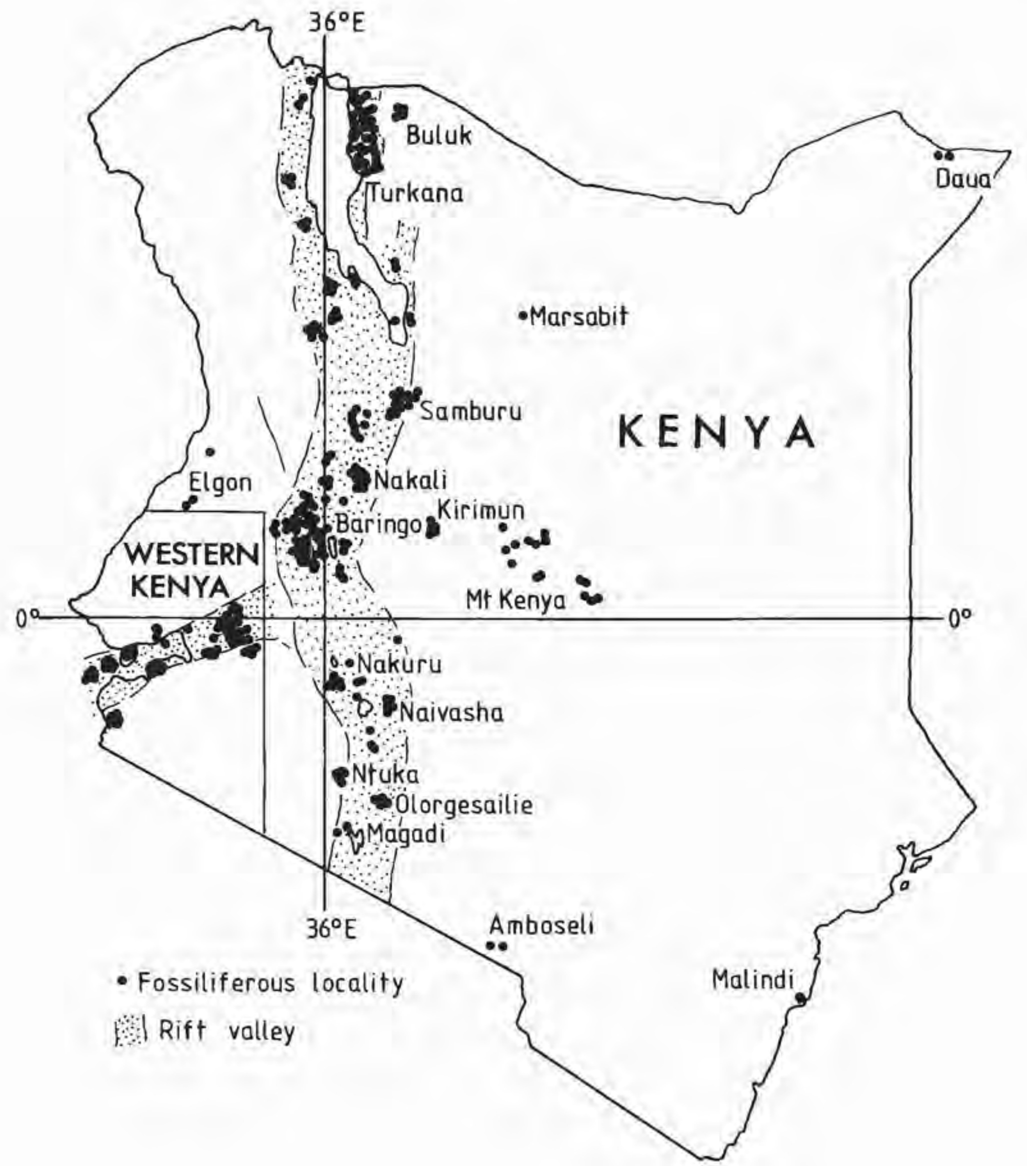


Fig. I–1

Distribution of Neogene Vertebrate Fossil Localities in Kenya

In order to permit the use of this gazetteer overseas, a standardized system of map co-ordinates has been employed, based on the Universal Transverse Mercator Grid (UTM Grid).

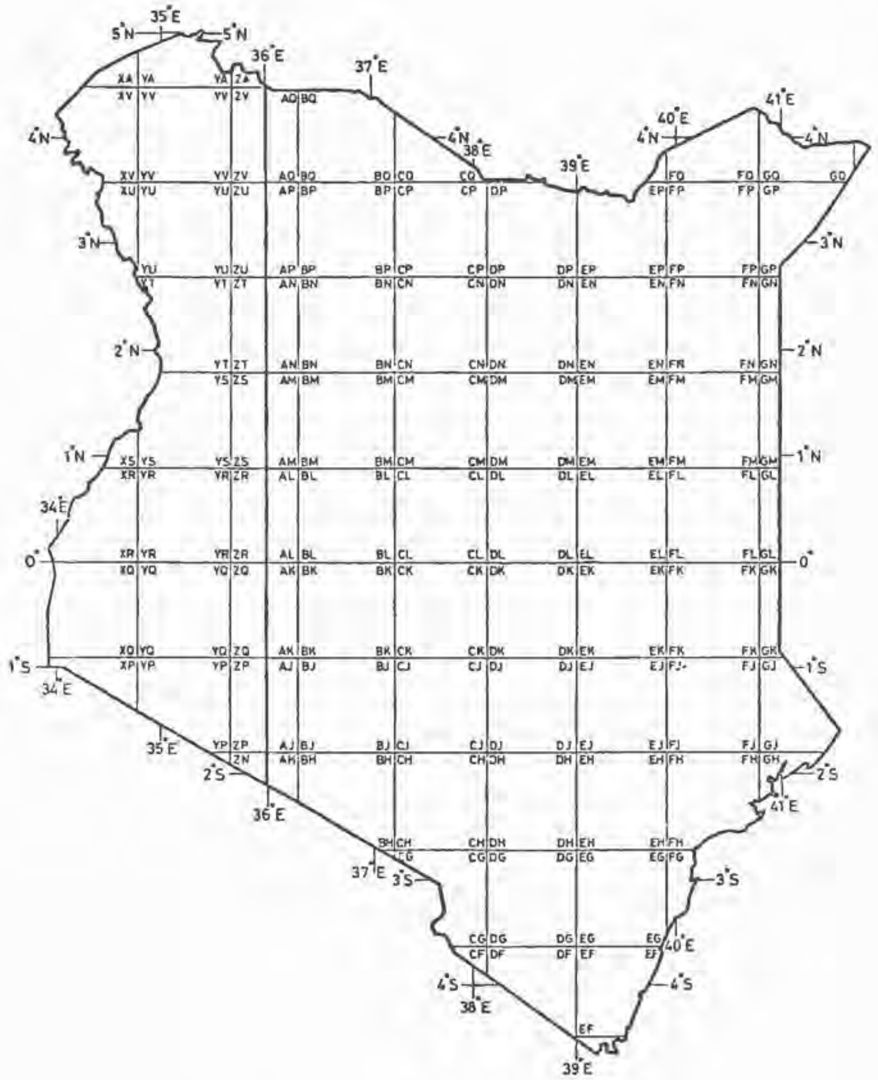


Fig. I–2

Locality Designation: UTM Grid Zones 36 and 37

The UTM System

It has been decided to standardise map references in the Kenya Palaeontology Gazetteer to the Universal Transverse Mercator system.

Kenya falls into Zones 36 and 37. Letters of the alphabet are used to designate 100 km subdivisions within each zone beginning with A in the West and Z in the East and A in the South and V in the North (fig. I–2). Each 100 x 100 km square is designated by two letters, the first giving the X coordinate, the second the Y coordinate. Each square so designated is then subdivided in 10 km squares starting at 00 in the southwest corner going to 00 in the northeast corner. Each of these 10 x 10 km squares is further subdivided into 1 x 1 km squares. Further subdivisions are possible, each time the scale division being one tenth of its predecessor. Thus, if a grid reference is required to the accuracy of 10 meters the map reference will consist of two letters of the alphabet and eight digits. A ten digit reference is accurate to one metre. Conversely a six digit reference denotes accuracy to 100 metres.

The 100 x 100 km subdivisions of Kenya are depicted in the attached figures (I–2 to 3).

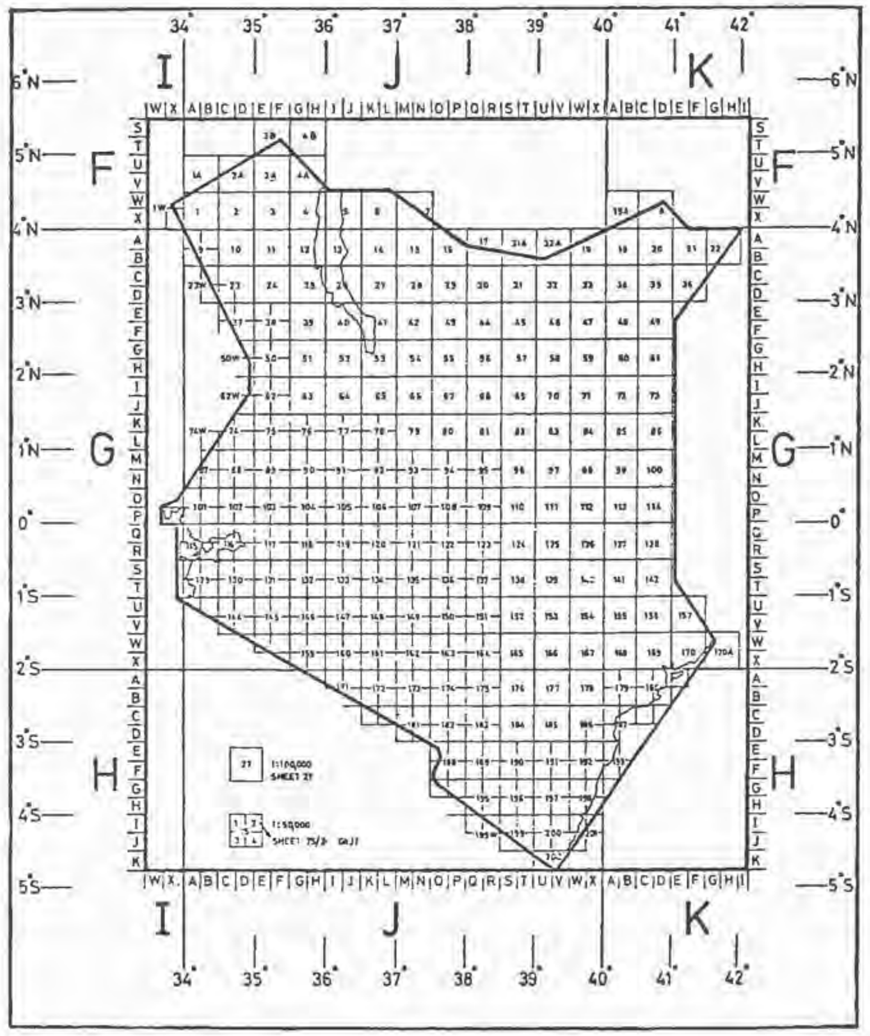


Fig. I–3

Cross Reference index Series Y731 Map Sheets to SASES index: Kenya

Fig. I–3 indicates the 1:50,000 and 1:100,000 map coverage of Kenya, superimposed on the UTM grid for ease of cross reference. Map references can be converted to latitude and longitude with little trouble.

For the purpose of the Kenya Palaeontology Gazetteer, Kenya has been divided into six areas. Each area will be the subject of a separate volume as follows:

Volume	Area
1	Western Kenya
2	South Rift
3	Central Kenya
4	Northwest Rift
5	Northeast Rift
6	Northeastern and Coast Province

Each area of Kenya is further subdivided into major fossiliferous regions, to each of which is devoted a chapter. Each region will be discussed under the following general headings:

- History
- Geological Map
- Stratigraphy
- Biostratigraphy
- Fossiliferous deposits
- Faunal lists

At the end of each volume will be a comprehensive bibliography for the region under discussion.

WESTERN KENYA

Western Kenya has yielded fossils from ten major regions (figs I–4, I–5). Each of these areas forms the subject of a separate chapter as follows:

Chapter	Area	Name
2	I	Songhor–Koru–Muhoroni
3	II	Rusinga Island
4	III	Mfwangano Island
5	IV	Uyoma Peninsula
6	V	Karungu
7	VI	Gwasi–Homa Bay
8	VII	Maboko–Ombo
9	VIII	Sondu–Kericho–Muhoroni
10	IX	Fort Ternan
11	X	Homa Peninsula

Regional Geology

Almost all of West Kenya has been geologically surveyed at a scale of 1:125,000 (fig. I–6). At this scale, many of the maps are of limited use for determining the geological context of fossils. They do however, provide a regional view of the main rock units, but in any case should be used with caution. In particular, geologists paid inadequate attention to the Tertiary rocks in the region and the standard of mapping is rather variable. Because of this, each fossil area has been remapped at 1:50,000 where possible, and at even greater scales if warranted.

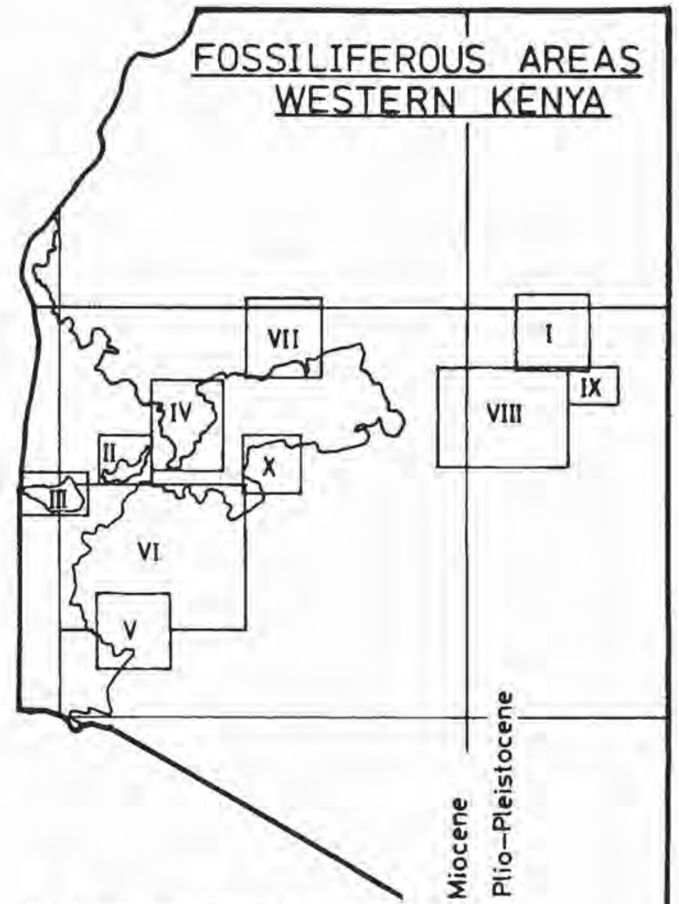
History of fossil discoveries in West Kenya

There has been a steady increase in the quantity] of fossil sites known in West Kenya (fig. I–7). Each major expedition has led to new discoveries, the main ones being the East African Archaeological Expedition of 1931–1935, the British–Kenya Miocene Expedition of 1947 to 1956 and the West Kenya Project of 1975–1982. As each area was studied in detail, especially with the aid of aerial photographs, new sites have been found, and will continue to be found.

Radioisotopic dating of West Kenya deposits

More than 60 radiometric dates have been published for Tertiary rocks of Western Kenya (fig. I–8). An ongoing programme of dating will increase this quantity by a substantial amount, and will perhaps be of greater use than available dates since the accent of the current programme is on the compilation of concordant sequences of dates in known stratigraphic contexts.

From the available dates it appears that the sediments of West Kenya span long periods of time with substantial gaps in the record (fig. I–9). The oldest sediments are in the region of 22.5 to 23.5 m.y. at Meswa Bridge. The major sites of Songhor and Koru seem to be about 19 m.y. old while the important localities of Rusinga, Uyoma, Mfwangano and Karungu are about 17.9 m.y. old. The Maboko and Nyakach areas are as yet undated but seem to be about 15 to 16 m.y. old on a basis of the aspect of the faunas therefrom. Above this comes the Fort Ternan beds currently dated at 14 m.y. after which there is a very long gap to the Homa sequence which comprises Pliocene, Pleistocene and Recent strata.



	Miocene	Plio–Pleistocene
I – Songhor–Koru–Muhoroni	51	10
II – Rusinga Island	40	7
III – Mfwangano Island	29	12
IV – Uyoma Peninsula	17	6
V – Karungu	5	13
VI – Gwasi – Homa Bay	9	8
VII – Maboko – Ombo	17	3
VIII – Sondu – Kericho – Muhoroni	23	5
IX – Fort Ternan	6	4
X – Homa Peninsula	0	41
Totals	197	109

Fig. I–4
Fossiliferous Areas: Western Kenya

DISTRIBUTION OF FOSSIL SITES W. KENYA

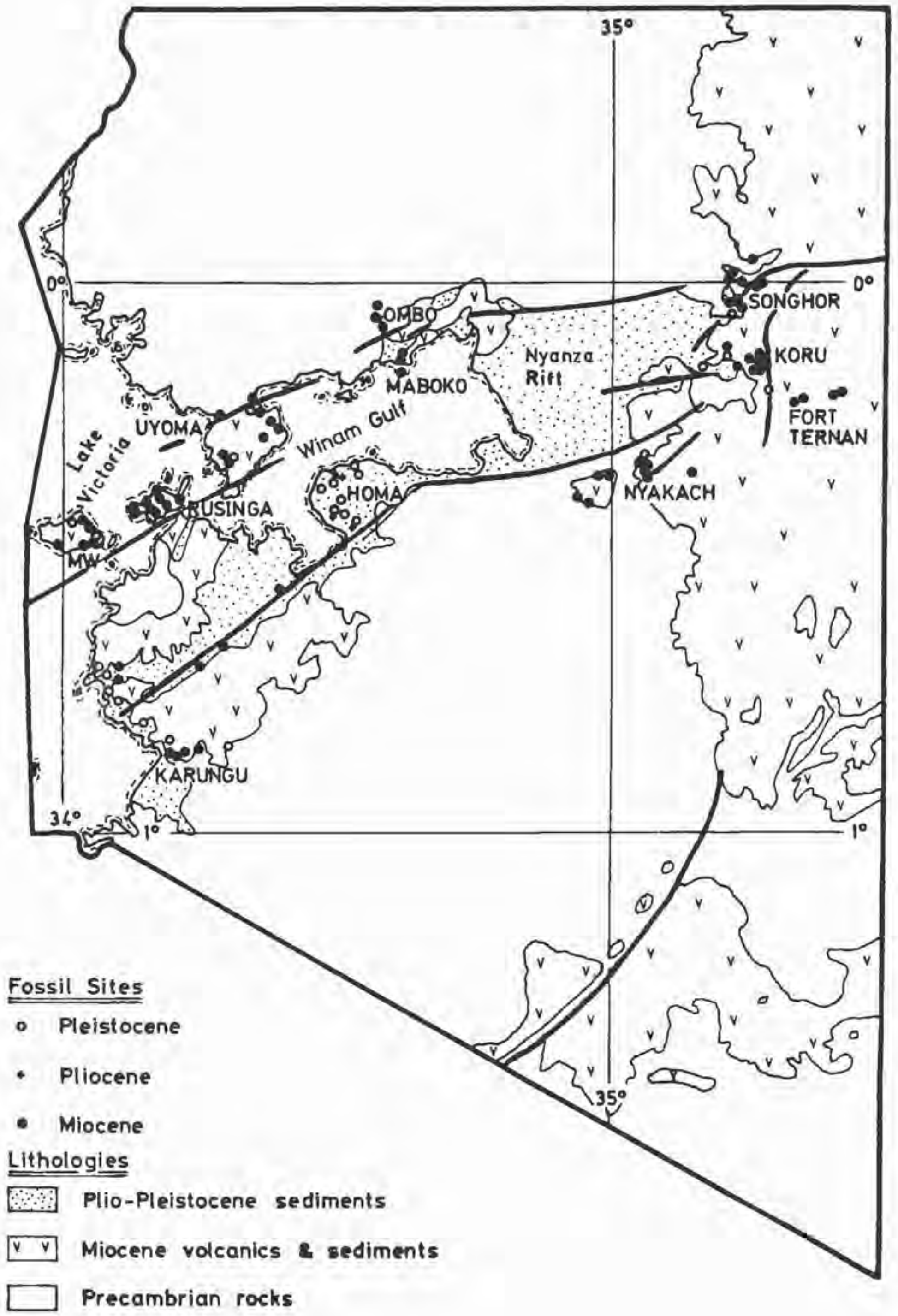


Fig. I–5

Distribution of fossil sites: W. Kenya

GEOLOGICAL SURVEY OF KENYA GEOLOGICAL REPORTS WESTERN KENYA

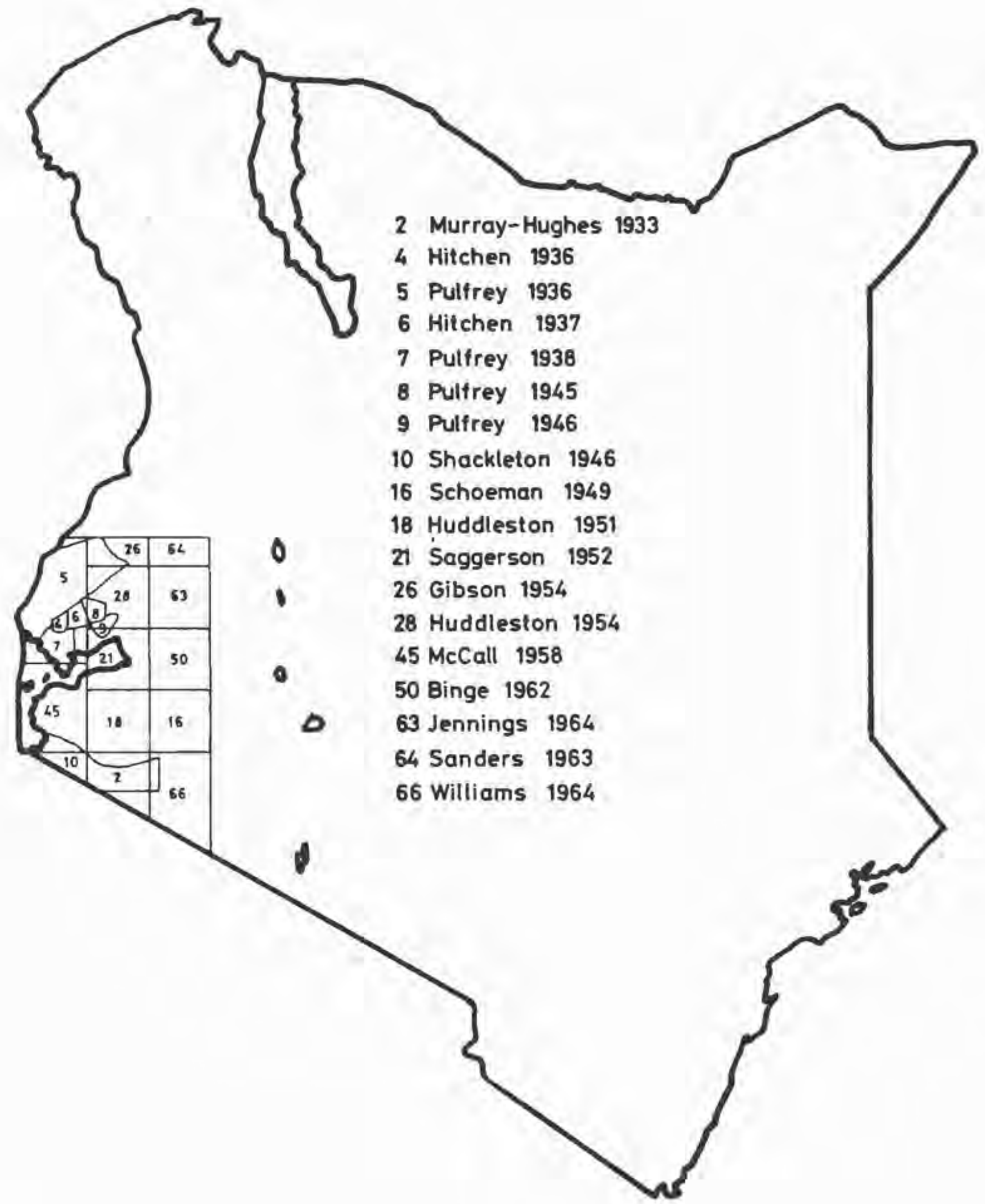
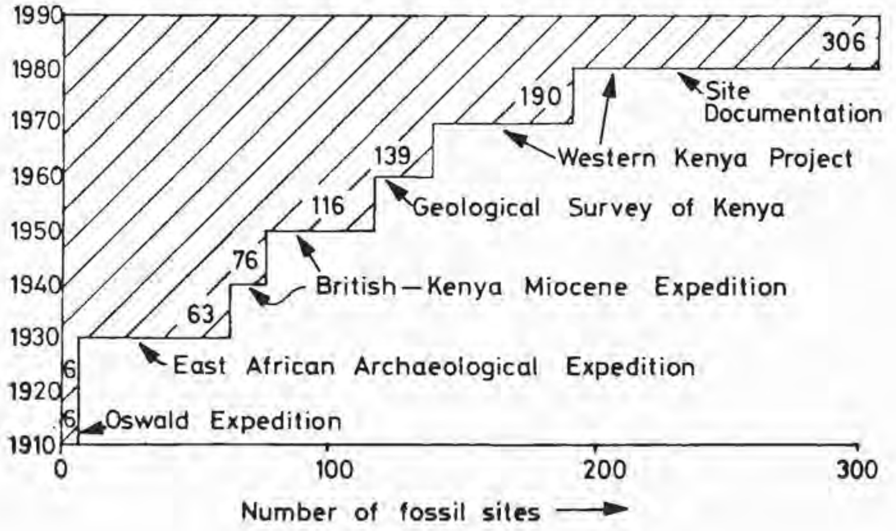


Fig. I–6

Geological Survey of Kenya: Geological Reports – Western Kenya

Decade	SO	RU	MW	UY	KA	GW	MB	NC	FT	HO	Total	Cumulative total
1980–1990	0	18	20	18	1	12	12	22	9	4	116	306
1970–1980	47	0	0	2	0	0	2	0	0	0	51	190
1960–1970	0	3	0	0	0	0	0	5	0	15	23	139
1950–1960	5	2	15	0	0	3	1	1	1	12	40	116
1940–1950	2	5	4	0	0	1	1	0	0	0	13	76
1930–1940	7	19	2	3	13	1	4	0	0	8	57	63
1920–1930	0	0	0	0	0	0	0	0	0	0	0	6
1910–1920	0	0	0	0	4	0	0	0	0	2	6	6
Totals	61	47	41	23	18	17	20	28	10	41		
Area	I	II	III	IV	V	VI	VII	VIII	IX	X		

Distribution of fossil sites in Western Kenya



PROGRESSIV INCREASE IN FOSSIL RESOURCES IN WESTERN KENYA

Fig. I–7

Progressive increase in fossil resources in Western Kenya

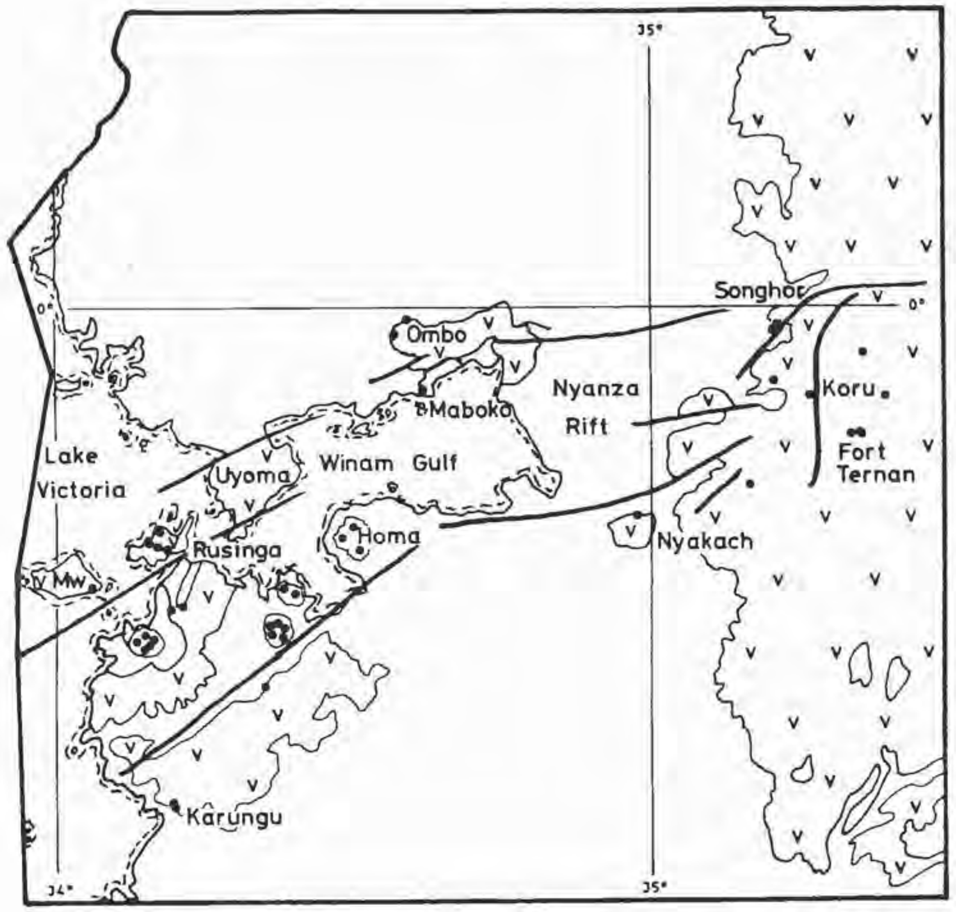
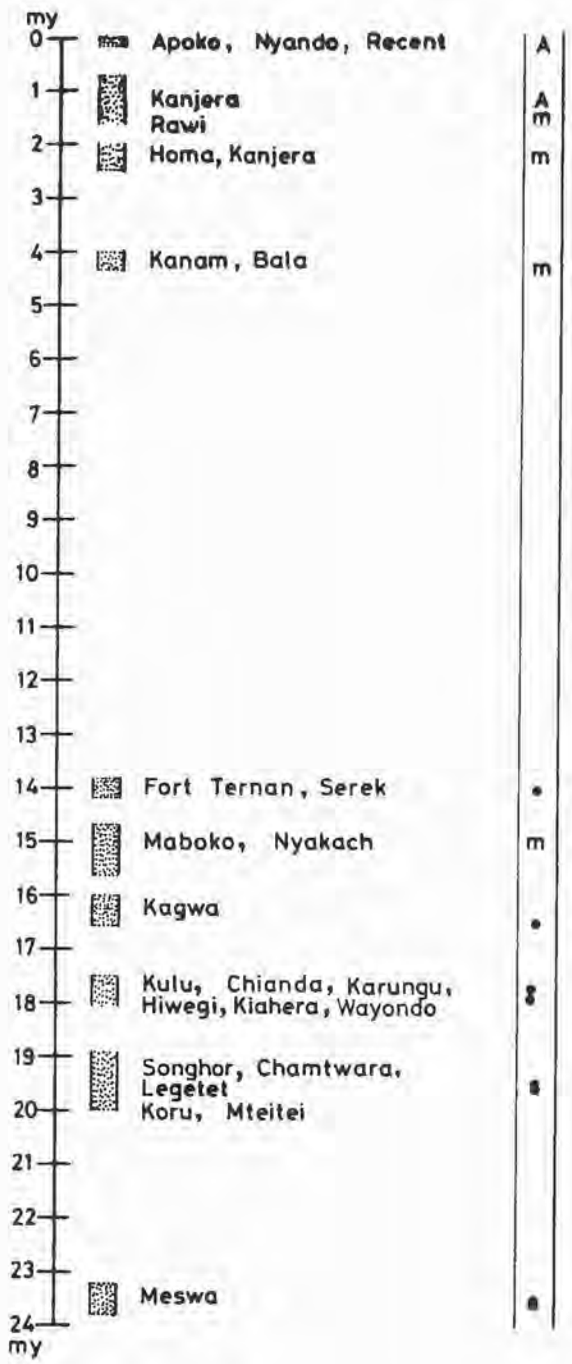


Fig. I–8

Radio–isotopic date samples: W. Kenya



o KAr DATE: m MAMMAL DATE: A ARTEFACT DATE:

Fig. I–9

Chronologic representation of fossiliferous strata in Western Kenya

CHAPTER 2

AREA I

THE KORU/SONGHOR/MUHORONI AREA

History

Dr. H. L. Gordon first noticed fossils in the Koru area in 1927 in a limestone quarry now known as locality 14 (Maize Crib) (fig. II–1). He sent samples to E. J. Wayland, who, realising the importance of the discovery subsequently paid a visit to Koru in 1928. Wayland found additional fossils at Maize Crib but also located another site, now known as locality 16 (Leakey's redbed). In 1931 A. T. Hopwood of the British Museum visited Koru for several weeks and found three more sites (loc. 15, also known as *Deinotherium* gully; *Chalicotherium* quarry; and a third site two and a half miles NE of *Chalicotherium* Quarry) (fig. II–2). Leakey visited Koru during this expedition and re–located Wayland's 1928 site. In 1932 Nilsson visited the Maize Crib site and made a small collection (now in the British Museum of Natural History) which included fragments of teeth that fitted onto specimens collected by Hopwood.

After this initial work little was done at Koru until the 1970's (fig. II–3). However, Leakey and MacInnes discovered a very rich site at Songhor in 1932 which was worked several times by the East African Archaeological Expedition (Kent, 1944) and also in later years during casual visits (MacInnes, 1943). The British Kenya Miocene Expedition made several extensive collections at Songhor in 1947, 1948, 1949, 1950 and 1958, and also visited Koru in 1948, and 1950 but made very small collections. The Mteitei Valley site was found in 1947 by R. M. Shackleton (1951) and small collections were made in 1947 and 1948.

Binge (1962) made a regional map at a scale of 1:125,000 which included the Koru/Songhor area. The map is inaccurate and of limited use in determining relationships of the strata to each other.

Patterson (in 1962) and Bishop (in 1965) made small collections at Songhor. Bishop et al. (1969) dated biotite flakes from Songhor at 19.6 m.y., and from Koru at 19.5 m.y. In 1966 Leakey made a huge collection at Songhor totalling more than 4,000 entries in the field catalogue. This was followed in 1971–1972 by a collection made by Andrews, who also studied the context of the fossils.

In 1975 the West Kenya Project began detailed context studies in the area which resulted in the discovery of many new localities in the Koru–Songhor–Mteitei Valley region. Some of the new sites (e.g. Chamtwara; Locs 10 and 29 in the Legetet Formation; Meswa Bridge (figs II–4 to 10) are extraordinarily rich in mammals and the primate sample from the area was more than doubled during the expedition. Context studies were completed and the whole region was remapped at 1:12,500 reduced to 1:50,000. The regional stratigraphy was established and radiometric samples collected. Results of this work are still in the process of publication but preliminary results are available (Pickford and Andrews, 1981; Pickford, 1981, 1983, 1984; Pickford and Tassy, 1980; Tassy and Pickford, 1983; Harrison, 1982; Martin et al., 1981).

Geological Map

Kent (1944) produced the first geological sketch map of the Songhor area. Shackleton (1951) made the first regional map which included much of the Tinderet Region. Binge (1962) published the quarter degree sheet for the area but it is unreliable as a source of information concerning the context of the fossil strata at Songhor and Koru.

The area was therefore remapped during the Western Kenya Project at 1:50,000 (reduced from 1:12,500). This revision permitted many of the fossiliferous localities to be placed in their correct superposition and allowed biostratigraphic and related studies to proceed on a firm stratigraphic basis. During the survey abundant new localities were located which yielded important information concerning the fauna, flora and palaeoenvironments. Important tectonic structures such as the Mteitei Valley and Koru Faults were recognised for the first time, which led to a significant revision of the geologic history of the area, especially the tectonic development of the Nyanza Rift Valley (Pickford, 1982). In addition it was discovered that rocks originally mapped as intrusive carbonatites (Le Bas and Dixon, 1965) were not only stratiform but contained abundant fossils. Many of the beds mapped by Kent and Shackleton were originally considered to be lacustrine, but it has now been demonstrated that almost all the sediment in the Koru–Songhor–Muhoroni region is subaerial in origin, derived predominantly from contemporary volcanic activity (Pickford, 1981). This explains why not a single aquatic faunal element has been found in these deposits among more than 100,000 fossils collected over a period of fifty years.

Stratigraphy

Early syntheses of the regional stratigraphy suffered from a lack of detailed survey. Nevertheless the broad lithostratigraphic categories were established by Shackleton (1951) and Binge (1962), although some of their conclusions have since proven to be incorrect. Detailed stratigraphic relationships were finally established by the Western Kenya Project during 1975–1981.

The oldest rocks in the region are gneisses of the Mozambique Belt exposed west of the Koru and Mteitei Valley Faults. Unconformably on a gneiss surface of low relief lies the Muhoroni Agglomerate, a volcanogenic/terrigenous unit dated by the K/Ar method at 22.5 m.y. (Bishop et al., 1969). The important site of Meswa Bridge occurs in this formation. These agglomerates were folded, faulted, intruded by calcite veins and eroded almost flat before the Koru Formation accumulated on top of it. This unit, dated at 19.6 m.y. (Bishop et al., 1969) is completely volcanogenic and contains abundant fossils (locs 16, 25, 32, 33, etc.). It is overlain by the Legetet Carbonatite Formation, a series of carbonatite units separated by fossiliferous palaeosols, (locs 14, 30, 21, 29, 11, etc.). This in turn is overlain unconformably by Walker's Limestone, a bedded carbonatite ash sequence containing abundant fossil leaves and snails, but little else (locs 28, 55). Unconformably above Walker's Limestone comes the Kapurtay Nephelinite Agglomerate, a very thick unit comprising the bulk of the sequence in the area. Intercalated in the agglomerates are the Chamtwara Member (loc. 34) and the Songhor redbeds (Songhor Main and Loc. 39) both of which are extremely rich in fossils. Above the Kapurtay Agglomerates comes the Cliff Agglomerate, a well indurated, erosion–resistant unit up to 80 metres thick. It forms a prominent mapping unit in the Mteitei Valley–Siret area, but is also found near Koru and Fort Ternan.

The next younger unit exposed in the map area is the Lumbwa Phonolite, dated in the Lumbwa area at 8.9 to 9.2 m.y. This unit underlies Tinderet Volcano and is mapped as a continuous strip from the Mteitei Valley eastwards towards Timboroa. Covering more than half of the map area are numerous flows of basaltic rocks (Augite nephelinites, Basanites, etc.) comprising the Tinderet Basanite Formation. The crater of Tinderet is preserved, and there are many basanitic plugs in the Koru and Mteitei Valley areas. These rocks are dated 9.9 and 5.5 m.y. (Baker et al., 1970). In the Siret Area, outside the Nyanza Rift Valley the Siret Agglomerate overlies the Tinderet Basanites. This 80–100 metre thick Augite Nephelinite Agglomerate contains abundant fossil wood. A centre in the Uson Area (GR. 5705) seems to be indicated by the presence there of massive agglomerate.

Covering much of the map area are black soils, but in the west at Songhor Post Office, in the Mbogo and Nyando drainages, are late Pleistocene sediments and tuffs. These contain »Middle Stone Age« artefacts and fossil mammal remains belonging to extant taxa. The sequence of Pleistocene beds contains two tuffs, designated the Nyando Ashes, which are useful stratigraphic markers.

Biostratigraphy

The Koru–Songhor–Muhoroni area has two main suites of fauna, one of them lower Miocene the other late Pleistocene in age. There are also some Recent sites which yield subfossil remains, but these are not enumerated here.

The earliest known fossiliferous site is locality 36 (Meswa Bridge) in the Muhoroni Agglomerate Formation. It yields a fauna which does not convincingly fit into the assemblages known from Koru and Songhor. Pickford (1981), therefore placed it in a faunal set on its own as Pre–Set I. It has yielded a zygolophodont proboscidean, a huge creodont, a new species of macroscelidean and a peculiar primate akin to *Proconsul major*, among many other remains of mammals, birds and gastropods.

The bulk of the Miocene fossil sites in the area can however confidently be placed into a single biostratigraphic unit, called Faunal Set I by Pickford (1981) (fig. II–10). There are some differences between sites in the Koru and Songhor areas, but mapping indicates contemporaneity of deposition. The differences, especially among primates and gastropods seem to be related to differences in the palaeo–climate and hence palaeo–vegetation. The Songhor/Mteitei Valley sites seem to contain assemblages of snails indicative of slighter drier conditions than at Koru, although both areas were, with little doubt, forested. These snail assemblages designated Ia (at Koru) and Ib (at Songhor and Mteitei) occur side by side in the fossil record through about 4 million years, but are geographically distinct (fig. II–12). It is postulated that area Ib was in a slight rain shadow throughout the period of deposition.

There are several differences between faunas of Set I and those of Set II, found at Rusinga, Mfwangano, Karungu and Uyoma. Important among these are the ruminants, suids and rodents, as well as some of the primates. For example *Micropithecus clarki*, *M. songhorensis*, *Limnopithecus evansi*, and *Proconsul major* are common at Koru and Songhor but have not been found at Rusinga; likewise, for *Bathyergoides neotertiarius*, *Afrocricetodon*, and *Dorcatherium songhorensis*. Conversely, in Set II faunas, *Kenyasus rusingensis*, *Libycochoerus jeanelli*, *Diamantohyus africanus*, *Kenyalagomys*, *Dorcatherium parvum*, *D. piggoti*, *D. chappuisi*, *Propalaeoryx* and *Canthumeryx* occur but have not been found at Koru or Songhor. The major cause of these differences is thought to be time, but there is good evidence, yielded by the snail assemblages, to suggest that ecological differences were also important factors.

The next youngest fossils in the area, which come from the Fort Ternan Beds, were placed by Pickford (1981) in faunal Set IV. For details of this faunal set, see the chapter on the Fort Ternan Beds.

In the Koru–Songhor–Muhoroni area, deposition continued intermittently after the accumulation of faunal Sets I and IV, but no fossiliferous sites have been found in these younger strata except in the late Pleistocene Nyando beds. Several of these sites yield stone artefacts of Middle Stone Age affinities and one has yielded fragments of a human skeleton (fig. II–13). The fossil beds are often associated with the Nyando Ashes, two or more tuffs which occur widely in the Nyanza region. All fossils identified from these sites differ little from extant species, even though the fossils are well mineralised.

MIOCENE FOSSILIFEROUS LOCALITIES IN THE KORU-SONGHOR-MUHORONI AREA

Site Desig.	Formation or name	# of Fossils in KNM coll.	Map Reference	Source
1	Songhor Main	8000+	460963	Shackleton, 1951
2	(Kapurtay)	0	482967	Binge, 1962
3	(see 32)	–	–	
4	(see 33)	–	–	
5	(Ngeron)	0	448028	Adachi & Yairi, 1975
7	(Muhoroni)	0	433908	Binge, 1962
10	(Legetet)	1500+	518829	
11	(Legetet)	2000+	514844	
12	(Legetet)	43	522847	
14	(Legetet) (Maize Crib)	500+	519821	
15	(Koru) (Deino Gully)	2	498818	
16	(Koru) (Leakey's Redbed)	40	508818	
20	(Koru)	23	511840	
21	(Legetet)	500+	512844	
22	(Legetet)	57	510847	
23	(Legetet)	4	511848	
24	(Legetet)	21	512848	
25	(Koru)	200	503855	
26	(Chamtwara)	8	508863	
27	(Legetet)	38	513833	
28	(Walker's)	6	498838	
29	(Legetet)	1000+	512841	
30	(Legetet)	41	518821	
32	(Mteitei)	300	501981	
33	(Mteitei)	150	503982	
34	(Chamtwara)	4000	521863	
35	(Chamtwara)	7	526856	
36	(Meswa)	1500	454853	
37	(Legetet)	15	521846	
39	(Songhor E)	19	467958	
40	(?Koru)	11	488018	
41	(Kipingai)	7	493048	
42	(Kapurtay)	5	499968	
43	(Kapurtay)	7	498970	
44	(Legetet)	8	510848	
45	(Legetet)	100	515843	
46	(Legetet)	5	515844	
47	(Legetet)	10	512847	
48	(Legetet)	6	521850	
49	(L. Kipsesin)	0	483963	
50	(U. Kipsesin)	11	479018	
51	(Kapurtay)	0	483963	
52	(Kapurtay)	3	478961	
53	(Kabewa)	2	552018	
54	(Koru)	7	456854	
55	(Walker's) (leaf loc.)	0	506840	
56	(Legetet)	18	512844	
57	(Koru)	2	508848	
58	(Mteitei)	10	516986	
59	(Kipingai W)	8	487046	
60	(Kipingai)	1	478064	

Table II–1

Miocene fossiliferous localities in the Songhor–Koru–Muhoroni Area

PLEISTOCENE FOSSIL LOCALITIES IN THE SONGHOR-KORU-MUHORONI AREA

Site Designation	# of Fossils	Map Reference
Songhor Post Office	20	454940
Ruke Bridge	0	503851
Muhoroni Railway Bridge	0	457829
Muhoroni River	0	448846
38 (Meswa)	0	453852
Oduo	0	379849
Muhoroni	0	458836
57a	0	508848
34a	0	521865
Lower Kipsesin	0	482011

Table II–2
Pleistocene fossil localities in the Songhor–Koru–Muhoroni Area

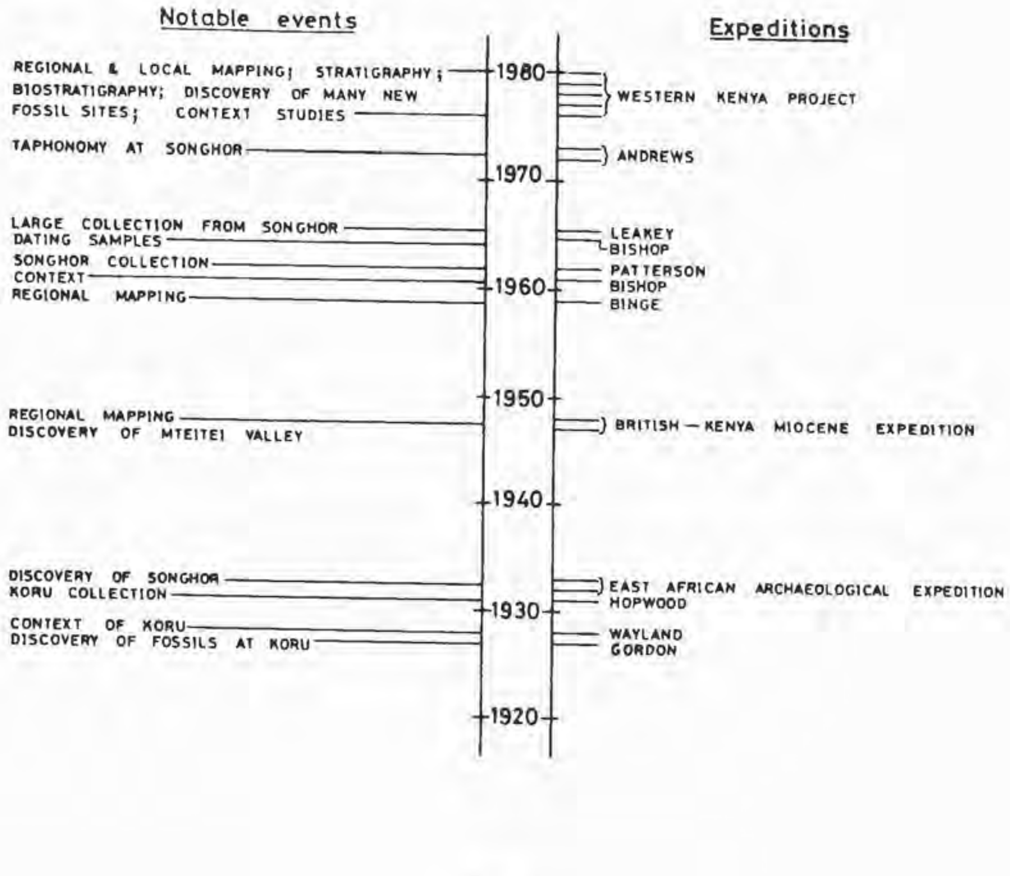


Fig. II–1
Historical Chart: Koru–Songhor

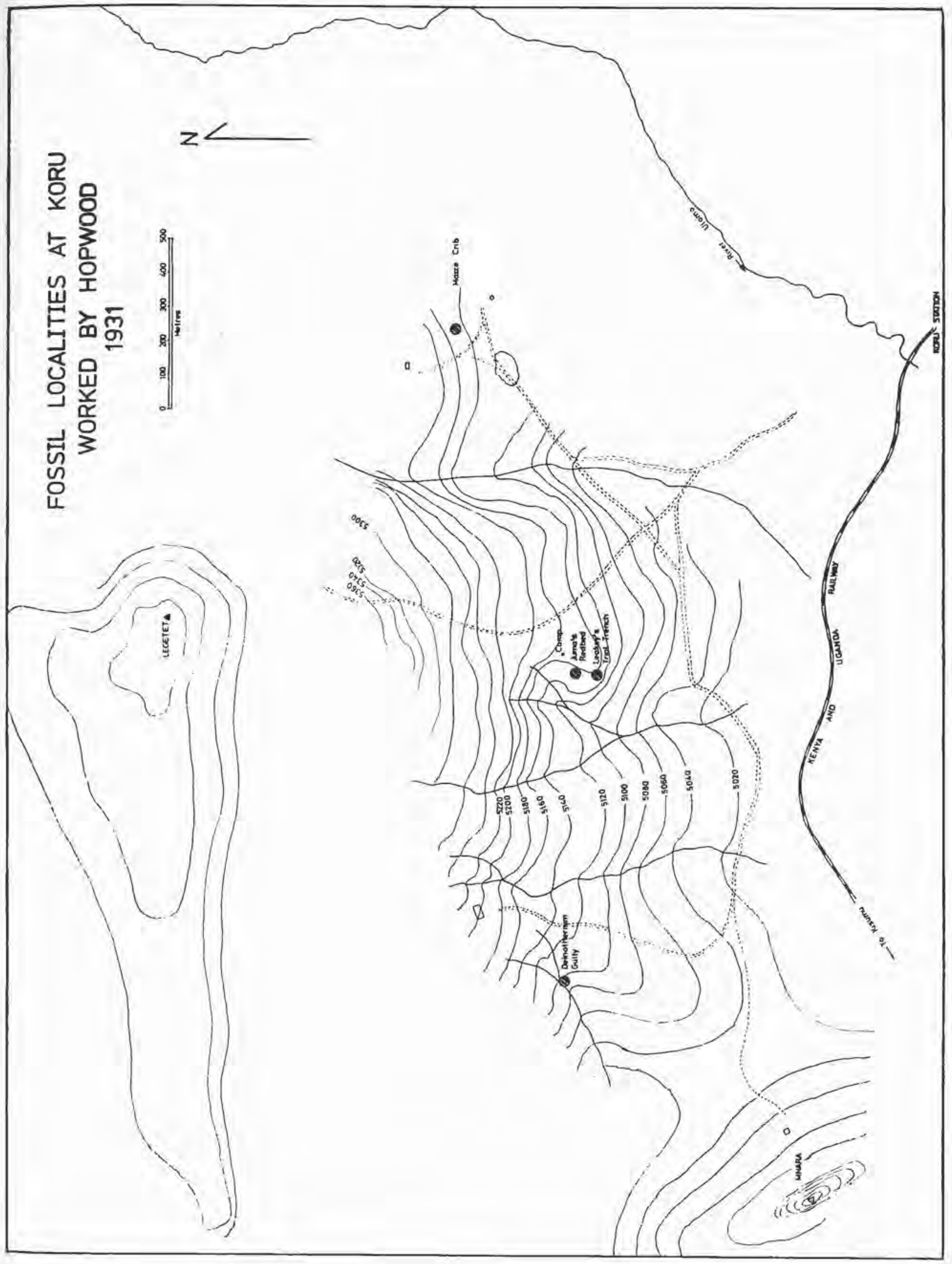


Fig. II–2
Fossil localities at Koru worked by Hopwood, 1931

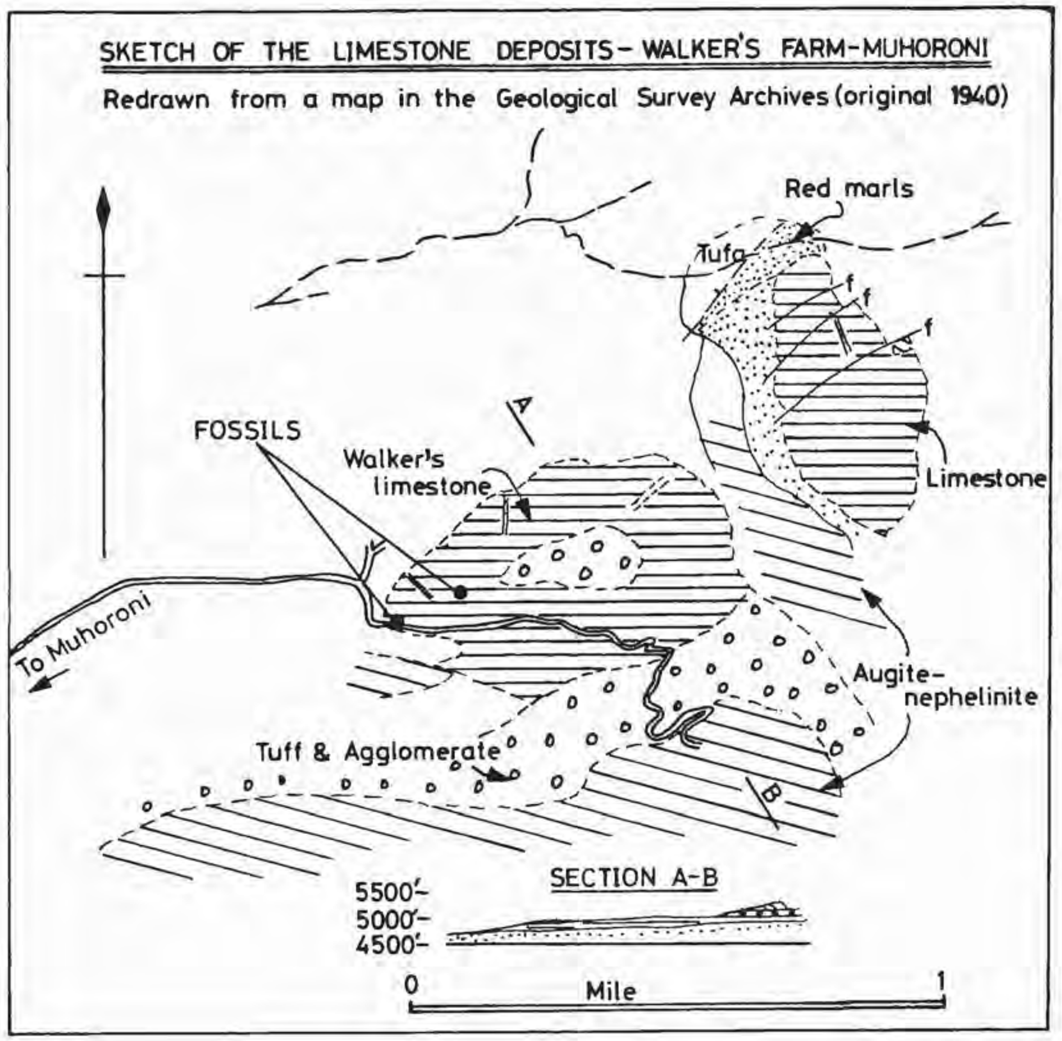


Fig. II–3
Sketch of the limestone deposits: Walker's Farm–Muhoroni

LOCALITY 36 MESWA BRIDGE
MUHORONI AGGLOMERATE

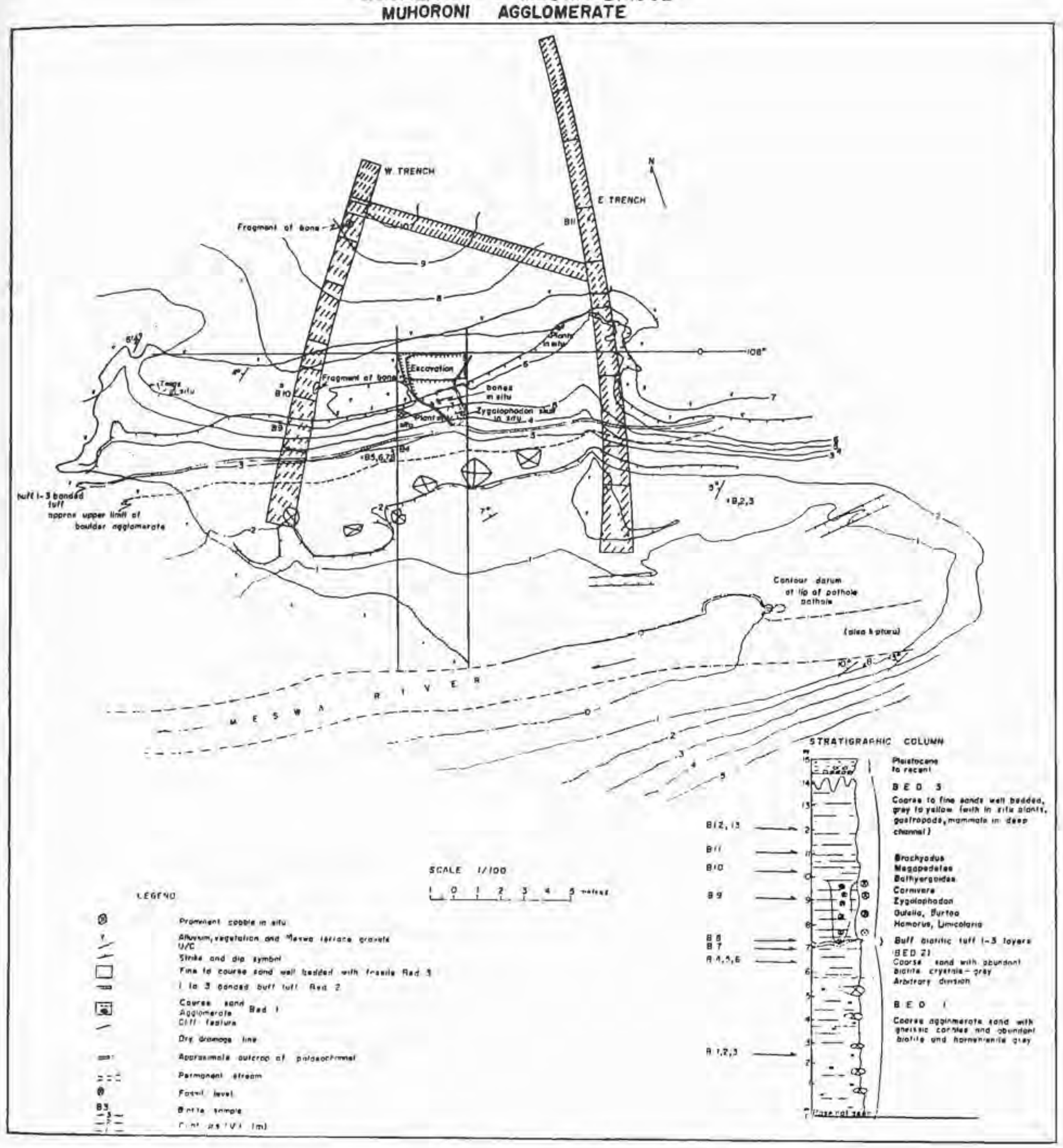


Fig. II–4
Locality 36: Meswa Bridge–Muhoroni Agglomerate

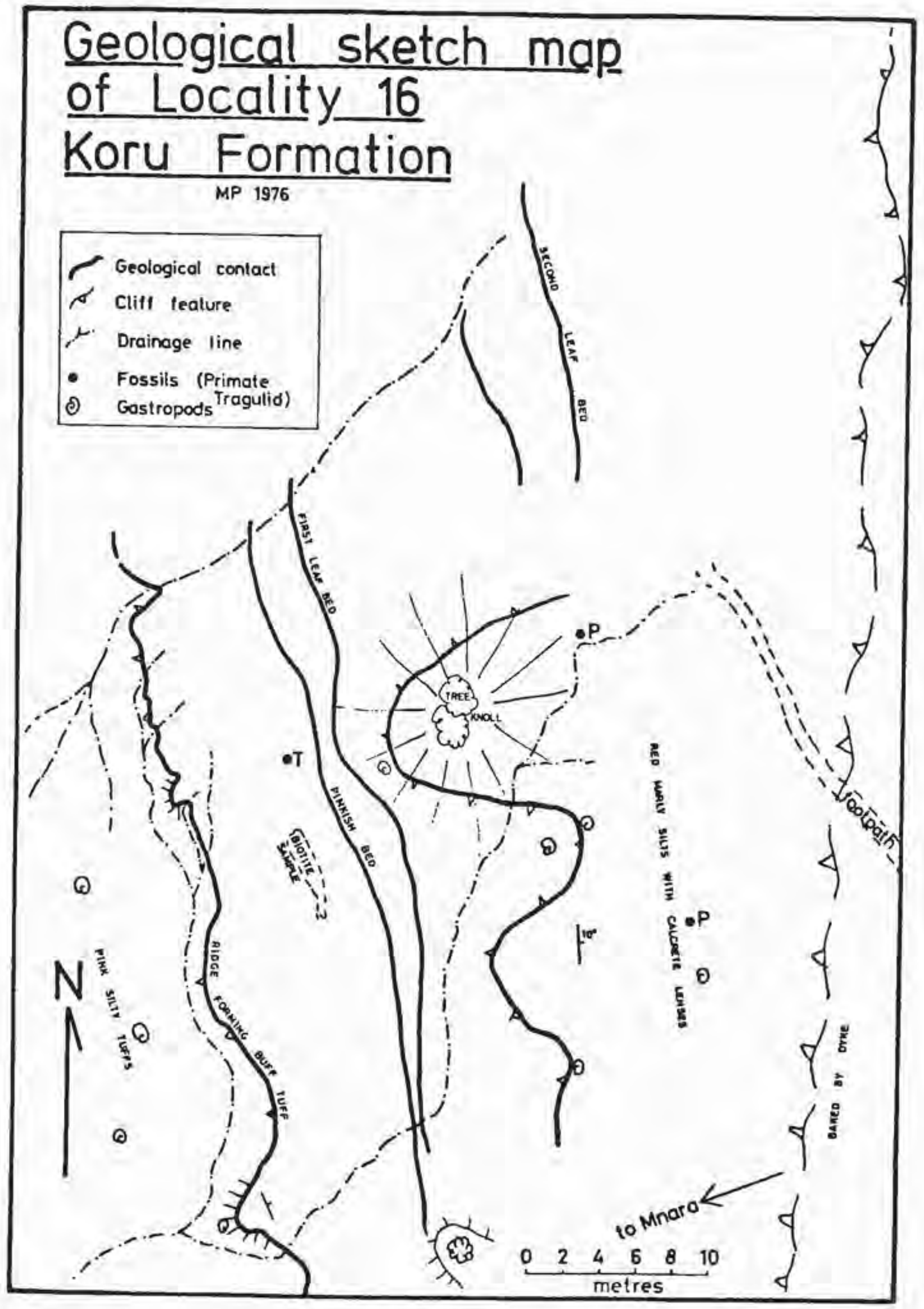


Fig. II–5

Geological sketch map of Locality 16 – Koru Formation

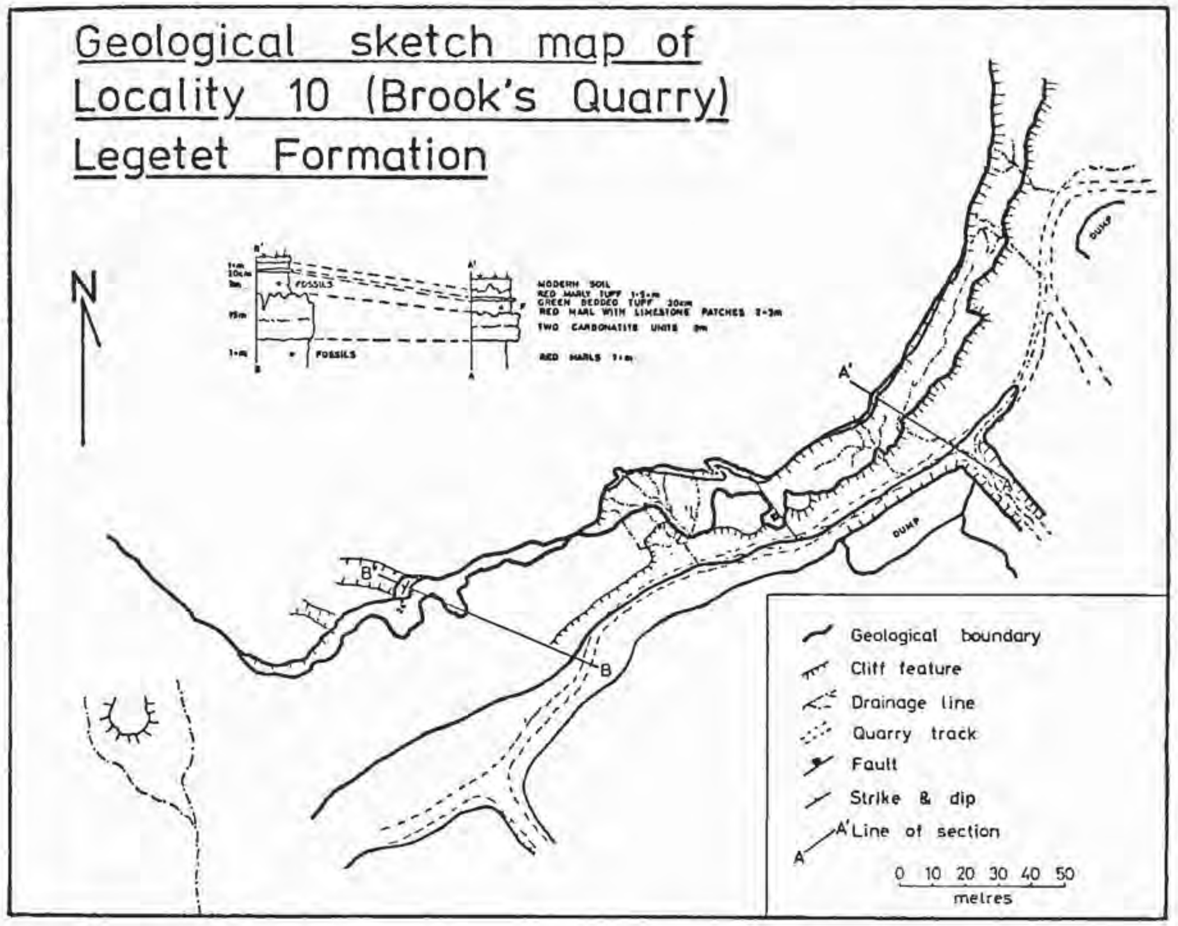


Fig. II–6

Geological sketch map of Locality 10 (Brook's Quarry) – Legetet Formation

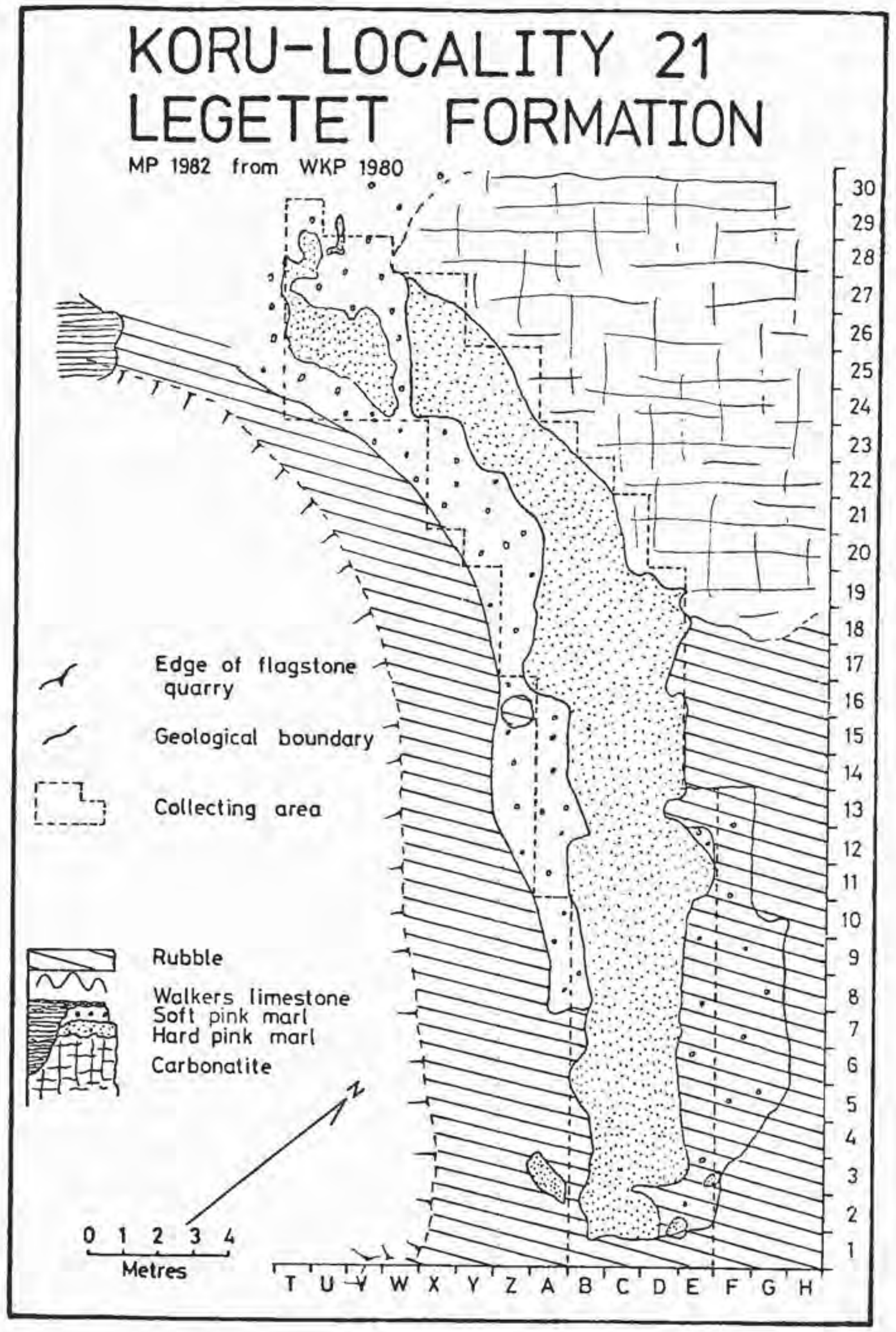


Fig. II–7

Koru–Locality 21: Legetet Formation

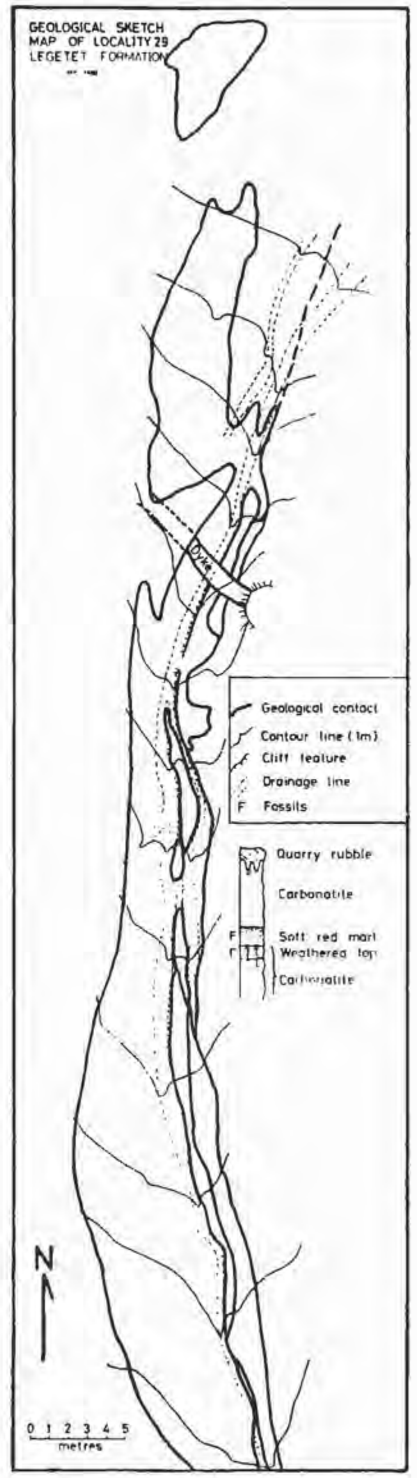


Fig. II–8

Geological sketch map of Locality 29: Legetet Formation

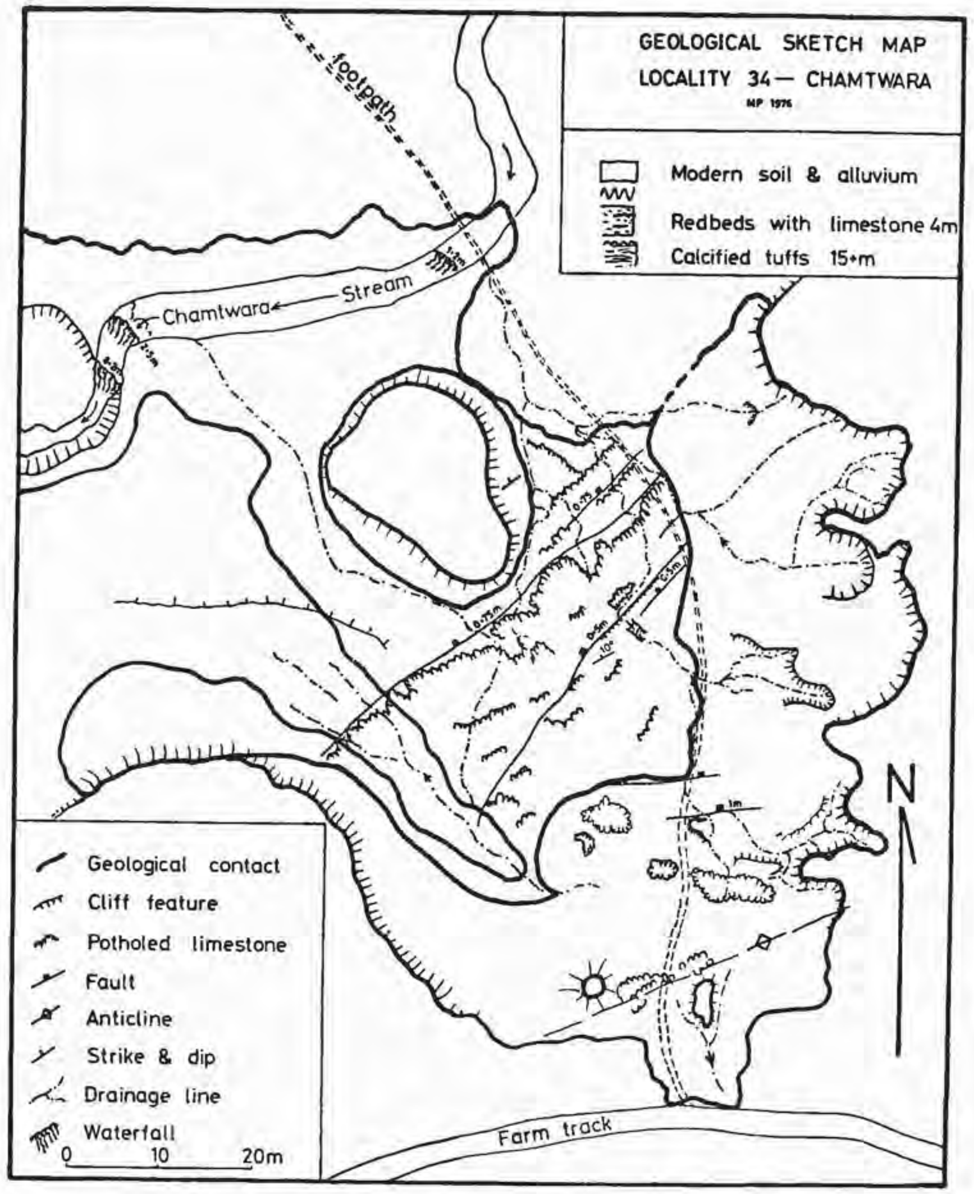


Fig. II–9

Geological sketch map of Locality 34: Chamtwara

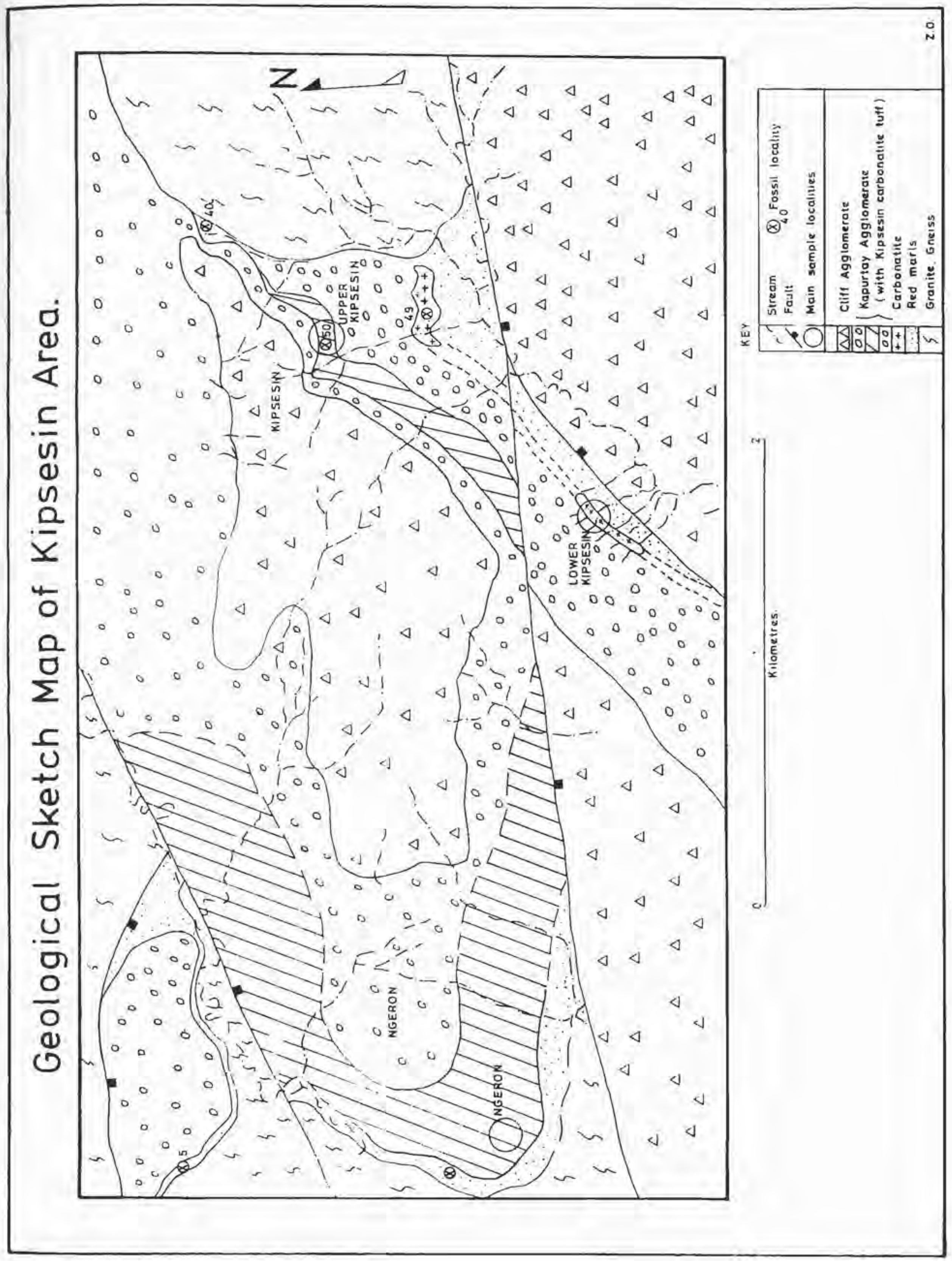


Fig. II–10

Geological sketch map of Kipsesin Area

FAUNAL LISTS KORU-SONGHOR-MUHORONI AREA	1 Songhor	10 Legetet	11 Legetet	12 Legetet	14 Legetet	15 Koru	16 Koru	20 Koru	21 Legetet	22 Legetet	23 Legetet	24 Legetet	25 Koru	26 Chamtwara	27 Legetet	29 Legetet	30 Legetet	32 Mteitei	33 Mteitei	34 Chamtwara	35 Chamtwara	36 Meswa	37 Legetet	39 Songhor East	40 Kipsesin (?=Koru)	41 Kipingai	42 Kapurtay	43 Kapurtay	45 Legetet	46 Legetet	47 Legetet	48 Legetet	50 Upper Kipsesin	52 Kapurtay	56 Legetet	58 Mteitei	59 Kipingai West	60 Kipingai
Brood cells	■	■	■		■											■		■	■																			
Cocoons	■	■	■	■	■				■	■		■	■		■	■		■	■	■	■	■	■	■	■	■				■			■	■		■	■	■
Myriapoda	■	■	■	■	■		■			■						■				■			■															■
Chelonia	■																	■	■	■				■														
Chamaeleonidae	■	■	■		■				■				■			■		■		■																		
Varanidae	■	■	■		■				■	■			■			■		■		■																		
Scincidae	■																																				
Geckonidae			■																																		
Agamidae																■																					
Lacertidae			■													■				■																	
Boidae	■	■	■										■			■		■	■	■					■										■			
Elapidae	■	■	■						■				■			■		■	■	■									■									
Colubridae	■												■			■																					
Viperidae																■																					
Ophides indet.	■	■	■							■			■			■		■	■	■					■													
Amphisbaenia	■															■																					
Falconiformes																				■																	
Cuculiformes	■								■																			■									
Columbiformes		■																																			
Passeriformes		■																		■																	
Musophagidae	■	■														■				■																	
Bucerotidae	■	■	■													■																					
Phasianidae	■	■	■													■				■																	
Phoenicopteridae																						■															
Miorhynchocyon clarki	■	■							■				■			■	■			■																	
Miorhynchocyon meswae																						■															
Miorhynchocyon rusingae	■																																				
Myohyrax oswaldi	■																			■																	
Macroscelid sp.							■																														
Galerix africanus	■	■											■					■		■																	
Amphechinus rusingensis	■	■					■		■							■				■																	
Gymnurechinus leakeyi	■	■			■											■				■								■									
Gymnurechinus camptolophus	■																																				
Protenrec tricuspis	■	■																		■																	
Parageogale aletris																				■																	
Erythrozootes chamerpes	■	■					■						■					■																			
Prochrysochloris miocenicus	■	■					■									■				■																	
cf. Propotto																																					
Propotto leakeyi	■											■								■																	
Pteropodid sp. a	■	■																		■																	
Pteropodid sp. b																				■																	
Taphozous incognita		■					■																														
Emballonurid sp.	■	■																																			
Nycterididae																				■																	
Hipposideros	■																																				
Hipposiderid	■																			■																	
Chamtwaria pickfordi																				■																	
Vespertilionid sp. a																				■																	
Vespertilionid sp. b	■																			■																	
Komba minor	■																			■																	
Komba robustus	■																			■																	
Progalago songhorensis	■																																				
Progalago dorae	■																			■																	
Micropithecus clarki		■			■								■			■				■																	
Nov. gen. songhorensis	■	■			■											■		■		■																	
Dendropithecus macinnesi	■																			■																	
Rangwapithecus gordoni	■																			■																	
Rangwapithecus vancouveringi	■																																				
Xenopithecus koruensis					■																																
Limnopithecus legetet		■			■			■		■			■			■				■								■									
Limnopithecus evansi	■																	■	■																		
Proconsul africanus	■	■	■		■		■	■	■				■			■		■	■	■			■															
Proconsul major	■	■	■		■		■	■	■				■			■		■	■	■		■																
Andrewsimys parvus	■																																				
Phiomys andrewsi	■															■				■																	
Paraphiomys pigotti	■		■													■				■																	
Paraphiomys stromeri	■		■													■				■																	
Epiphiomys coryndoni	■															■				■																	
Diamantomys luederitzi	■		■						■							■				■																	
Kenyamys mariae	■																																				
Simonimys genovefae	■															■																					
Myophiomys arambourgi	■																																				
Elmerimys woodi																				■																	
Bathyergoides neotertiarius	■															■				■																	
Proheliophobius leakeyi	■																																				
Paranomalurus bishopi	■		■						■							■				■																	
Paranomalurus soniae	■		■						■							■				■																	
Paranomalurus walkeri	■		■						■							■				■																	
Zenkerella wintoni	■																																				
Megapedetes pentadactylus	■								■											■																	
Afrocricetodon songhori	■		■						■							■				■																	
Protarsomys macinnesi																■																					
Notocricetodon petteri	■		■													■																					
Vulcanisciurus africanus	■																			■																	
Kelba quadeemae	■																					■															
Teratodon spekei	■				■					■			■							■		■															
Hyainailurus sp.																						■															
Isohyaenodon andrewsi	■																			■																	
Isohyaenodon pilgrimi	■																																				
Isohyaenodon sp.	■																			■																	
Hecubides euryodon	■																																				
Hecubides sp.	■																			■																	
Kichechia zamanae	■	■	■	■	■				■				■			■		■	■	■																	
Melailurus africanus	■																																				
Orycteropus minutus	■		■															■		■		■															
Prodeinotherium hobleyi						■																															
Archaeobelodon sp.	■	■																																			
Eozygodon morotoensis																						■															
Bunohyrax sp.	■																																				
Megalohyrax championi							■																														
Chalicotherium rusingense	■	■					■													■																	
Rhinocerotidae	■																			■																	
Anthracothere sp. a																						■															
Brachyodus aequatorialis	■																			■																	
Nguruwe kijivium	■												■					■	■																		
Dorcatherium songhorensis	■	■	■		■		■	■	■	■	■	■				■	■	■	■	■	■	■	■	■					■		■					■		
Gelocus whitworthi	■																																				
Walangania africanus	■	■	■	■	■		■	■	■	■	■		■		■	■	■	■	■	■				■	■	■		■	■				■					

FOSSIL GASTROPODS OF THE KORU-SONGHOR-MTEITEI AREA	1	2	3	4	5	7	10	11	12	14	15	16	20	21	22	23	24	25	26	27	28	29	30	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Maizania lugubroides	■																											■																								
Ligatella miocenica	■																							■	■								■																			
Edouardia																						■				■																										
Cerastua miocenica	■						■															■		■	■										■																	
Cecilioides								■																																												
Subulinidae	■						■	■	■	■		■			■			■				■	■	■	■	■	■	■	■				■		■			■		■												
Krapfiella angusta	■						■	■	■	■							■	■				■		■			■		■						■		■	■														
Pseudoglessula	■																																																		
Curvella							■																				■																								
Opeas							■	■		■																																									
Pseudopeas								■		■												■																														
Achatina leakeyi	■					■	■	■	■	■		■	■				■	■		■		■		■	■	■	■	■	■			■		■	■		■	■				■			■			■				
Burtoa nilotica	■						■	■	■	■		■	■		■	■	■	■		■	■	■	■	■	■	■	■	■	■				■		■	■	■			■												■
Sitala?								■														■			■																											
Urocyclid slugs							■																	■	■	■																									■		
Trochozonites							■	■		■					■							■		■	■													■														
Trochonanina	■						■	■	■	■												■		■	■			■																								
Zingis?	■						■			■												■		■	■				■									■														
Thapsia	■						■	■	■	■		■						■			■	■	■	■	■	■	■	■	■									■														
Chlamydarion							■	■		■					■							■																										■				
Halolimnohelix							■	■	■	■								■				■		■	■											■	■															
Tayloria	■						■	■										■				■		■	■			■						■		■																
Gonaxis (large)	■						■	■		■										■		■		■	■			■																								
Gonaxis protocavalli	■						■	■	■	■		■										■		■	■				■									■														
Marconia	■						■	■	■	■							■	■			■	■																■		■												
Edentulina																												■																								
Gonospira							■	■	■	■							■					■				■		■	■								■	■														
Streptostele												■																■																								
Ptychotrema								■		■												■																														
Primigulella	■						■	■	■	■		■			■		■	■	■			■	■	■	■		■	■	■		■				■	■	■	■		■								■				
Gulella (small)							■	■	■	■							■	■				■		■	■			■	■									■														

Fig. II–12

Fossil gastropods of the Koru–Songhor–Mteitei Area

SONGHOR FAUNAL LIST PLEISTOCENE SITES	Songhor Post Office	Ruke Bridge	Muhoroni Riv. Bridge	Muhoroni River	Location 38, Meswa	Lower Kipsesin
Limicolaria sp.			■			■
Varanus					■	
Small carnivore	■					
Cercopithecus					■	
Homo					■	
Tachyoryctes				■		
Loxodonta					■	
Equus					■	
Diceros	■					
Hippopotamus					■	
Redunca				■	■	
Kobus large sp.	■		■		■	
Small bovid		■	■	■		

Fig. II–13

Songhor Faunal list: Pleistocene sites

←

Fig. II–11

Faunal lists: Koru–Songhor–Muhoroni Region

CHAPTER 3

AREA II

RUSINGA ISLAND

History

The earliest record of the presence of fossils on Rusinga was made by Maufe (1908) who noted fossil wood in stratified tuffs. Vertebrates were first found by E. J. Wayland in 1930 and the first mammals were located by the East African Archaeological Expedition of 1932, led by L. S. B. Leakey. Hominoids were found during the first visit of the E. A. A. E. by Miss Kitson (E. A. A. E. Field Report for April, 1932) a discovery which led to much future activity, not only by the E. A. A. E. but by many subsequent expeditions both before and after the 2nd World War (fig. III–1).

The main period of collecting was by the British–Kenya Miocene Expedition (fig. III–2) which worked on the island between 1947 and 1956, during which time well over 20,000 fossils were taken. Little activity took place after the B. K. M. E. until the mid– sixties when Van Couvering studied the stratigraphy and petrology of the island (fig. III–3). This phase of study was followed by expeditions led by Andrews in the early 1970's. A renewal of interest in Rusinga Island followed the discovery of a *Proconsul nyanzae* lower leg and foot by Pickford in 1980; of additional parts of a *P. africanus* skeleton by Pickford and Walker in 1981 and parts of the 1948 *P. africanus* skull by Pickford in 1981. An expedition jointly directed by A. Walker and R. Leakey is currently investigating the palaeontology of Rusinga.

Geological Map

The geological Map of Rusinga Island is slightly modified from Van Couvering (1972). Published maps by Kent (1944) are at too small a scale to be of much use to modern students, although the original field maps made by Kent, housed in the BM(NH) Palaeontology Division Archives, are of tremendous geological and historical value. Maps by Shackleton (1951) are useful because of the great detail shown, especially of the Kathwanga–Kiahera area. Whitworth (1953) published maps of the Gumba Peninsula, but their scale is rather too small to be of great use. It should be noted that Van Couvering's 1972 remapping of Gumba is probably not a fair reassessment of Whitworth's work (see section on Stratigraphy).

Various large scale maps of important exposures have been made by Shackleton (1951) and Van Couvering (1972) and several new ones by Pickford are included here.

Considerable amounts of additional detailed survey remain to be done on Rusinga. Although much of the broad sequence is probably now correctly determined there are still problem areas which require attention. Some of these areas are highlighted in the stratigraphy section.

Radioisotopic Dating

Evernden et al., 1965, were the first to publish radioisotopic ages for the Rusinga fauna. They obtained a variety of dates, both very old and rather young, but eventually concluded that the age of the *Proconsul* beds was in the region of 15 m.y. old, and therefore contemporary with the *Dryopithecus* faunas of Europe.

Van Couvering and Miller (1969) obtained additional dates made on samples collected from a better understood rock sequence and concluded that the Hiwegi Formation was about 18 m.y. old, and the Rusinga Agglomerate about 19.6 m.y. old. The capping lavas of the Lunene Formation were dated at about 16.5 m.y.

A new dating programme by Drake, Van Couvering, Pickford and Curtis (in prep.) has resulted in the discovery that dates obtained from bleached biotites are liable to be too old, since Potassium apparently leaches out of the crystals at a greater rate than Argon, resulting in relative enrichment of Argon over Potassium. In biotites from Rusinga there is a relatively straightforward increase in apparent radioisotopic age with loss of K. This realisation has permitted a new look at the K–Ar chronology of Rusinga and it is now thought that all the lower Miocene strata of Rusinga accumulated during a period of about 200,000 years, at 17.9 ± 0.2 m.y

The Wayondo fauna is certainly close to that of Hiwegi in terms of its evolutionary stage, but it contains a few taxa suggestive of an earlier fauna which are not found in the younger Hiwegi deposits. A refinement of the dating of the Wayondo Formation is a requirement to be kept in mind by future researchers.

The Kulu fauna is without exception, very close to that of Hiwegi and there is little reason to separate the two for biostratigraphic reasons.

Stratigraphy

The sequence of rocks exposed on Rusinga is comprised of three major suites, lower Miocene, late Pleistocene and Holocene in age. The most important of these is of course the richly fossiliferous lower Miocene succession, but the late Pleistocene strata are of importance in providing evidence concerning the earlier part of Lake Victoria's history. Although it is not generally known, the late Pleistocene strata are richly fossiliferous, and yield a fauna which no longer occurs on the island.

The lower Miocene succession is divided into two stratigraphic groups; the Rusinga Group and the Kisingiri Group (Van Couvering, 1972). The Rusinga Group is subdivided into six lithostratigraphic formations as follows:

Kulu Formation	Youngest
Hiwegi Formation	
Ombonya Formation	↑
Rusinga Agglomerate Formation	
Kiahera Formation	
Wayondo Formation	Oldest

This sequence is thought to overlie Pre–Cambrian Nyanzian leucogranites, although these are not exposed on the island. Above the Rusinga Group comes the Kisingiri Group comprised of the Kiangata Nephelinite Agglomerates overlain by the Lunene Lava Formation. Fossils are known to occur in the Kisingiri group, both on Rusinga and more profusely on Uyoma, but 99.9% of Rusinga's Miocene vertebrate fossils have been collected from Rusinga Group sediments.

The late Pleistocene Wasiriya Beds (Van Couvering, 1972) outcrop as extensive terrace deposits in many parts of the island, but particularly in the Nyamsingulu–Wakondu area in south–central Rusinga.

Although these terrace deposits outcrop as high as 120 feet (40 metres) above present day lake level (Kent, 1942) they accumulated in response to a base level only about 50 feet (16 metres) above lake level (Van Couvering, 1972). Inability on the part of Kent (1942) to appreciate the nature of the depositional profile of the Wasiriya Beds led to some spurious ideas concerning former very deep stands of Lake Victoria, now generally considered never to have been much more than 19 metres deeper than it now is (Kendall, 1969). Round the inland edge of the Wasiriya outcrop, there are many places which yield fossils, mostly modern in aspect.

The Holocene sediments on Rusinga occur up to about three metres above lake level, forming extensive flatlands bordering the lake edge, as well as separating the Kiakanga Peninsula from Lugongo. These sediments are known to contain shell middens on the mainland opposite Rusinga, but I saw no fossils on Rusinga itself.

GEOGRAPHIC AND STRATIGRAPHIC POSITIONS OF FOSSILIFEROUS SITES ON RUSINGA

The Wayondo Formation

The Wayondo Formation (fig. III–4) outcrops in Central and Western Rusinga, notably at Wayondo, West Kiahera and Gumba. There is a small but important outcrop at Kathwanga (R 124).

Fossils occur moderately profusely in redbeds of the Wayondo Formation, especially at R 74 (Gumba redbeds) (fig. III–5). The oldest member, the Brown Breccia, is not known to yield mammals, though I saw fossil plants at one point in the West Kiahera area, and Shackleton (1951) recorded gastropods in this unit at a spot 1000 yards E61°S of Kiahera summit. Above this comes the Micaceous Member of Van Couvering (1972) a sequence capable of subdivision into four or more units (Shackleton, 1951). The lowest of these are the Gumba redbeds and lateral equivalents at Gunda (site R124), R113 (fig. III–6), R73 (Kalim) and R76 (Wayondo). Locality R71 (Kiune) is also probably of Wayondo age. Fossils occur in grits and clays within the redbeds, the majority being of aquatic affinities. *Etheria* and other bivalves are common at most localities, as are turtles, crocodiles, *Brachyodus* and deinotheres. Vertebrate remains are often rolled and polished, indicating that post–mortem transportion was an important factor at these levels. Specimens are often bright red.

Above the redbeds comes a series of pale grey, lavender and yellowish silts, sands and gravels chiefly waterlain, but with minor palaeosol development in patches (the Lone Hill Beds and the Kidiwa Valley Beds). Fossils, all of terrestrial affinities are washing out of these beds at Gumba, R113, Nyamwita (near R73) and R76. Brown friable limestones yield most fossils, notably gastropods and insect cocoons, but also rodents and primates. Fossil leaves and seeds occur as well. The Lone Hill beds are however, rather poorly fossiliferous.

The Kiahera Formation

(fig. III–7)

Above the pale grey fluvial sediments of the Lone Hill beds comes the unfossiliferous Tuff with Blocks. Above this come a thick series of well bedded red tuffs rich in mica which grades upwards into green and brown interbedded tuffs and palaeosols. The red tuffs have yielded a few fossils upstream from R107 (leaves and a primate humerus) and at R123 north of Kiahera Hill, it is rich in gastropods though few mammals are known. In the interbedded green tuffs and brown palaeosols occur several beds rich in gastropods and cocoons. One bed at Site R126 yielded fruit, insects and leaves. Above this unit, the highest in the Micaceous Member, comes a very coarse bouldery tuff, possibly a mudflow deposit. No fossils have been recorded from this unit which is unconformably overlain by the Rusinga Agglomerate Formation.

On Kiakanga (Gumba) Peninsula a conformable sequence of grits, tuffs and cobbly tuffs contains few fossils at sites R114 and R120. In many exposures there are quantities of fossil wood and in a few places there are fossil leaves and even footprints.

Site R114 (often called »Whitworth's Pothole« was mapped in the Hiwegi Formation by Van Couvering (1972), but this is almost certainly not the case. The flaggy tuff sequence, in which the »pothole« limey grit occurs is conformably disposed on the tuff- with-blocks below and the contact is gradational. Although it is not possible in the absence of younger rocks to provide an upper age limit to the period of the »pothole« fill, it being the youngest preserved local event, it seems that it would not have been substantially later than the flaggy tuffs. I incline to the view therefore that site R114, which yielded a significant assemblage of articulated mammal skeletons, is possibly of Kiahera Formation age.

Kiahera Formation outcrops on Wanyama Peninsula have yielded a few gastropods and a deinothere, but the beds exposed there are generally very poorly fossiliferous. Fossils labelled Lisiwi may possibly come from Kiahera outcrops near the gully of that name between Wayondo Hill and Kulu. My examinations of the more prominent outcrops in the area yielded no fossils whatsoever, and the fossils in question may have come from elsewhere. The position of the site of Ondongo, which yielded red fossils like those from Gumba, is unknown, and it is not a recognised place name on Rusinga as far as I could ascertain. In Swahili, the word »Ndongo« means »mud«, and the informant of the collector of this particular assemblage, may have misunderstood his questions concerning place names. Alternatively, it might represent a corruption of Wayondo.

The Rusinga Agglomerate

It is not generally realised that the Rusinga Agglomerate is a composite unit containing sediments and soils as well as agglomerates. In the R107 area in particular, but also near Sienga, at Kiahera and on Mfwangano the bedded grits and palaeosols are intercalated between coarse agglomerates (Van Couvering and Miller, 1969). However, few fossils have been found in these strata on Rusinga Island. In the R107 area, Van Couvering (1972) recorded the presence of tragulids in one of the palaeosols, but my own searches revealed very little additional material. Whitworth (1961) however, records an appreciably diverse fauna from the Rusinga Agglomerates on Mfwangano Island, and it may be worthwhile prospecting these strata more thoroughly. In many places they contain fossil plant remains.

The Ombonya Formation

The Ombonya Formation outcrops in a restricted area southwest of Hiwegi Hill where it is mapped between Rusinga Agglomerate below and Hiwegi Formation above. According to Van Couvering (1972) it is unfossiliferous and in my own traverses I saw nothing in situ. A few bone scraps on the surface may have come from superjacent outcrops of Hiwegi Formation.

Hiwegi Formation

The Hiwegi Formation has without a doubt produced the bulk of Miocene fossils from Rusinga (fig. III–8). It is divided into four members, all of which are fossiliferous although of these, the Fossil Bed Member has yielded appreciably more vertebrate fossils than the other members combined.

The oldest member in the Hiwegi Formation, the Kathwanga Point Tuff, was generally thought to be unfossiliferous apart from a basal layer crammed with fossil leaves. Closer inspection however, has revealed that it also yields fruits and seeds as well as insects, gastropods, birds and mammals. These, without exception, come from the interface between the post–Rusinga– Agglomerate palaeosol, and the basal layers of the Kathwanga Point Tuffs which covered it by subaerial ashfalls. The fossil insect assemblage at R107 came from this horizon as did a bird body from R106, fossilised with its flesh intact. In tracing this level along strike northeastwards towards R105, I noted leaves and twigs at all exposures, fruits and seeds at many outcrops, but few places with insects, gastropods and very few vertebrates. The R107 occurrence yields insects, fruit, seeds, leaves and twigs as well as *Proconsul nyanzae*. The most unexpected fossil occurrences at this level, however, are near the top of Kiahera Hill, where marl–filled tree trunk moulds contain partially articulated mammal skeletons ranging in size from rodents to giraffids, as well as insects. I saw three such occurrences at Kiahera. The same horizon is well exposed on the eastern bluffs of Kathwanga Point, where fossil leaves are common. The bulk of this unit above the palaeosol appears however, to be unfossiliferous.

Above the Kathwanga Point Tuffs comes the Grit Member, a relatively poorly fossiliferous sequence of fluvial tuffaceous silts, sands, grits and conglomerates. It contains a few leaves, gastropods, crocodiles and mammals in the west Kathwanga Point exposures, but it should be noted that the bulk of loose fossils on the surface of this member is derived from superjacent outcrops of Fossil Bed Member. A few fossils were seen in the grit beds at R106 and in the Hiwegi area, but the results of searches were usually rather poor. The only exception, if the level is correctly identified, is the R105b »Fruit and Nut Bed«, (loc. R117) placed here by Van Couvering (1972).

In contrast, the Fossil Bed Member is extremely richly endowed with fossils of many kinds, including leaves, seeds, insects, gastropods, reptiles and mammals. Estimates from field catalogues indicate that over 80% of Rusinga fossils were probably derived from this member. Three major fossil–bearing exposures of this member are known, the R1–R3 area east of Hiwegi Hill (figs III–9 to 11), the R105–106–107 area (Muanga) west of Kiahera Hill (fig. III–12) and the R5 area at Kathwanga Point (figs III–13 to 15). Many smaller occurrences are known, especially in the West Hiwegi gullies, and in isolated patches of sediment round the island. Not all the smaller sites listed in the literature and field catalogues can be pinned down geographically, among which are R10–19, R30–40 and R108–R112, all of which are probably in the Fossil Bed Member. I strongly suspect that these sites are mostly merely subdivisions of the principal collecting areas, as R20–29 were in the Kulu Formation outcrops.

A custom of the British–Kenya Miocene expedition was to issue alphabetical postscripts to the main areas for particularly significant parts of those areas. Thus R1a is a particular pinpoint in the R1 area where a *Proconsul* mandible was found in 1942, and which later yielded abundant fossils, including two rhino skeletons in excavation. Likewise, R3A is a point in the R3 area which yielded four partial skeletons of *Dendropithecus*. The only obvious departure from this »rule« was in the case of the »Fruit and Nut Bed« (R105b) which is well separated from R105, although it is downstream in the same gully system.

Later expeditions have not always been rigorous about provenience of fossils, and designations such as Kamasengere, meaning R105 through R113, and Hiwegi, meaning R1–R3, are all too frequent. Particular note should be made of the 1956 collection in which homonyms of Rusinga sites were used. It is pretty certain that the 1956 collection was made only in the R1 and R3 areas, on a basis of (1) the field notes, (2) conjoining specimens collected in previous and subsequent years (3) the preservation characters of the fossils and (4) the nature of the assemblages collected. Yet the designations R2, A1, A2, A3 as well as R1 and R3 were used for these assemblages, each apparently for separate gullies in the East Hiwegi area. This incomprehensible usage of site numbers has badly misled palaeontologists who have studied the 1956 collections in ignorance of the homonymy. Thus many taxa listed for the Kulu Formation (as R2) have not in fact, ever been collected there. In particular this is so of insectivores, rodents and gastropods. Equally incomprehensible was the use of similar site designations A1 and A3 for specimens collected at Mfwangano the same season.

The list of site synonyms is rather long, in which one site is known by several different designations. For example, parts of the R5 area are also known as Kathwanga (often also spelt Kaswanga), plus several other names (Kathwanga North etc., Kiagasa, Carnivore Gully, Whitworth Gully, etc), and numbers (possibly R90 to R99), as well as alphabetical postscripts (R5a etc). A separate table of possible homonyms and synonyms has been prepared, a copy of which is lodged with the Palaeontology Division of the National Museum of Kenya.

The Fossil Bed Member is comprised of various strata in all its major outcrops. Collectors were unable to distinguish assemblages from different beds, with the result that material from a range of strata has generally been lumped together. The effect of this lumping is difficult to assess without excavations, but preliminary assessments by me suggest that different assemblages are sometimes badly mixed, in particular aquatic and subaerial assemblages at R5. In a few cases superjacent outcrops of other formations have also been sampled, as in the R106–R107 area where Fossil Bed Member, Kathwanga Point Member, Grit Member, Rusinga Agglomerates and Kiahera Formation are all represented.

Van Couvering's (1972) placements of sites in the Kiahera area are suspect. On his detailed map of the R105–R106–R107 area he has placed R107 in the precise area known to have yielded the 1948 *Proconsul africanus* skull, a site designated R106A by the British–Kenya Miocene Expedition. In addition the evidence afforded by the discovery of the fossil insect site, always labelled R107, indicates that R107 was to the southwest of R106 across the large gully with two waterfalls, which runs from south to north bisecting the badlands in this area. Furthermore, R105 is in my view placed by Van Couvering too close to R106 and it should be two hundred metres to the northeast of R106, separated from it by largely overgrown Quaternary deposits. On his large scale map of Rusinga, the R105–R106–R107 area is placed too far to the southwest as is R105b, the »Fruit and Nut Bed«. The position of R113, (comprised of several distinct sites) is also incorrectly positioned on the map.

The Kamugere area is a natural extension of the R3 area, separated from it by a small gully. The strata which yield fossils at Kamugere are precisely those that do so at R3, and I strongly suspect that many collections labelled R3 include material from the Kamugere area. This would not be a serious hazard, and lumping the areas together would make good sense at the scale of operations used by the British–Kenya Miocene Expedition.

Locality R7, a limestone deposit once exploited on a small scale for lime burning yields large bones and teeth but little else. It is probably in the Fossil Bed Member or the Kibanga Member. The Kibanga Member (which on his map was inadvertently labelled Kibade Member by Van Couvering, 1972) overlies the Fossil Bed Member. It is generally poorly fossiliferous as far as vertebrates are concerned, but gastropods and plant remains are common in many places. This is particularly so of the R1 area where steep bluffs of the Kibanga Member immediately north of the main gully system yield abundant cocoons and a diversity of snails but also a few mammals. In addition the gastropod site known as »R4 (top)« often thought to be in the Kulu Formation because of its number, is actually in the Kibanga Member, exposed in the lower slopes of Kiangata Hill. A few vertebrates occur here and the R2–4 assemblages may have minor contamination from the Kibanga Member.

The stratigraphic position of »Whitworth's Pothole« (R114), given as Hiwegi Formation by Van Couvering (1972) is more likely to be in the Kiahera Formation. A minor mammal assemblage from red grits at Kiune is of interest if it is genuinely of Hiwegi age (Van Couvering, 1972) since it closely resembles the fossil assemblages from the red and orange grits of the Wayondo Formation. Its stratigraphic relations need rechecking, especially in view of its proximity to the extensive Wayondo Formation outcrops at Wayondo not too far distant.

An attractive looking gully on the southwest face of Wanyama Hill is however very disappointing in its fossil content, since it yields predominantly cocoons and little else. It is not entirely clear where the position of the Wanyama site is. Van Couvering (1972) places it in the Hiwegi Formation, evidently on the basis of the conspicuous gully system, but the British–Kenya Miocene Expedition Field Catalogue places it below the Basal (i.e. Rusinga) Agglomerate, in which case it would be of Kiahera age. The question is largely academic since few fossils ever came from Wanyama, but some of these, including the holotype of *Megapedetes* and paratype of *Kenyalagomys* are of much importance.

Very few fossils labelled Sienga have been collected, but among these is the most complete mandible known of *Rangwapithecus*, and a palate of a gomphothere. The position of the site which yielded these specimens is not precisely known. Van Couvering (1972) suggested tentatively that it might be on the northeast side of and close to Sienga knoll in the Hiwegi Formation which outcrops there. The British–Kenya Miocene Expedition Catalogue has an entry reading »Sienga, below lava cap« which agrees in essence with Van Couvering's placement.

In the Utajo Bay area, fairly conspicuous outcrops of Kibanga Member occur, which yield only a few gastropods and cocoons along with very occasional bone scraps. Further northwards along the Ulugi Peninsula, Van Couvering (1972) recorded the presence of gastropods in some sections, possibly on the basis of insect cocoons which are common in the area.

Kulu Formation

(fig. III–16)

The Kulu Formation, largely lacustrine and marginal lacustrine in facies, is extremely rich in fossils in certain localities, perhaps yielding more specimens per cubic metre than any of the Hiwegi levels. This is not only true of the fish bearing shales which are a feature of this formation, but also of sands at Nyamsingula which yield birds, reptiles and mammals. The Kulu Formation yields very few gastropods. Despite the limited areas of outcrop, the two main fossiliferous areas have yielded over 5% of Rusinga fossils. The most significant collecting area is the R2–R4 gully system (fig. III–17), also known in the literature as Kulu and Kulu–Waregu but known by Rusingans as Nyamsingula, a series of steep-sided gullies which often cut through the entire sequence to expose Hiwegi and Rusinga Agglomerate Formation below. This gully system was tentatively subdivided by the British–Kenya Miocene Expedition into ten collecting areas designated R20–R29. Since no records were ever made of the boundaries or whereabouts of these sites they retain no value at all. Indeed the boundary between R2 and R4 is unknown, as are the relative positions of the two areas. It is not known, for example, except by inference, whether R2 represents the downstream part of the gullies and R4 the upstream portion, or whether R2 is the right fork and R4 the left fork. That collectors took little notice of these distinctions is revealed in the field catalogues where many specimens have generalised provenience data such as »R2–4, Kulu, Kulu–Waregu, Nyamsingula etc.« and very few are labelled with the R20–R29 series of numbers.

Outcrops assigned to the Kulu Formation at Wakondu (fig. III–18) are surrounded on three sides by Wasiriya Beds and on the fourth by Rusinga Agglomerates. Although the facies is somewhat different from typical Kulu Formation, the stratigraphic identification of this outcrop is probably correct. For its minute area, it has yielded an impressive collection of fossils, predominantly aquatic and amphibious in affinities.

Fossil fish sites are known in the Kulu area (not to be confused with R2–4) and are designated as Nyamuga, Kosala I, and Kosala II (Van Couvering, 1972, map). Assiduous search would probably result in further sites being identified in the extensive Kulu outcrops.

Lacustrine sediments in the North Kiakanga exposures were thought by Whitworth (1953) to be possible correlatives of the Kulu Formation. No fossils have been located in the Kiakanga outcrops, but the facies seems good for the preservation of fish. The significance of these lake beds is that they may represent the key to establishing the relative position of site R114 in the Rusinga succession, since the shales underlie the strata containing the »pothole«. I suspect however that they may correlate with the Sena Beds of Mfwangano which are part of the Kiahera Formation on that island.

Kiangata Agglomerate

Apart from fossil wood, the Kiangata agglomerate is generally considered to be unfossiliferous. The formation contains a substantial proportion of sediments, including limestones which have yielded gastropods from an exposure on the south side of Hiwegi Hill. The usually steep slopes of this formation preclude the accumulation of lag deposits of fossils and it may be worthwile to prospect carefully along its outcrop for *in situ* material. On Uyoma peninsula, intra-Kiangata sediments have yielded rich fossil assemblages.

Lunene Lava

Capping the Rusinga Island succession is the Lunene Lava Formation consisting of three lava flows, tuffs and agglomerates as well as palaeosol horizons. The only known fossils from this formation on Rusinga are from a red calcareous soil profile near the top of Hiwegi Hill, known as Kawass. On Uyoma, correlative horizons yield numerous fossils. The position of the Kawass site is largely academic, since no specimens in any collections I have seen are labelled Kawass, or any other designation recognisable as the Kawass site. Presumably, the few fossils noted by Shackleton (1951) have been mislabelled or have been lost.

The Wasiriya Beds

(figs III–19 to 20)

These largely unstratified Pleistocene terrace deposits contain fossils at many points on Rusinga, usually near the inland edge of the outcrops. The richest site, which yields articulated bovid skeletons, is close to the Wakondu Miocene site. Other richly fossiliferous areas occur in the Nyamwita Valley where MacInnes (1952) recovered the holotype of *Orycteropus crassidens*, and west of Nyamsingula where many bovids can be seen washing out of calcareous silts and grits characterised by kunkar nodules.

However, occasional fossils of this age can be found almost anywhere on Rusinga, and I have seen Pleistocene mammal teeth at R1, R5, Gumba and R106, among other places on the island. Although none of the fossil mammals found in the Wasiriya Beds occurs on the island today, it is likely that at least some of them survived there until the advent of large scale human settlement in the 19th Century.

Kent (1942) and Van Couvering (1972) both reported an abundance of stone tools weathering out of these beds, but I saw very few specimens, none of which were *in situ*. I suspect that most of the material seen by them could be naturally fractured cobbles of lava which commonly occur in the area.

Biostratigraphy

The earliest faunas from Rusinga collected from the Wayondo and Kiahera Formations (figs III–21 to 22) are clearly of Faunal Set II affinities (Pickford, 1981), close in general aspect to the Hiwegi faunas. There are only a few taxa, notably *Teratodon*, *Dorcatherium songhorensis* and *Nguruwe kijivium*, which suggest any possibly close affinities with Set I faunas. All other taxa common to the two faunal sets are generally rather long-lived. The inference to be drawn from these data is that all the Rusinga faunas are significantly later than those of Koru and Songhor.

The faunas from the Hiwegi (figs III–23 to 24) and Kulu Formations (fig. III–25) as so similar to each other, that they cannot be separated biostratigraphically on presently available evidence. The only differences seen are related to biofacies presumably being due to differences in environment (floodplain for Hiwegi, lacustrine and littoral Kulu).

The fauna from Lunene levels is too poor on which to base any major conclusions, but what little has been found on Uyoma indicates similarity to Hiwegi faunas. However, the same taxa (e.g *Paraphiomys*, *Dorcatherium*) also occur in the Set III fauna of Maboko, so that little can be said with conviction, concerning the biostratigraphic organization of the Lunene faunas.

Synonyms

Gumba Peninsula

Bones from R74 and R75 have frequently been labelled Gumba, Gumba red earths, Gumba redbeds etc. and these designations should not be confused with »Whitworth's Pothole«, site R114, which has also been loosely called the Gumba site. Bones from different levels at R74 were not generally kept apart, although a *Dendropithecus* jaw was collected from the Lone Hill Beds which overlie the redbeds. Most fossils from Gumba, do in fact come from the redbeds.

Kiahera Area

R113, also known in the field catalogues as Kamasengere, (as were R106/R107, by some authors) consists of several separate fossil concentrations at different levels within the sequence (see map). However, all are in the Wayondo Formation, despite conjectures to the contrary by Van Couvering (1972).

R73 was sometimes known as Kalim, and the word Nyamwita is associated with R73 and other sites of unknown location.

Katoe–Kisenye–Wayondo Area

The area surrounding Wayondo Hill has many small patches of fossiliferous sediment. A variety of names and numbers has been employed for these sites in the past, but none was recorded in sufficient detail to allow anything more than a regional allocation. Among these are Katoe, Katuroe, Katowe, Kisenye, Wayondo and R76, as well as possibly Lisiwi and Ondongo.

R71

R71 is also known in the field catalogues and literature as Kiune, Kiyune, Kiune Hill and West of Kiune Hill.

R114 was originally called Whitworth's Pothole. Unfortunately, well after the designation R114 had been used for the »pothole« site, the same number was used in 1955 for a newly found plant bearing site on the western nose of Lugongo, probably the same site that is now known as R125.

A few fossils of Kiahera age may have come from the R107 area, but the bulk of fossils from R107 are from Hiwegi Formation strata, principally the basal palaeosol of the Kathwanga Point Tuffs.

Wanyama locality presents a difficulty in that the field catalogue states that the fossils come from below the basal agglomerate, while the conspicuous gully system labelled Wanyama by Van Couvering, (1972) overlies the basal agglomerate, and is therefore of Hiwegi age. On the northeast side of Wanyama, however, there are fossils, albeit few in number from the Kiahera Formation.

Hiwegi area

Sites in the vicinity of Hiwegi Hill have been called by numerous designations, only a few of which can still be identified in the field. Sites in the R1 area have been variously called R1, RA1, R1a, below R1, Luanga, A1, A2, A3 (the last three used for 1956 collections only), Warengi, R1–R1a, R2 (1956 collection only), Watengi and Waregi.

Area between Hiwegi and Mbita

Various sites in the area between R1 and Mbita were numbered, but none of the old designated localities can be pinpointed on the ground. Therefore two new numbers have been used (R118, R119), for sites in this area. Old numbers used in field catalogues for fossils collected in this general area are R10–R20, R10 near Government Camp, R11 near Government Camp, Government Camp, Hiwegi South and Hiwegi near camp. The Government Camp was presumably near the present site of Mbita Village.

R3 – Kamugere area

Well separated from R1 by unfossiliferous sediments are the richly fossiliferous areas of R3 – Kamugere. Collecting localities in this area have been called by various designations over the years, including R3, R3a, R3b, Kamugere, Warengi, between Hiwegi and Ulugi, and Waregi.

R4 top

Fossils from the Hiwegi levels below Kiangata were sometimes labelled Kiangata or »R4 top«. These should not be confused with fossils from R4 which are of Kulu age.

R5 area (Kathwanga Point)

Fossils from Kathwanga Point have been labelled with a variety of locality designations. Among these are R5, R5a, R5 Kansanga, R30–R40, Kathwanga, Kathwanga North, Kathwanga West, and Kathwanga Got. Various persons names were proposed for particular gullies in the Kathwanga area but these have seldom been used. (Kathwanga is frequently spelt Kaswanga)

Kiahera Area

In the area northwest of Kiahera Hill is the R105–R106–R107 site complex. Various names have been proposed for this area, including Muanga, Umanga, R100–R113, Kamasengere (partim), Kiagasa, R106a, R106b, R105b, Fruit and Nut bed, Muanga 2, Umanga 1.

Nyamsingula area

Fossils collected in the Nyamsingula gully system have been labelled with various site designations including Nyamsingula (West and East), R2, R2a, R4, R4a, R2–4, R20–R29, Kulu–Waregu, Wariga, Warigi, Warigu and Gulu–Waregu, but these designations mean very little now, since maps of the precise spots were never made. Note should be made of the fact that the site labelled »R4 top« is in the Hiwegi Formation, and that all fossils collected in 1956 and labelled R2 came from the R1 area.

Fossils from Pleistocene terrace deposits are found in many parts of Rusinga but rarely in any markedly concentrated patches. Only the Wakondu occurrence is a rich concentration. The fossils have thus generally been labelled with the name of the nearest Miocene outcrops, but no difficulty arises because of the immediately noticeable faunal and preservation differences (fig. III–26).

FOSSIL PLANT LOCALITIES

Fossil plants are very common on Rusinga Island; indeed they were the first fossils found there (Maufe, 1908). The bulk of the botanical remains come from the Hiwegi Formation, but there are seeds and leaves in the Kiahera Formation and abundant wood in the Kiangata and Rusinga Agglomerates. The accompanying map (fig. III–27) depicts only the more interesting leaf and seed sites. Fossil wood occurs at many places on the island but is generally of little scientific value since no internal structures are preserved.

Two sites are of particular interest because of the abundant fruits and seeds recovered therein. R117, which is probably the »Fruit and Nut Bed« of the British–Kenya Miocene Expedition (=?R105a) is in the Grit Member of the Hiwegi Formation according to Van Couvering (1972). R107, and its lateral equivalents at R106, R105, Kathwanga and Kiahera, yields abundant seeds, leaves and twigs from a palaeosol at the base of the Kathwanga Point Tuffs, virtually wherever it outcrops. There are other interesting seed sites at R118 and R119, just to the west of Site R1 in the Hiwegi area and at a site near Kathwanga Point. Most of the other localities depicted on the map have yielded only a few plant fossils of limited diversity.

It is important to note that the sites which yield rich and diverse floras tend to yield few mammals and *vice versa*.

THE WAYONDO FORMATION FOSSIL SITES

Site Designation	# of Fossils	Map Reference	Source
R71	76	304567	L. G. C. L. *, 1951
R73	49	289539	L. G. C. L., 1951
R74	300+	253528	Whitworth, 1953
R75	50±	249531	Whitworth, 1953
R76	43	321572	L. G. C. L., 1951
R113	112	274541	Van Couvering, 1972
R121	few	262536	
R124	few	281560	
Katoe	many	315568	

* L. G. C. L. = Le Gros Clark and Leakey

Table III–1

The Wayondo Formation fossil sites

THE KIAHERA FORMATION FOSSIL SITES

Site Designation	# of Fossils	Map Reference	Source
R114	111+	251539	Whitworth, 1953
R120	few	250540	
R123	few	284546	
R126	common	282539	
R127	few	252543	
Wanyama	few	299585	
Lutare	7	area 2554	Whitworth, 1953

Table III–2

The Kiahera Formation fossil sites

THE HIWEGI FORMATION FOSSIL SITES

Site Designation	# of Fossils	Map Reference	Source
R1	2000+	347553	L. G. C. L. *, 1951
R3	2000+	352559	L. G. C. L., 1951
R3a	many	350561	
R3b	several hundred	350558	
R4 top	44+	315557	
R5	3000+	277558	L. G. C. L., 1951
R7	15+	318559	Van Couvering, 1972
R105	600+ (incl. R105b-R117)	278547	
R106	700+	279549	
R117	500+	276554	
R118	many	549343	
R119	many	550343	
R122	few	296540	
R125	few	300540	
West Hiwegi	few	344559	
Kiahera	100	285542	L. G. C. L., 1951
Sienga	40	296529	L. G. C. L., 1951
Utajo	few	347576	

* L. G. C. L. = Le Gros Clark and Leakey.

SITES -- THE POSITIONS OF WHICH ARE UNKNOWN

R10-R19	(Hiwegi area)
R30-R39	(Kathwanga area)
R80-R90	(Kathwanga area)
R90-R104	(Kathwanga-Kiahera area)
R108-R112	(Kathwanga-Kiahera area)
R115-R116	(between Lunene and Kathwanga)
Kiacata	(near Kiangata?)
Kiagasa	(near R106)

Table III–3

The Hiwegi Formation fossil sites

THE KULU FORMATION FOSSIL SITES

Site Designation	# of Fossils	Map Reference	Source
R2	1000+	320551	Van Couvering, 1972
R4		319551	Van Couvering, 1972
Nyamuga	few	316554	Van Couvering, 1972
Kosala I	few	323565	Van Couvering, 1972
Kosala II	few	324564	Van Couvering, 1972
Wakondu	73+	304533	Van Couvering, 1972

Table III–4

The Kulu Formation fossil sites

FOSSIL LOCALITIES IN THE WASIRIYA BEDS

Site Designation	# of Fossils	Map Reference
Hiwegi area	few	349554
Nyamsingula area	20-30	321552-319549
Wakondu area	many	304532
Nyamwita valley	many	287532-289529
R113 area	few	274544
Kaswanga area	few	277558
Gumba area	few	252528

Table III–5

Fossil localities in the Wasiriya Beds

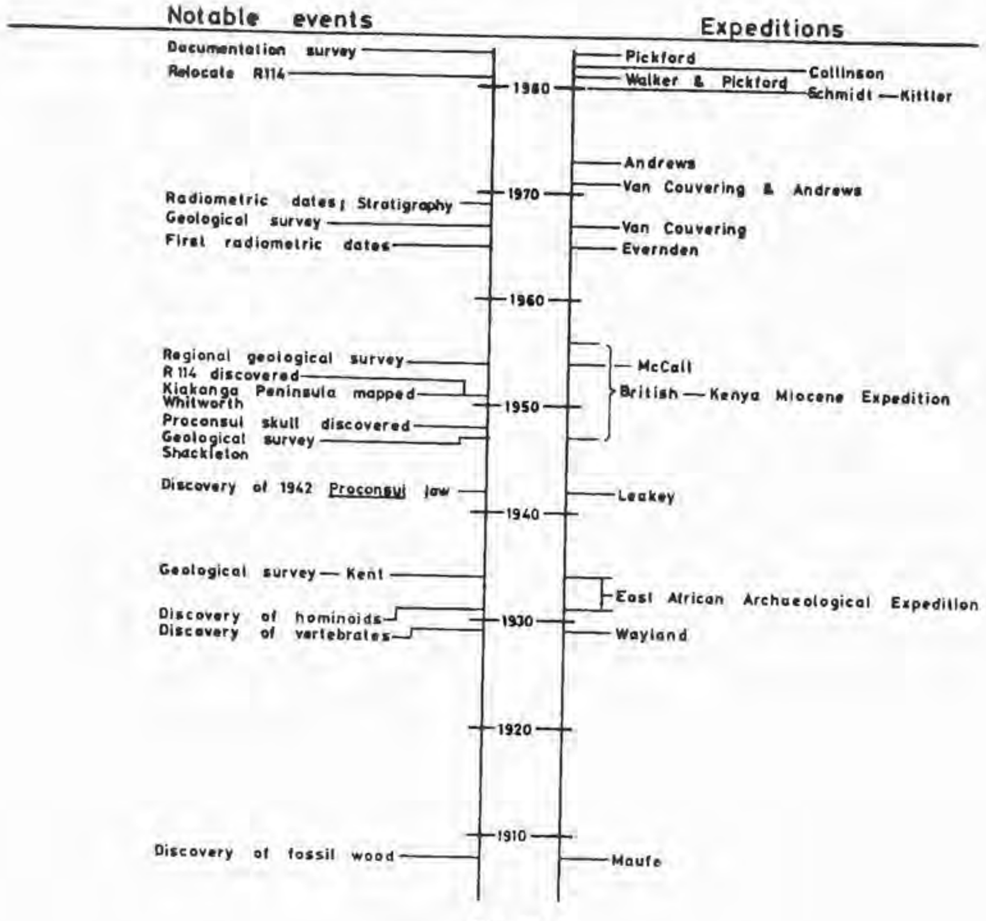
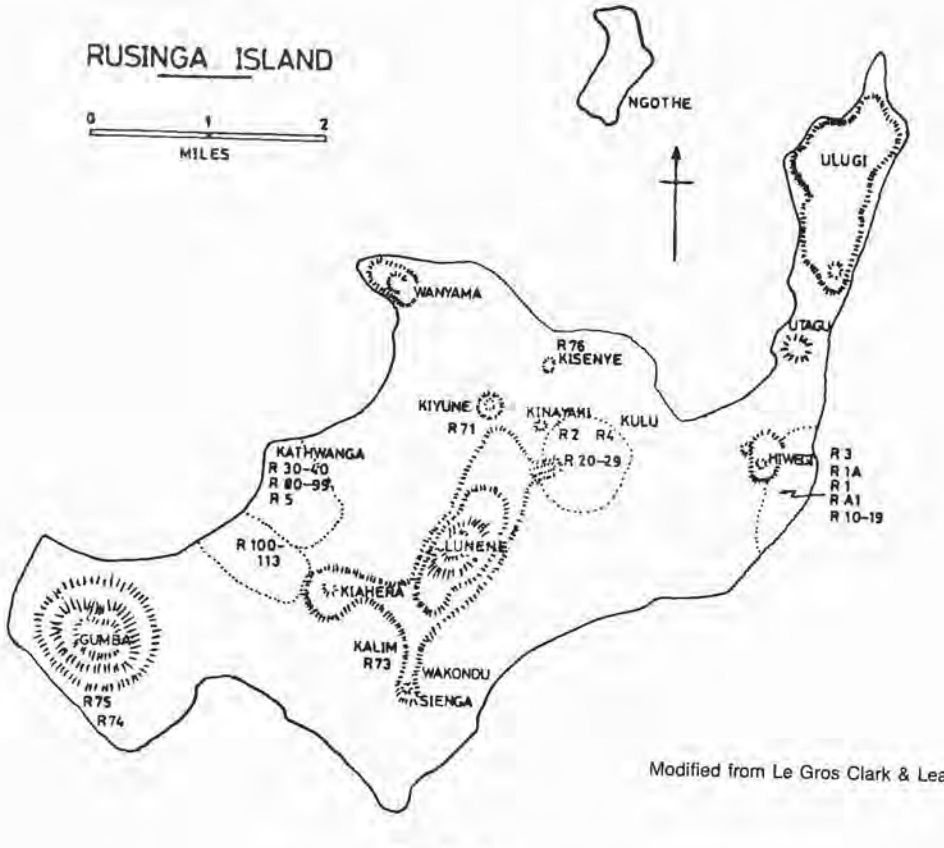


Fig. III–1

Historical Chart: Rusinga Island



Modified from Le Gros Clark & Leakey 1951

Fig. III–2

Rusinga Island fossil sites: 1951

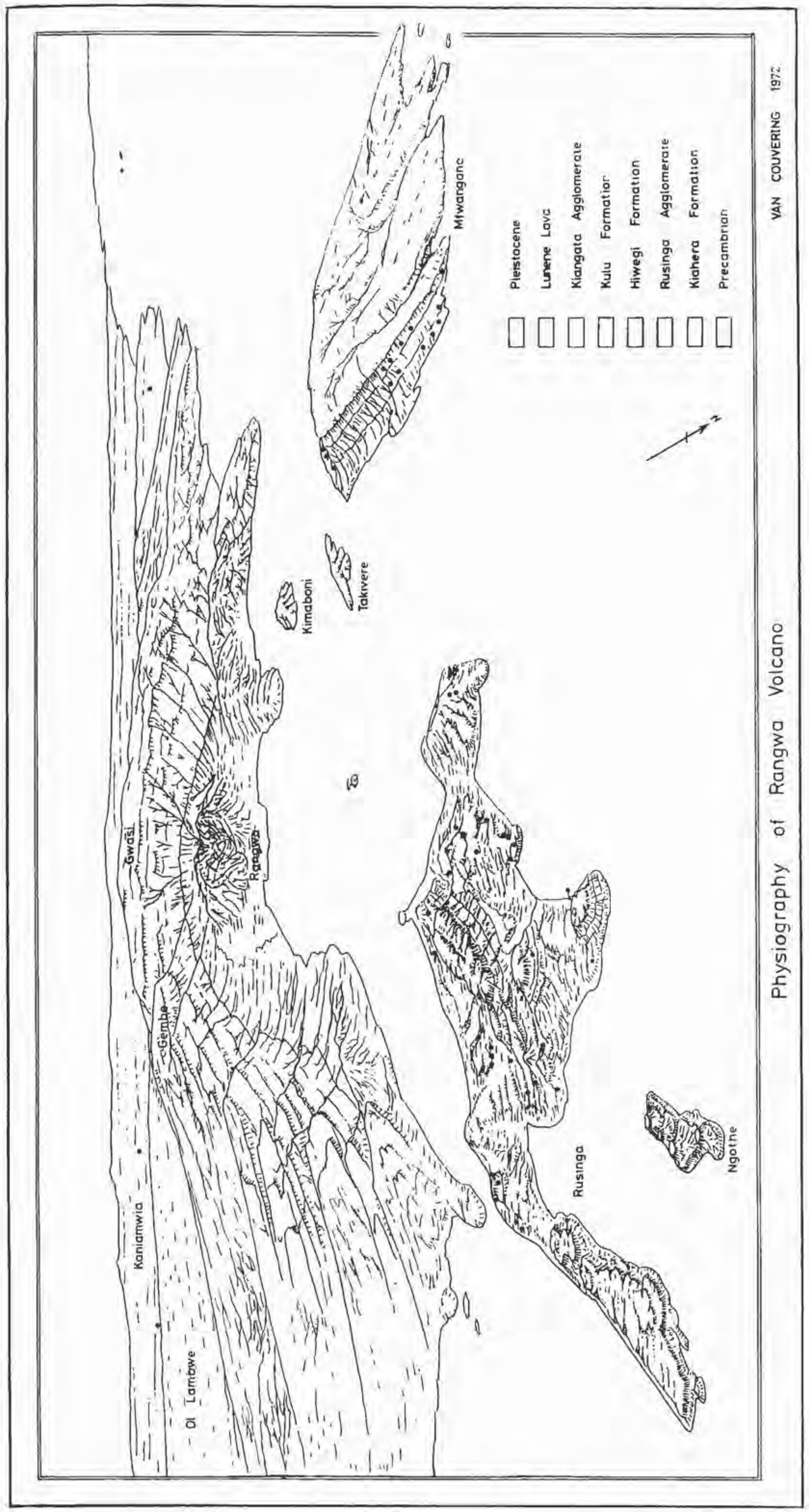


Fig. III–3

Physiography of Rangwa Volcano

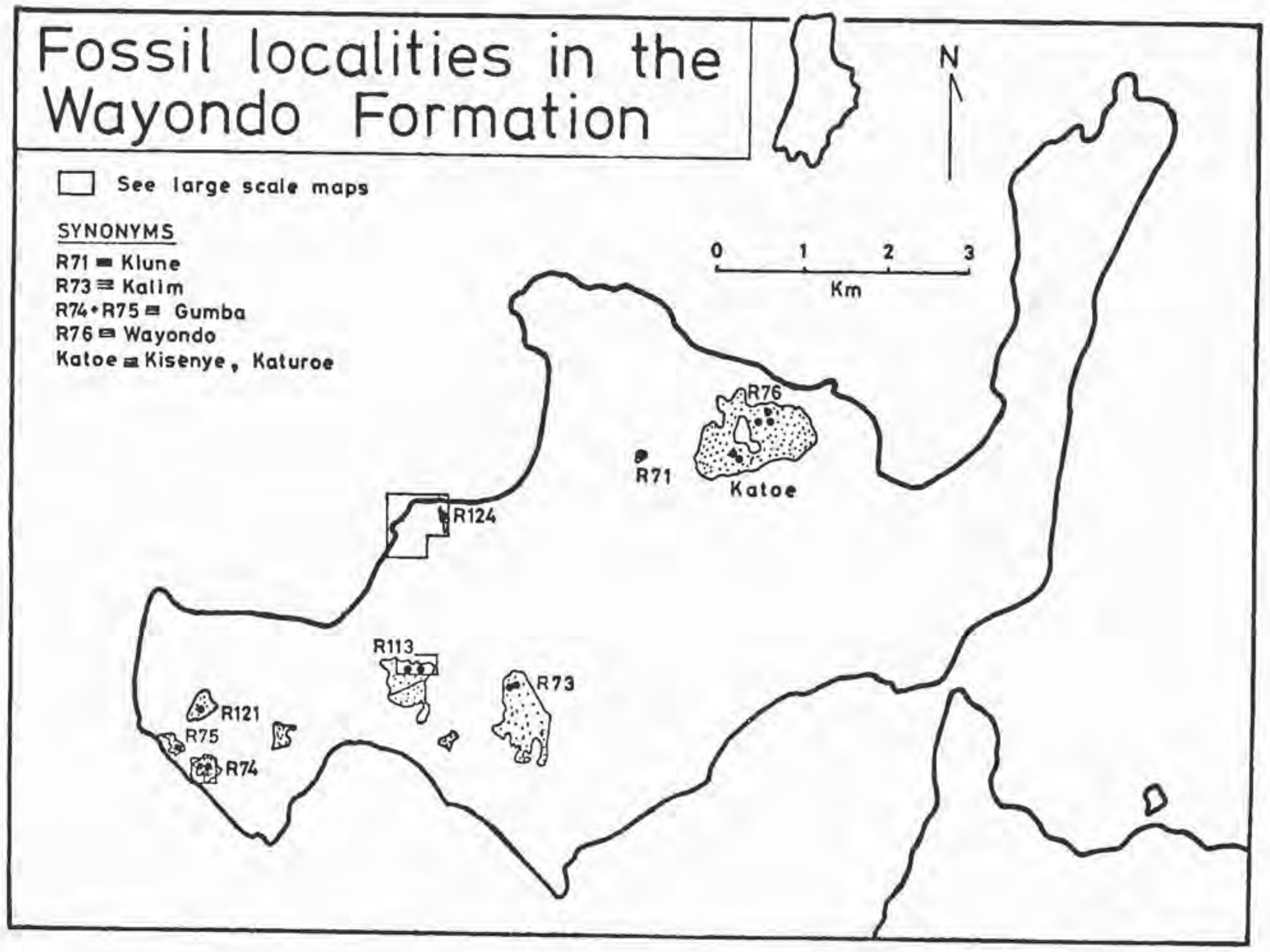


Fig. III–4
Fossil localities in the Wayondo Formation

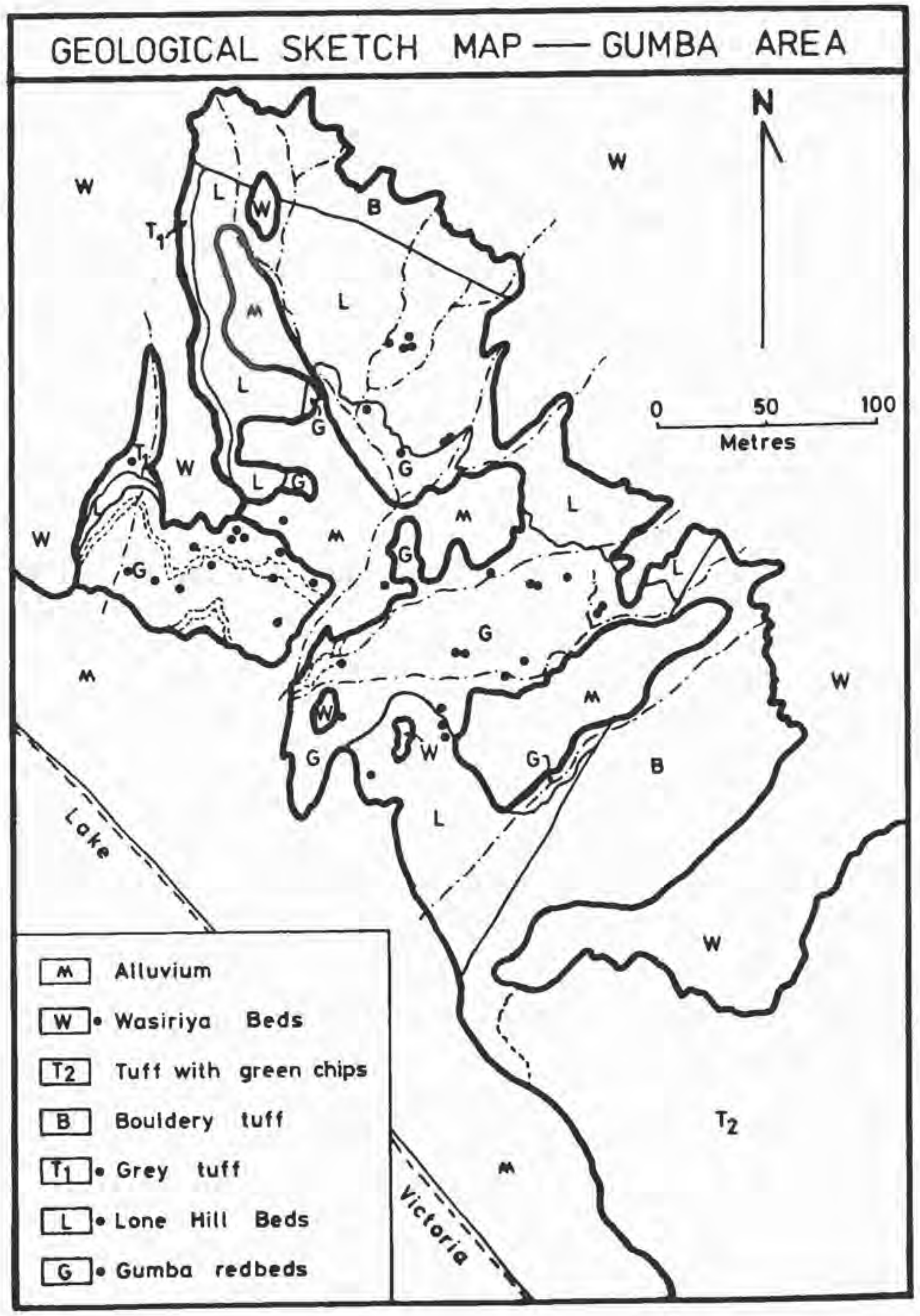


Fig. III–5
Geological sketch map: Gumba Area

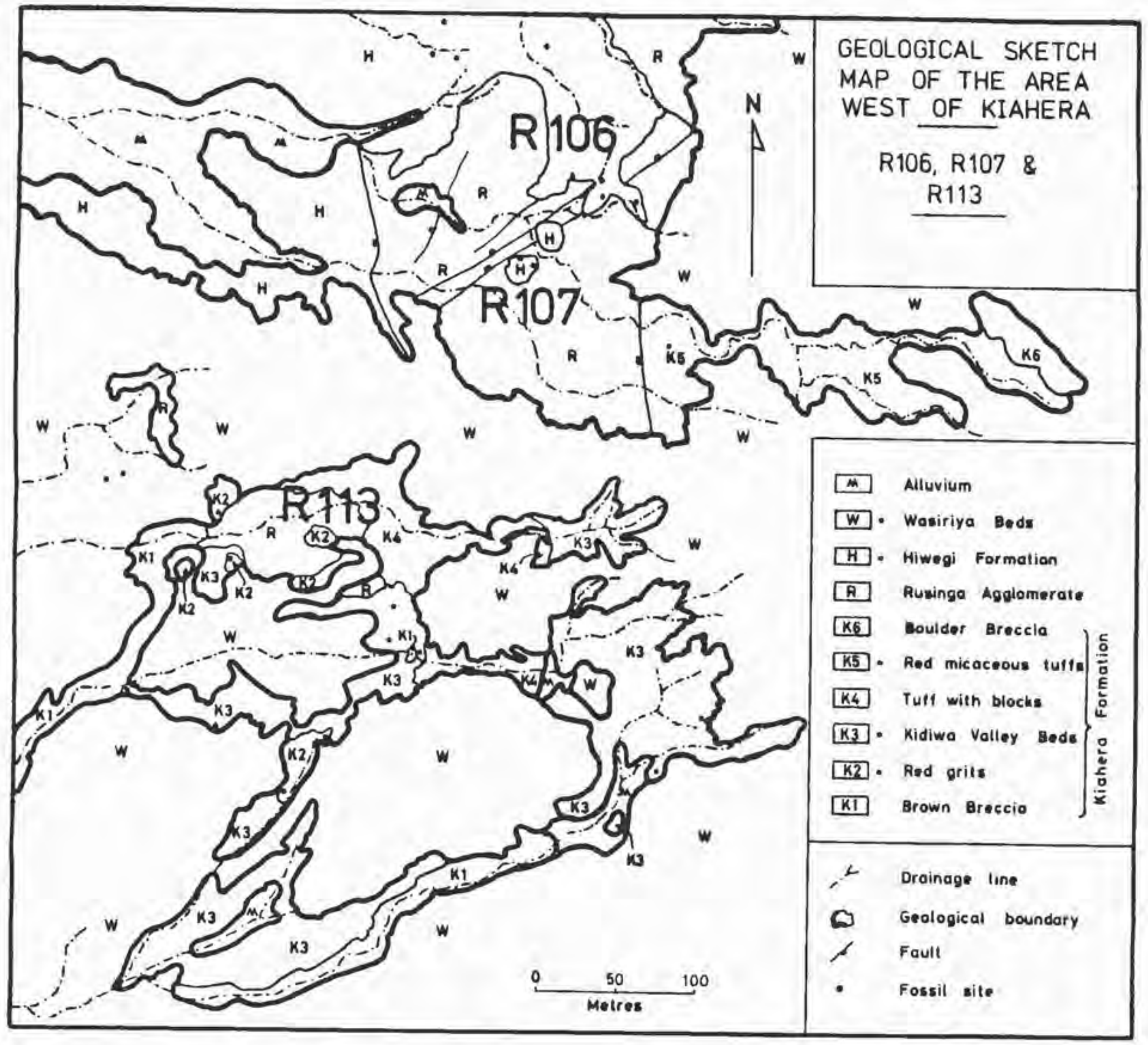


Fig. III–6
Geological sketch map of the area West of Kiahera

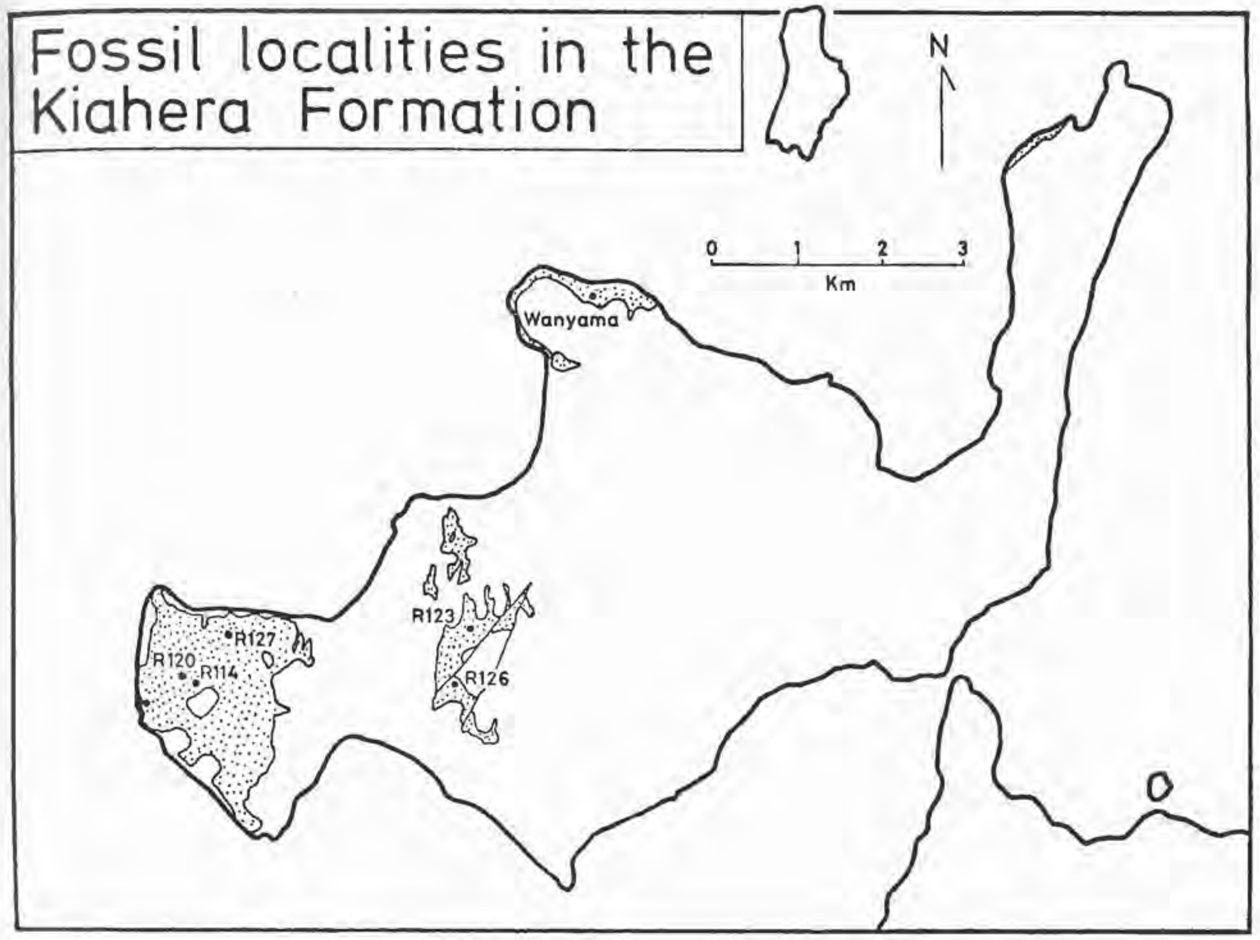


Fig. III–7
Fossil localities in the Kiahera Formation

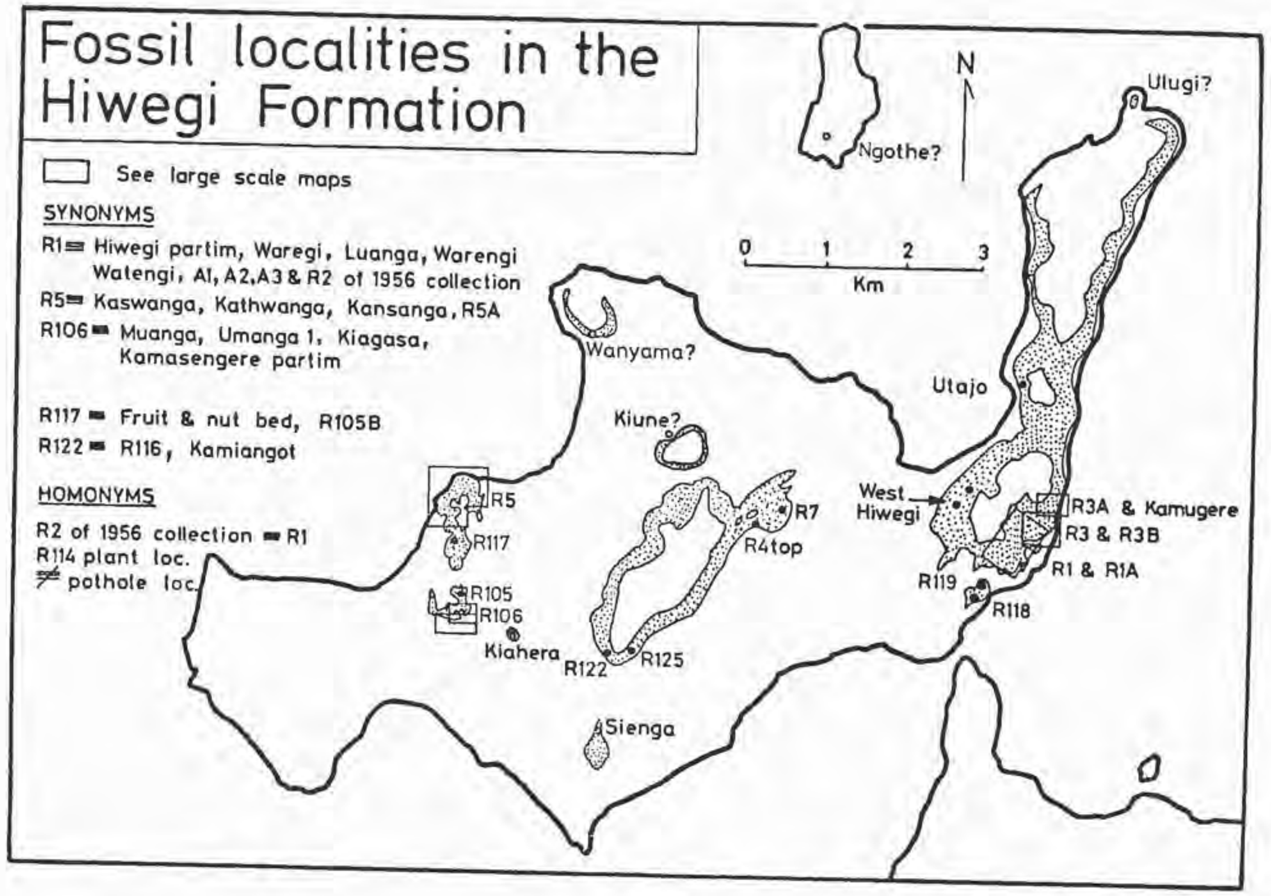


Fig. III–8
Fossil localities in the Hiwegi Formation

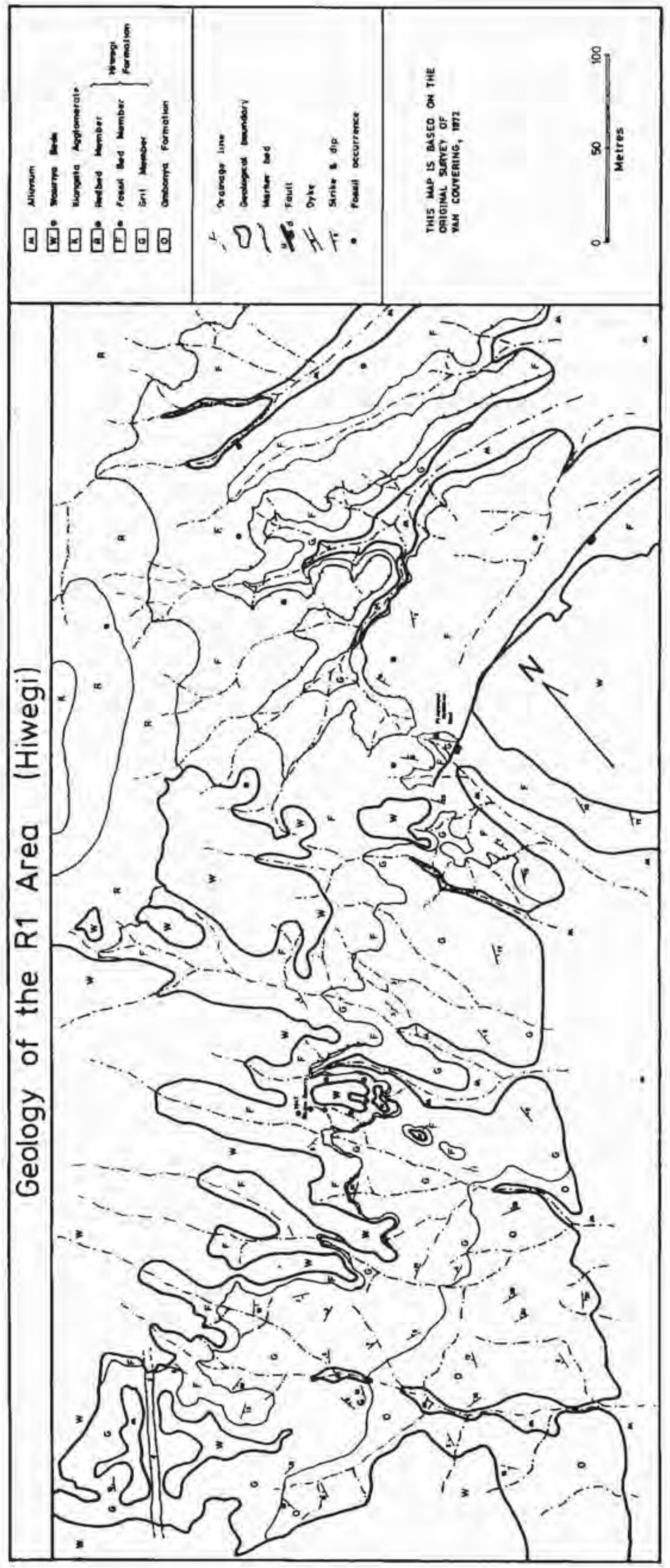


Fig. III–9
Geology of the R1 Area (Hiwegi)

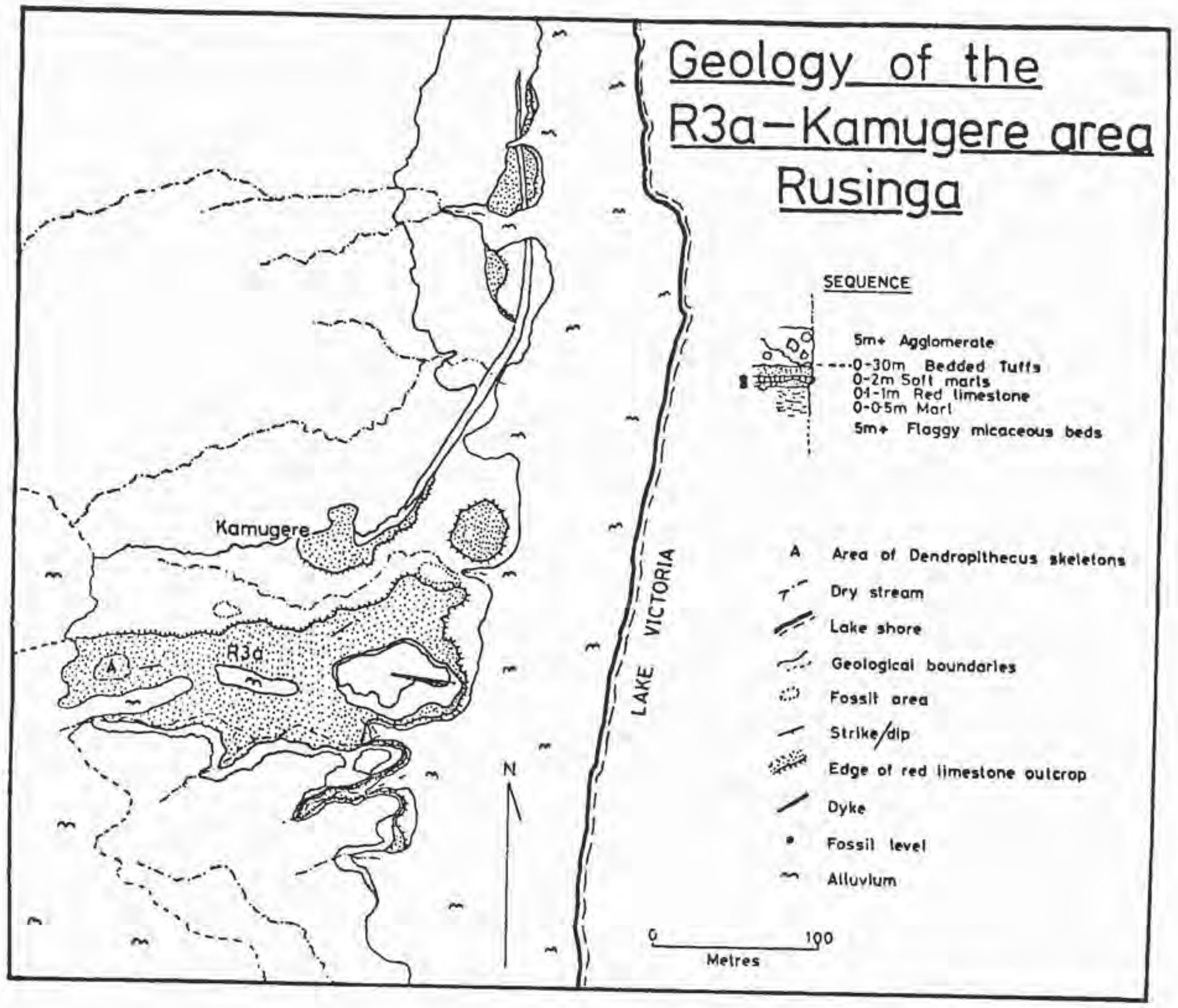


Fig. III–10
Geology of the R3A–Kamugere area: Rusinga

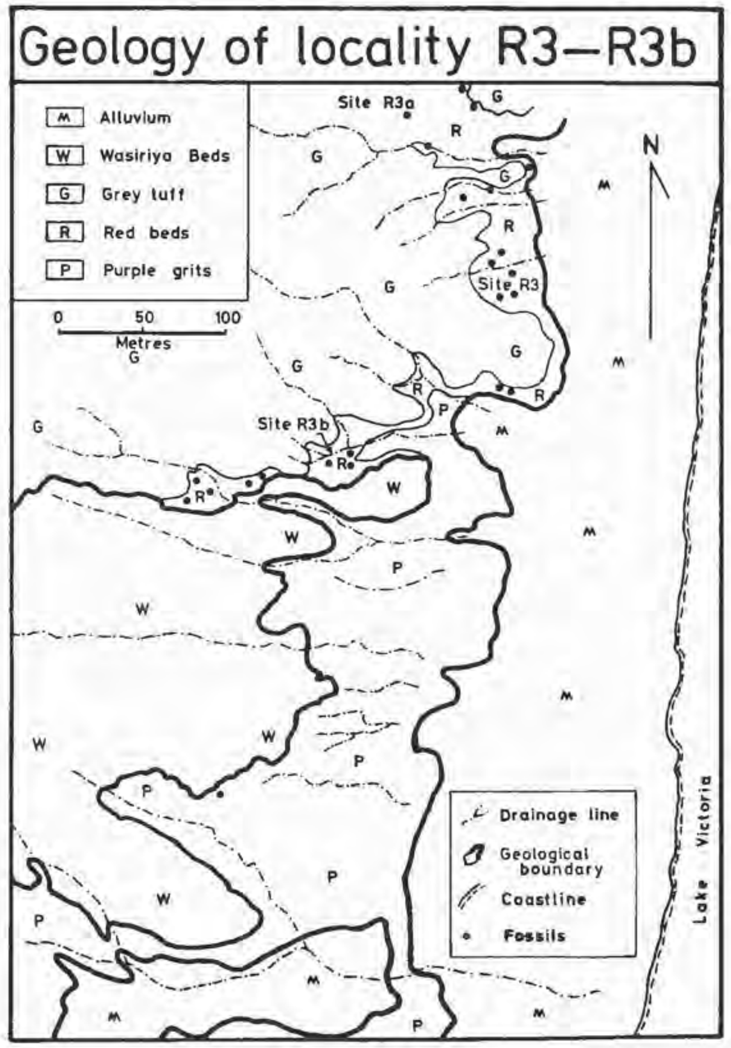


Fig. III–11
Geology of locality R3–R3b

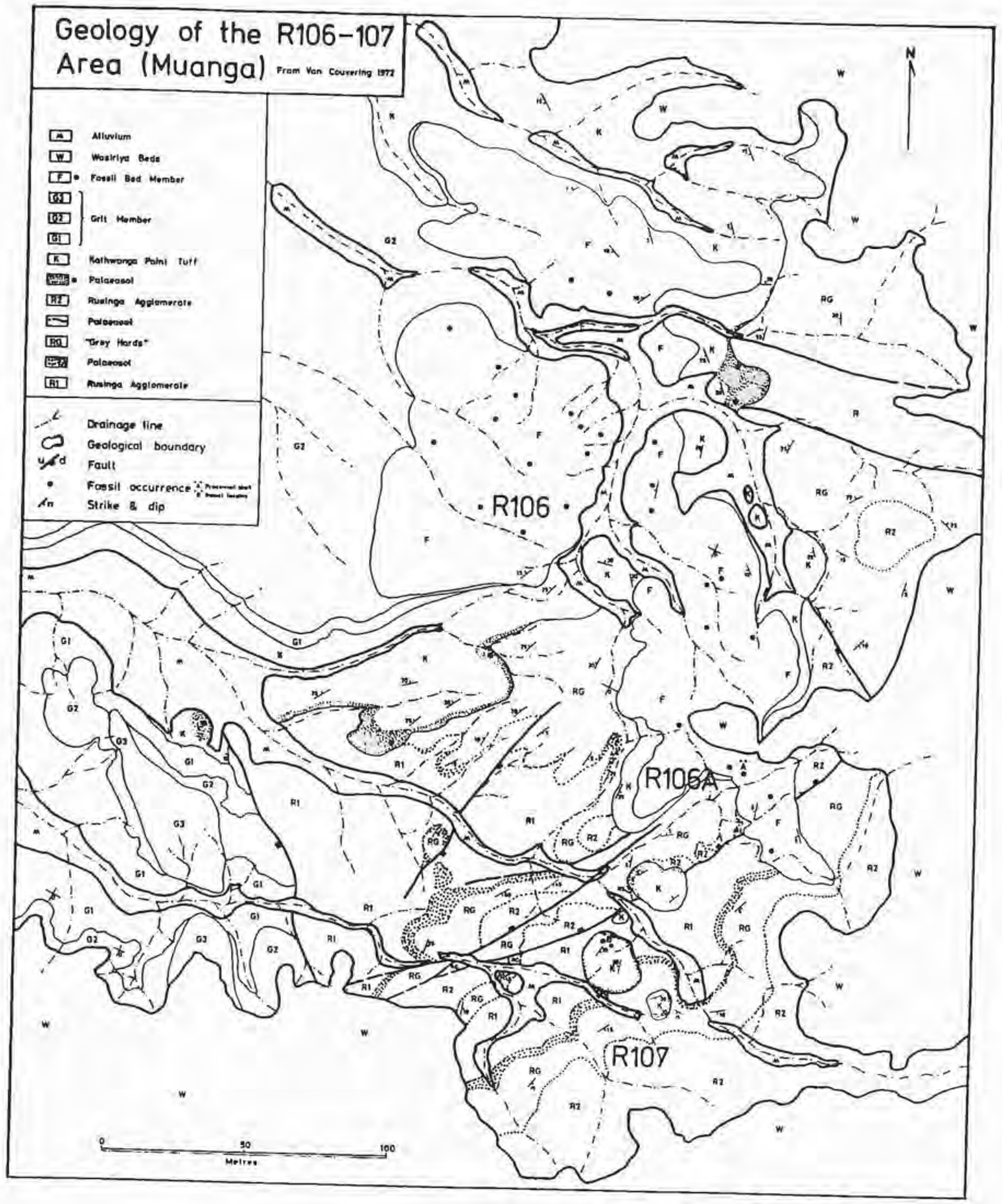


Fig. III–12
Geology of the R106–107 Area (Muanga)

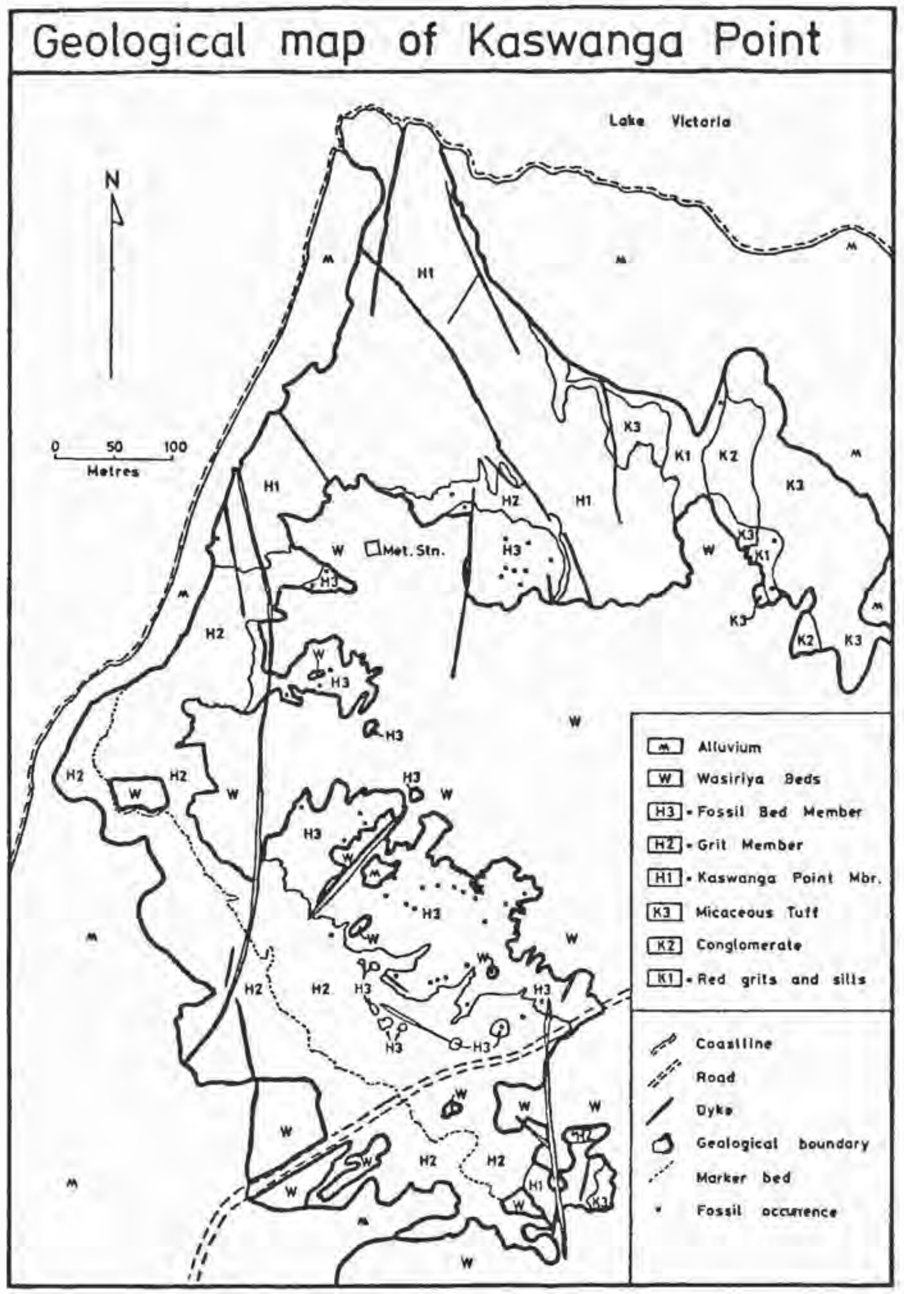


Fig. III–13
Geological Map of Kathwanga Point

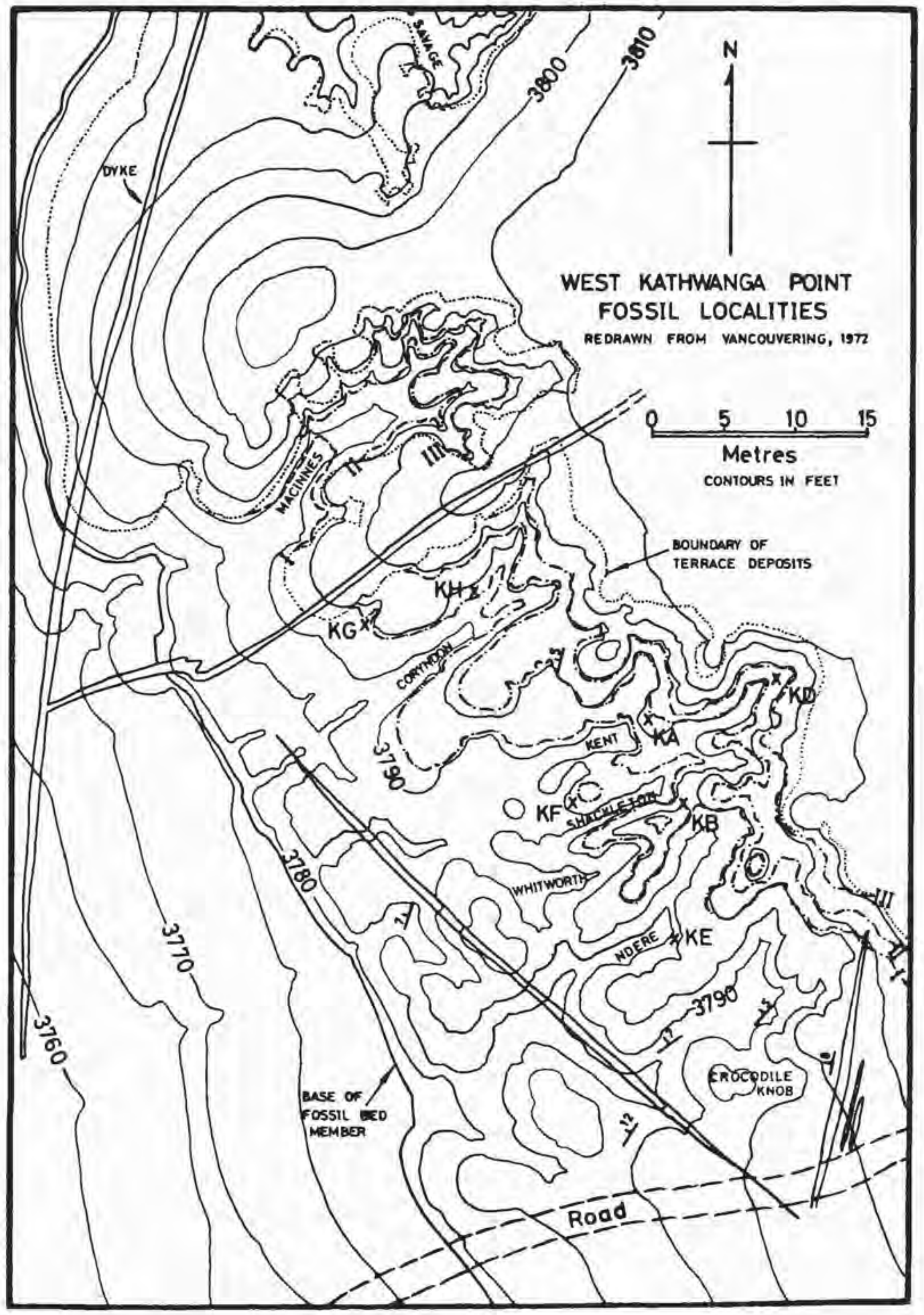


Fig. III–14

West Kathwanga Point Fossil Localities

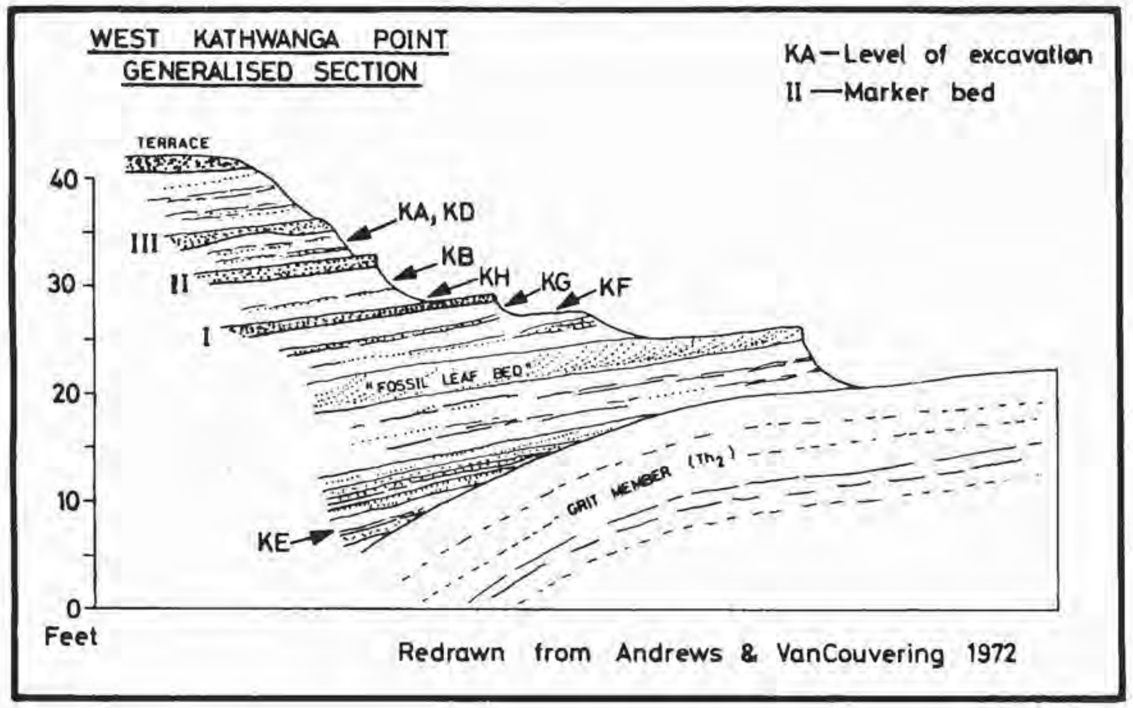


Fig. III–15

West Kathwanga Point: Generalised Section

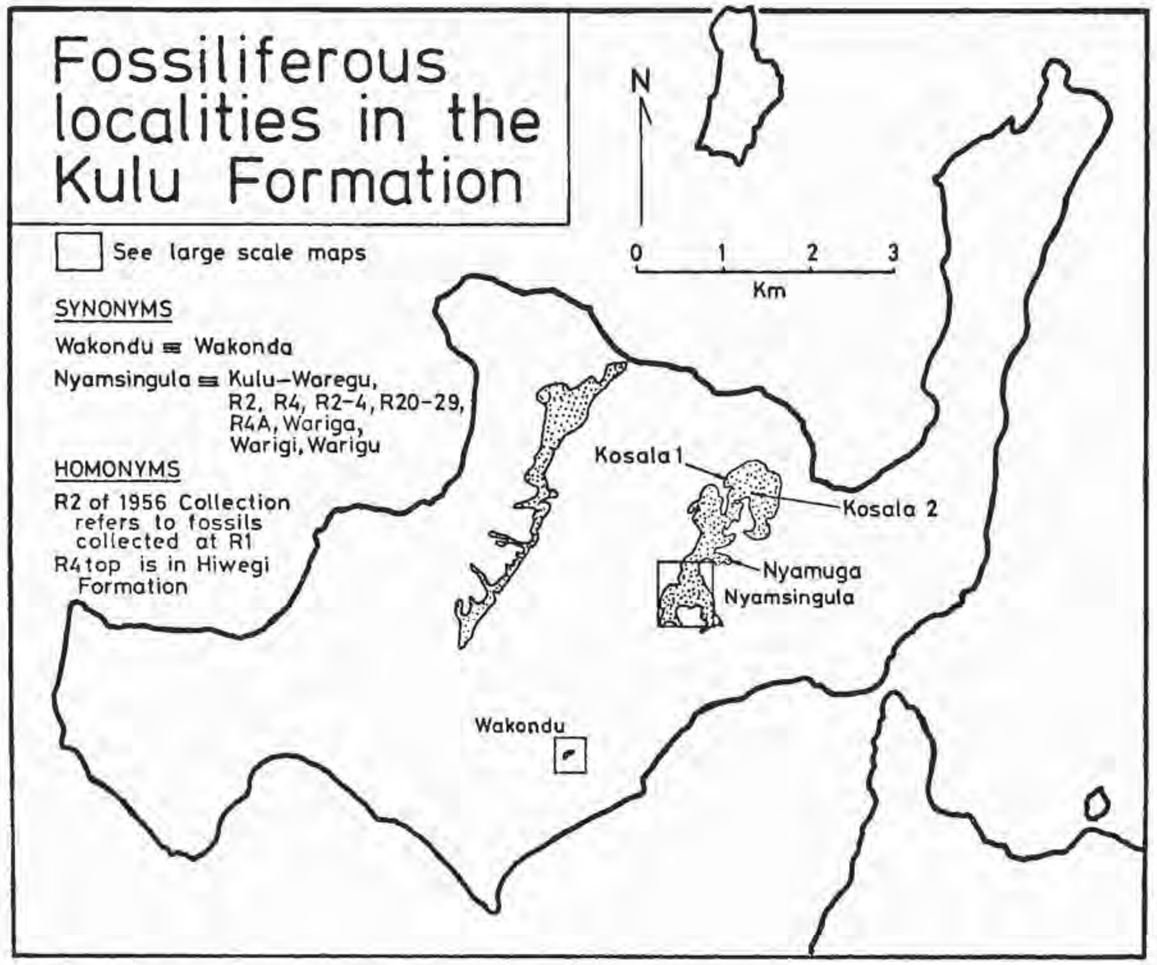


Fig. III–16

Fossiliferous localities in the Kulu Formation

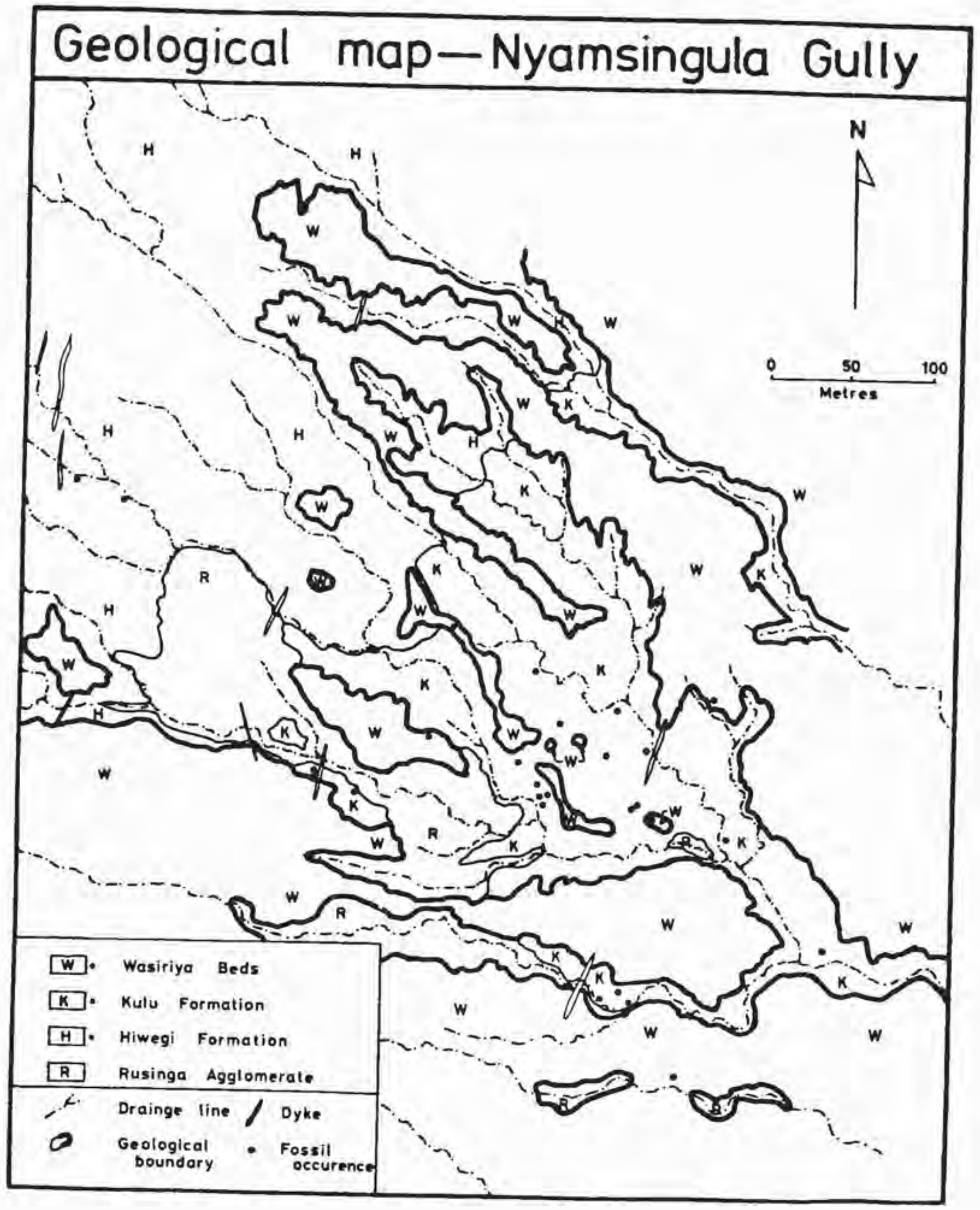


Fig. III–17
Geological Map: Nyamsingula Gully

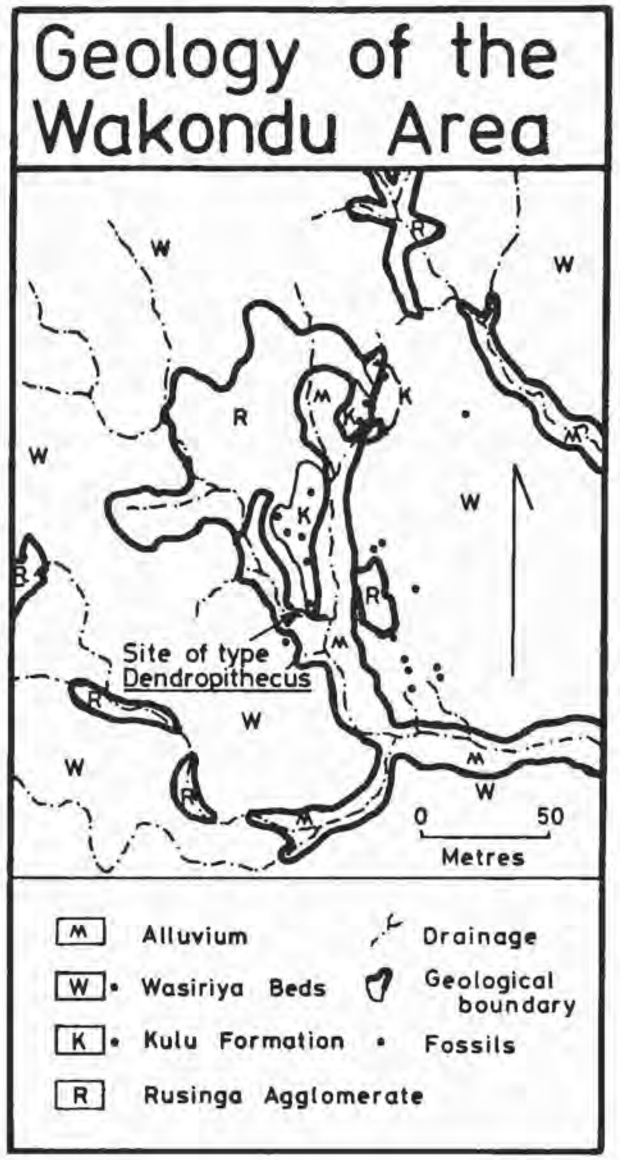


Fig. III–18
Geology of the Wakondu Area

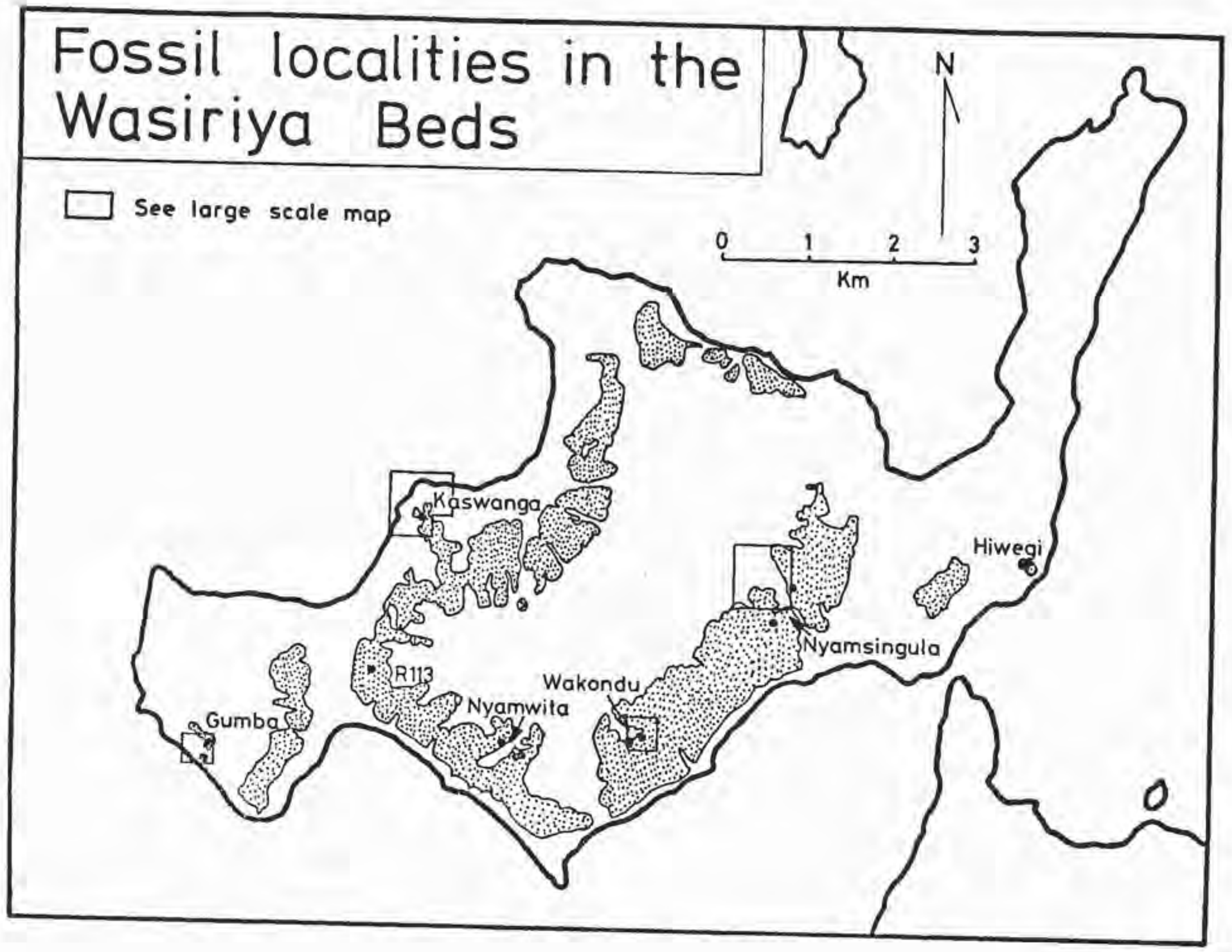


Fig. III–19

Fossil localities in the Wasiriya Beds

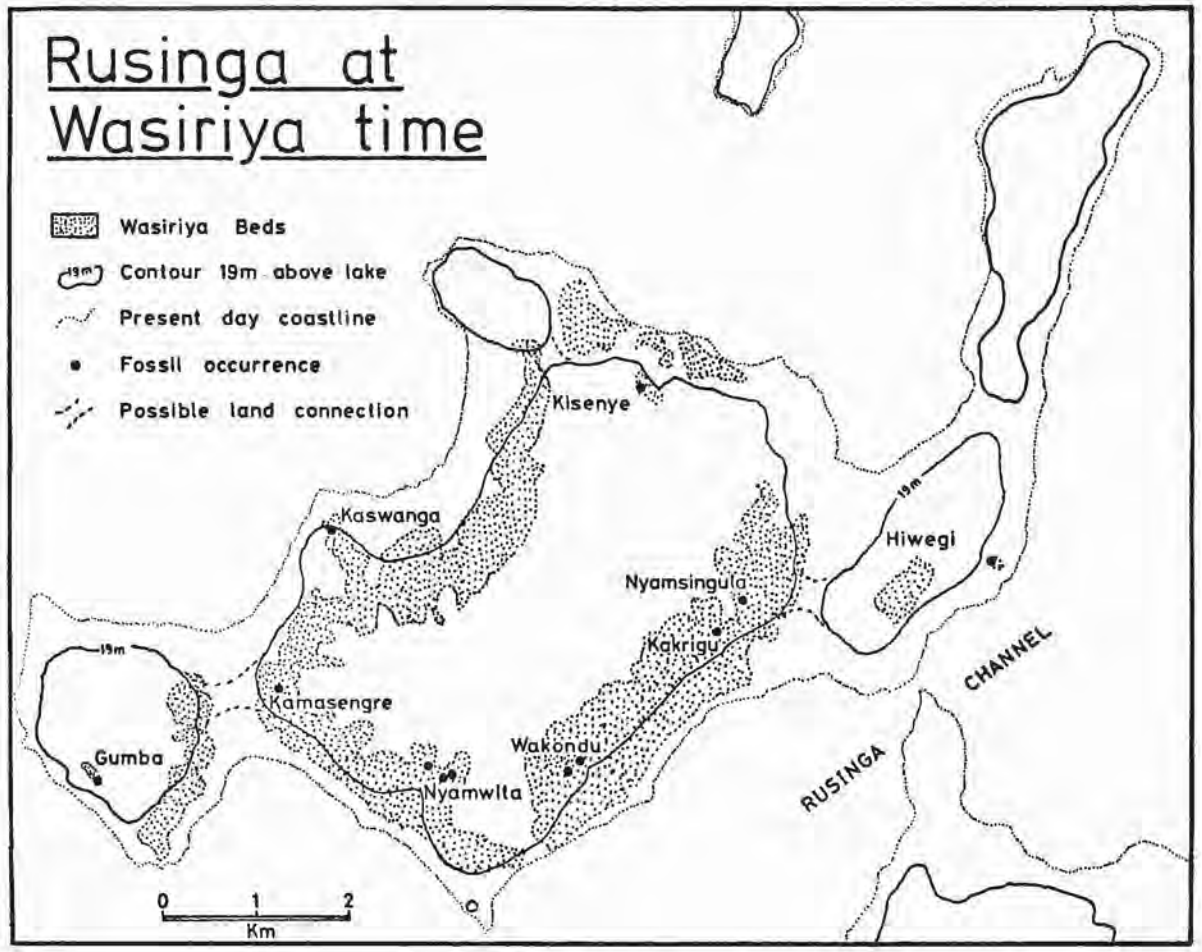


Fig. III–20

Rusinga at Wasiriya Time

THE FAUNA OF THE WAYONDO FORMATION

		R 73 (Kalim)	Gumba (R 74, R 75)	R 113	Wayondo (R 76, Katoe)	Wanyama	R 124	R 121	Kiune (R 71)
Insecta	Cocoons		■	■	■				
Myriapoda	Millipede			■					
Crustacea	Potamidae		■		■		■		■
Gastropoda	Maizania lugubroides		■		■				
	Ligatella miocenica					■			
	Cerastus miocenica			■					
	Cerastus majus		■	■					
	Subulinidae		■	■					
	Burtoa nilotica			■	■				
	?Zingis			■					
	Thapsia			■					
	Lanistes carinatus				■				
	Pila ovata		■		■				
	Melanoides				■				
Bivalvia	Etheria elliptica	■	■	■	■		■		
	Aspatharia triangulata		■						■
	Iridina		■						
	Mutela		■				■		
Pisces	Protopterus		■		■				
	Polypterus		■						
	Lates karungae		■						■
Chelonia	Pelomedusidae	■	■	■	■		■		■
	Trionychidae	■	■	■	■		■		
Crocodilia	Euthecodon		■						
	Crocodylus	■	■	■	■		■		
Varanidae	Varanus		■		■		■		
Ophides	Indet.				■				
Aves	Phoenicopteridae								■
Mammalia	Galagidae		■						
	Dendropithecus macinnesi		■	■					
	Proconsul nyanzae		■	■	■				
	Limnopithecus legetet		■						
	Paraphiomys piggoti		■	■	■				■
	Paraphiomys stromeri								■
	Megapedetes pentadactylus				■			■	■
	Diamantomys leuderitzi		■	■					■
	Simonimys genovefae			■					
	Anasinops leakeyi		■						
	Teratodon spekei		■	■	■				
	Orycteropus africanus		■						
	Prodeinotherium hobleyi	■	■		■	■			■
	Archaeobelodon	■							■
	Megalohyrax championi		■	■	■				■
	Chalicotherium rusingense		■	■				■	■
	Dicerorhinus leakeyi	■	■	■					■
	Aceratherium acutirostratum		■	■					
	Chilotheridium pattersoni		■						
	Brachypotherium heinzelini	■	■	■	■				
	Brachyodus aequatorialis	■	■		■		■		■
	Hyoboops africanus	■	■		■				■
	Diamantohyus africanus		■		■				
	Libycochoerus jeanelli		■	■	■				■
	Kenyasus rusingensis		■	■	■				■
	Nguruwe kijivium		■						
	Dorcatherium chappuisi								■
	Dorcatherium piggoti		■		■				■
	Dorcatherium parvum		■						■
	Propalaeoryx nyanzae		■		■				
	Canthumeryx sirtensis	■	■						■

Fig. III–21

The Fauna of the Wayondo Formation

THE FAUNA OF THE KIAHERA FORMATION

		R 120	R 123	R 126	R 114	Lutare (R 127)
Arachnida	Mygalomorpha			■		
Insecta	Cocoons			■		■
Myriapoda	Millipede			■	■	
Crustacea	Potamidae		■			
Gastropoda	Maizania lugubroides	■	■	■	■	
	Ligatella miocenica		■			
	Cerastus miocenica		■		■	
	Cerastus majus	■	■			
	Subulinidae			■		■
	Burtoa nilotica		■	■	■	■
	?Zingis	■	■			
	Thapsia		■			
	Trochonania		■		■	
Chelonia	Testudinidae	■				
Crocodilia	Crocodylus	■	■			
Varanidae	Varanus	■	■			
Ophidea	Indet.	■				
Aves	Phoenicopteridae				■	
Mammalia	Myohyrax oswaldi					■
	Proconsul nyanzae				■	
	Kenyalagomys rusingae				■	
	Paraphiomys piggoti				■	
	Paraphiomys stromeri				■	
	Proheliophobius leakeyi				■	
	Simonimys genovefae	■				
	Teratodon spekei				■	
	Isohyaenodon pilgrimi				■	
	Kichechia zamanae				■	
	Dicerorhinus leakeyi	■				
	Brachyodus aequatorialis	■			■	
	Kenyasus rusingensis	■			■	
	Dorcatherium chappuisi				■	
	Dorcatherium piggoti				■	

Fig. III–22

The Fauna of the Kiahera Formation

Fig. III–23

The Fauna of the Hiwegi Formation

THE FAUNA OF THE HIWEGI FORMATION

		R1 (R1A, RA1)	R3 (R3A, R3B, Kamugere)	R5 (R5A, Kaswanga)	R7	R105 (excluding R105A)	R106 (R106A)	R107	R117 (=R105A)	R122	R125	West Hiwegi	Kiahera Hill	Sienga	Kiungata (R4 top)
Arachnida		■													
Insecta	Cocoons & brood cells	■	■	■			■	■					■		
	Tenebrionidae							■							
	Cisteiidae							■							
	Scarabeidae			■				■							
	Curculionidae							■							
	Eucnemidae							■							
	Sphingidae							■							
	Noctuidae			■											
Myriapoda	Millipede	■	■	■			■	■	■				■		
Gastropoda	Maizania lugubroides	■	■	■			■	■	■		■		■		■
	Ligatella miocenica	■	■	■				■							
	Edouardia mfwanganensis	■	■	■											
	Conulinus			■											
	Cerastus miocenica	■	■	■			■								
	Cerastus majus	■	■	■			■	■	■		■		■		■
	Subulinidae	■	■	■			■	■	■		■		■		■
	Burtoa nilotica	■	■	■				■			■		■		■
	Urocyclid slug			■											
	Trochonanina	■	■	■				■							■
	?Zingis	■	■	■				■					■		■
	Thapsia	■	■	■									■		
	Chlamydarion		■	■				■							
	Halolimnohelix		■	■											
	Tayloria		■	■				■	■						
	Gonaxis large sp.		■	■									■		
	Gonaxis protocavalii		■	■						■					
	Edentulina rusingense	■	■	■											
	Ptychotrema														■
	Gulella small sp.		■	■											
	Succinea			■											
Chelonia	Pelomedusidae			■											
	Testudinidae	■	■	■			■								
Crocodilia	Crocodylus piggoti			■			■								
Varanidae	Varanus	■													
Ophidea	Boidae														
Cordylidae	Gerrhosaurus	■	■	■			■								
Mammalia	Miorhynchocyon clarki			■			■								
	Miorhynchocyon rusingae														
	Hiwegicyon juvenalis														
	Myohyrax oswaldi	■	■	■					■			■			
	Parageogale aletris		■												
	Protenrec tricuspis	■													
	Gymnurechinus leakeyi	■	■	■			■		■					■	
	Gymnurechinus camptolophus														
	Amphechinus rusingensis	■	■	■			■								
	Galerix africanus											■			
	Propotto leakeyi		■												
	Megadermatidae														
	Komba minor														
	Komba robustus														
	Progalago songhorensis	■	■	■			■								
	Mioeuoticus sp.														
	Dendropithecus macinnesi	■	■	■		■	■	■				■	■		
	Limnopithecus legetet	■	■	■		■	■						■		
	Rangwapithecus vancouveringi	■	■	■		■	■	■						■	
	Proconsul nyanzae	■	■	■		■	■	■					■		
	Kenyalagomys rusingae	■	■	■		■	■	■				■	■		
	Kenyalagomys minor	■	■	■			■		■						
	Paraphiomys piggoti	■	■	■			■					■	■		
	Paraphiomys stromeri	■	■	■			■						■		
	Diamantomys leuderitzi	■	■	■			■					■		■	
	Kenyamys mariae														
	Simonimys genovefae														
	Myophiomys arambourgi						■								
	Proheliophobius leakeyi	■													
	Paranomalurus soniae			■											
	Paranomalurus walkeri			■											
	Megapedetes pentadactylus	■	■	■							■	■		■	
	Notocricetodon petteri			■											
	Vulcanisciurus africanus	■	■	■			■								
	Teratodon spekei											■			
	Hyainailourus nyanzae		■												
	Pterodon africanus														
	Anasinops leakeyi	■	■	■			■								
	Metapterodon sp.		■												
	Leakeytherium hiwegi		■	■									■		
	Isohyaenodon andrewsi		■												
	Isohyaenodon pilgrimi	■		■											
	Hecubides euryodon	■	■	■									■		
	Hecubides macrodon			■											
	Kichechia zamanae	■	■	■			■	■							
	Pseudailurus africanus														
	Orycteropus africanus	■	■	■			■								
	Archaeobelodon	■	■	■			■		■			■		■	
	Zygolophodon morotoensis	■		■											
	Prodeinotherium hobleyi	■	■	■	■		■		■			■	■	■	
	Megalohyrax championi	■	■	■		■	■	■				■	■	■	
	Meroehyrax batese	■													
	Chalicotherium rusingense	■	■	■	■	■	■	■				■	■		
	Dicerorhinus leakeyi	■		■	■		■					■			
	Aceratherium acutirostratum	■	■					■							
	Brachypotherium heinzelini	■		■	■							■			
	Hyoboops africanus	■	■	■		■	■	■				■			
	Brachyodus aequatorialis	■	■	■		■	■	■				■		■	
	Diamantohyus africanus	■	■				■						■		
	Libycochoerus jeanelli	■	■												
	Kenyasus rusingensis	■	■	■		■	■	■				■	■		
	Nguruwe kijivium	■	■	■			■								
	Dorcatherium chappuisi	■	■	■		■	■	■				■	■		
	Dorcatherium piggoti	■	■	■		■	■	■				■	■		
	Dorcatherium parvum	■	■	■	■	■	■					■	■	■	
	Canthumeryx sirtensis		■										■		
	Propalaeoryx nyanzae	■	■	■			■					■	■		
	Walangania africanus	■	■	■		■	■						■		

FOSSIL SNAILS OF RUSINGA ISLAND	Wanyama	Lisiwi	Wayondo	Katuroe	Gumba	Kamasengere	R 113	R 107	R 105a	Sienga	R 114	R 106	Top of Kiahera	Kiarcata	Kathwanga Got	R 115	Kiangata	Hiwegi	Waregi	Warengi	Watengi	R 1	R 3	R 3a	R 5	Wakondu	R 2-4	R 4a	R 4 top
Maizania lugubroides			■	■				■	■		■	■	■			■		■				■	■	■	■	■	■		■
Ligatella miocenica								■						■				■				■	■	■	■		■		
Edouardia mfwanganensis																						■	■	■	■				
Conulinus																									■				
Cerastus miocenica		■					■				■	■										■	■	■	■				
Cerastus majus					■	■	■	■	■	■			■	■	■			■				■	■	■	■		■	■	■
Subulinidae	■					■		■	■	■		■	■			■		■		■	■	■	■	■	■	■	■		■
Burtoa nilotica			■					■		■			■				■	■	■			■	■	■	■		■	■	■
Urocyclidae																					■				■				
Trochonanina								■										■				■	■	■	■				■
Zingis							■	■					■									■	■		■				■
Thapsia		■					■			■			■					■				■	■	■	■		■		
Chlamydarion								■										■							■				
Halolimnohelix						■																	■						
Tayloria								■	■														■	■	■				
Gonaxis large sp.													■										■	■	■				
Gonaxis protocavalii														■									■		■				
Edentulina rusingense																								■			■		
Ptychotrema																													■
Gulella small sp.																							■	■	■				

Fig. III–24

Fossil snails of Rusinga Island

THE FAUNA OF THE KULU FORMATION		Nyamsingula (R2-4)	Wakondu	Nyamuga	Kosala I & II
Myriapoda	Millipede	■	■		
Decapoda	Potamidae		■		
Gastropoda	Maizania lugubroides	■	■		
	Ligatella miocenica	■			
	Cerastus majus	■			
	Subulinidae	■	■		
	Burtoa nilotica	■			
	Thapsia	■			
	Edentulina rusingense	■			
Bivalvia			■		
Amphibia					■
Pisces	Palaeofulu			■	■
	Nderechromis	■		■	■
Chelonia	Pelomedusidae	■			
Crocodilia	Crocodylus	■	■		
Aves	Phoenicoleakeyus aethiopicus	■			
Mammalia	Miorhynchocyon clarki	■			
	Myohyrax oswaldi	■			
	Gymnurechinus leakeyi	■			
	Amphechinus rusingensis	■			
	Dendropithecus macinnesi		■		
	Proconsul nyanzae	■			
	Kenyalagomys rusingae	■			
	Paraphiomys piggoti	■			
	Paraphiomys stromeri	■	■		
	Megistotherium	■			
	Leakeytherium hiwegi	■			
	Hecubides euryodon	■			
	Orycteropus africanus	■			
	Archaeobelodon	■			
	Prodeinotherium hobleyi	■	■		
	Megalohyrax championi	■	■		
	Chalicotherium rusingense	■	■		
	Dicerorhinus leakeyi	■			
	Aceratherium acutirostratum	■	■		
	Chilotheridium pattersoni	■			
	Hyoboops africanus	■	■		
	Brachyodus aequatorialis	■	■		
	Anthracothere nov. gen.	■			
	Diamantohyus africanus	■			
	Libycochoerus jeanelli	■			
	Kenyasus rusingensis	■			
	Dorcatherium chappuisi	■			
	Dorcatherium piggoti	■	■		
	Dorcatherium parvum	■			
	Walangania africanus	■	■		

Fig. III–25

The Fauna of the Kulu Formation

THE FAUNA OF THE WASIRIYA BEDS		Wakondu	Nyamwita	Gumba	R113	Kulu (Kakrigu)	Kisenye	Hiwegi	Unlocalised
Gastropoda	Limicolaria		■			■	■		
	Burtoa					■			
	Trochonanina					■		■	
Lagomorpha	Lepus capensis		■						
Rodentia	Tachyoryctes splendens								■
Tubulidentata	Orycteropus afer crassidens		■						
Carnivora	Hyaena hyaena				■				
Perissodactyla	Ceratotherium simum		■						
	Equus burchelli				■				
Artiodactyla	Phacochoerus aethiopicus	■		■				■	
	Alcelaphus buselaphus	■	■	■		■	■		
	Rusingoryx atopocranion	■			■	■			
	Redunca redunca	■	■	■	■	■			
	Cephalophus sp.		■						
	Gazella granti					■			
	Syncerus caffer			■	■	■	■		

Fig. III–26

The Fauna of the Wasiriya Beds

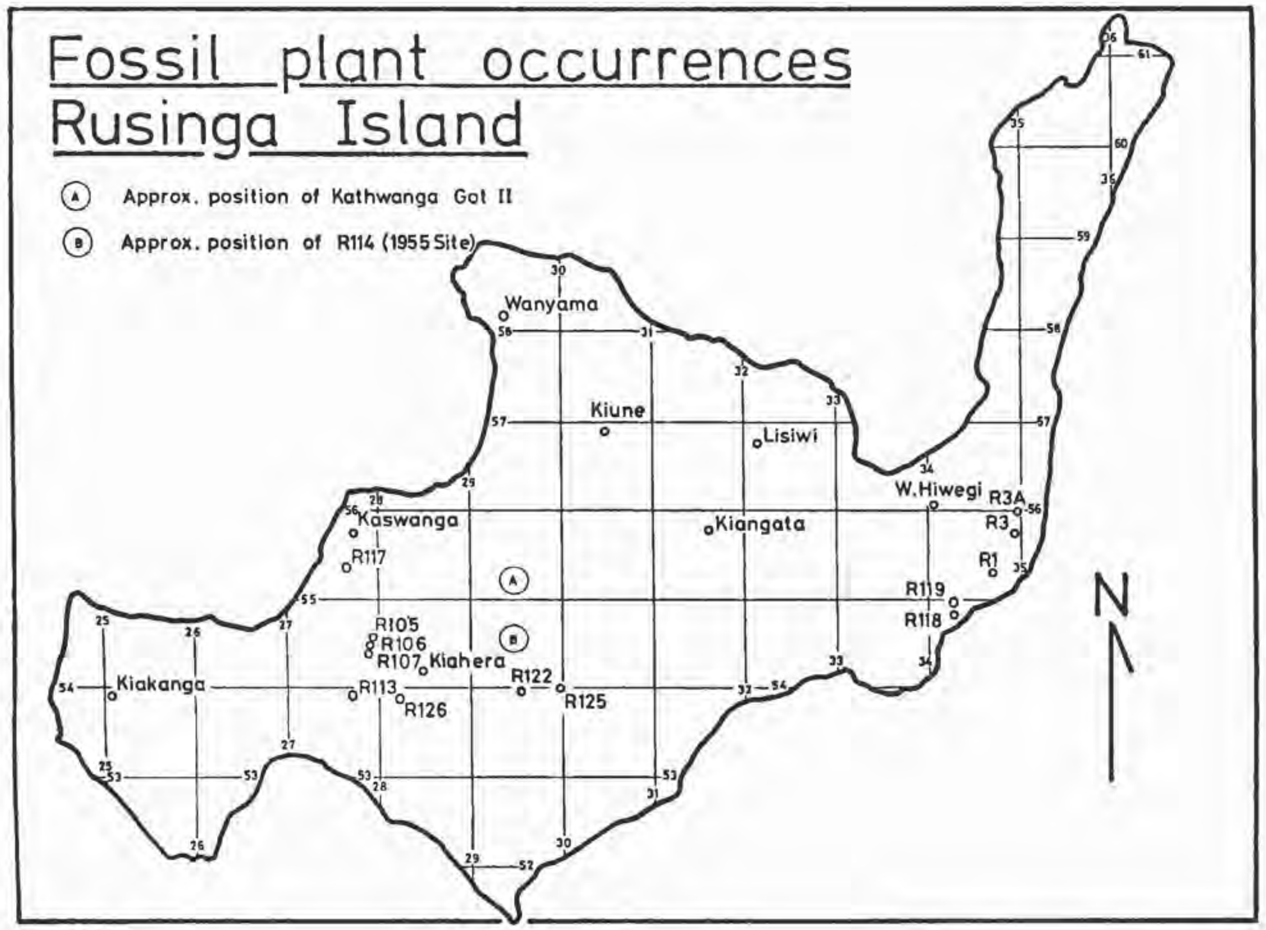


Fig. III–27

CHAPTER 4

AREA III

MFWANGANO ISLAND

History

Fossils were first recorded at Mfwangano by L.S.B. Leakey in 1932, during the East African Archaeological Expedition. In 1934, P.E. Kent visited the island in order to make a preliminary geological survey (Kent, 1944), and he recognised the basic stratigraphic similarities between Rusinga and Mfwangano (fig. IV–1).

The paucity of mammalian fossils in the deposits seems to have been responsible for the lack of further interest in Mfwangano until the post–war British–Kenya Miocene Expedition when several visits were made to the island in 1947, 1949–1952, 1955–1956 and 1958. Great excitement was generated late in 1951 by the discovery of fossilised insects at several sites (Leakey, 1952). McCall (1958) visited Mfwangano in 1954, and measured a representative section near Makira. The significance of this section seems to have escaped Whitworth (1961). McCall also placed Mfwangano in its regional setting to the volcanic centre of Kisingiri. The greatest number of fossils was collected in 1955 during which expedition Whitworth (1961) mapped the geology of the island as well as the detailed geology of the Walangani and Makira areas.

Various reports have been written about the fossils collected from Mfwangano, but the collections have not generally been given the attention they deserve. Only one paper on palaeobotany (Chesters, 1957) has been written despite the fact that the island is a palaeobotanists paradise, abounding in fossil leaves, seeds, fruit, twigs and stems, all beautifully preserved. The Gastropoda were described by Verdcourt, (1963), but the varied insect remains have received scant attention (Paulian, 1976; Wilson and Taylor, 1969). A small proportion of the mammalian fossils has been described (Andrews, 1978; Butler, 1965; Lavocat, 1973; Pickford, 1975; Savage, 1965; Whitworth, 1954, 1958; Wilkinson, 1976). In 1981, Collinson (unpubl.) made small collections of plants at two localities on Mfwangano.

In 1984, the author remapped Mfwangano as part of the National Museum of Kenya Site Inventory project, discovering several new localities in the process.

Geological Map

The geological map of Mfwangano was prepared by the author during a three week survey in February, 1984. Previous maps of the area (McCall, 1958 and Whitworth, 1961) were regionally inaccurate or at too small a scale to be of much value. Mapping was done on aerial photographs at a scale of approximately 4cm:1km and then transferred to a scale of 1:50,000. Two areas were mapped in greater detail, including Makira and the area from Waware to Masisi.

Stratigraphy

Erosion has progressed satisfactorily during the past thirty years, so that many of the stratigraphic relationships which seemed obscure to Whitworth (1961) can now be settled. Several problems remain to be solved, but appreciable improvements in exposure are needed before these can be properly tackled.

As was realised from the earliest days of geological study at Mfwangano, the stratigraphy of the island is broadly comparable to that of Rusinga (Kent, 1944; McCall, 1958; Whitworth, 1961; Van Couvering, 1972). All lithostratigraphic formations recognised on Rusinga occur at Mfwangano (fig. IV–2). In addition PreCambrian granites are exposed on the southeastern shore of the island. It is more difficult to recognise individual sedimentary marker horizons common to the two islands but some undoubtedly exist. For example the Lower Makira beds closely recall the Lone Hill and Kidiwa Valley beds of Rusinga, (Van Couvering, 1972). The plutonic/carbonatite breccia of Mfwangano (Whitworth, 1961) closely resembles the Boulder Breccia Member of Rusinga (Shackleton, 1951; Van Couvering, 1972). There is a very close resemblance between the Rusinga Agglomerate Formation of Rusinga and the Melanite Agglomerates of Mfwangano. On the latter island however, there appears to be a greater number of melanite bearing agglomeratic horizons and at least two sedimentary levels in the unit, while on Rusinga there is only one sedimentary intercalation.

In the Walangani area, the red pisolithic tuffs of Whitworth (1961) are very probably the same unit as the Kathwanga Point Tuffs on Rusinga (Van Couvering, 1972).

Part of the Upper Agglomerate and intercalated lavas of Mfwangano are comparable to the Kiangata Agglomerate and Lunene Lava on Rusinga. On Mfwangano however, there is a substantial thickness of agglomerate preserved over and above the equivalents of the Kiangata and Lunene Formations, while on Rusinga only a minute occurrence of post–Lunene Lava agglomerates is found on Wanyama Hill (Van Couvering, 1972).

Whitworth proposed that the Sena Beds of Mfwangano were equivalent to the Kulu beds of Rusinga, a point reiterated by Van Couvering (1972). Improved exposures reveal, however, that the Sena Beds represent a thin shale facies in Whitworth's Tuff with Blocks unit, and it underlies the Rusinga Agglomerate. It occupies a comparable position in the column to the shale on Kiakanga Peninsula of Rusinga Island. Stratigraphic studies on Mfwangano are somewhat complicated by the fact that melanite crystals occur in some of earliest volcanic rocks in the sequence. The early examples of melanite crystals are always small to minute and occur in blocks within agglomeratic rocks. It is only in genuine Rusinga Agglomerate that the melanite crystals become large (up to 0.5 cm) and where they comprise a major proportion of the matrix of the agglomerate. Thus, tiny melanite crystals in the Sena beds are not proof of a post–Rusinga Agglomerate age for the unit.

McCall (1958, fig. 7) measured a section in the Makira area which included two horizons of Melanite Agglomerate separated by sediments, above which occurred further sediments which he correlated with the Hiwegi Series of Rusinga. It is extraordinary therefore that Whitworth failed to notice these strata, and placed all of it (150 metres thick) into his Upper Agglomerate. This fundamental error led to much confused thought about the stratigraphy of the island. For example, outcrops of the lowermost agglomerate in the sequence (the Green Nephelinite Agglomerate of McCall, 1958) found by Whitworth in gullies draining the eastern slopes of the island, were thought by him to be downfaulted Upper Agglomerate. Sena Hill was thought to be Upper Agglomerate, yet it is comprised of the most representative Rusinga Agglomerate yet found on the island. Rusinga Agglomerate supposedly underlying the Sena Beds is actually comprised of large blocks of Melanite Agglomerate which have tumbled down from the cliffs of Sena Hill and lodged in the scree below. In particular there are large outcrops of sub–Kiangata formations along much of the south coast of Mfwangano (fig. IV–3) as far west as Ugena eight kilometres west of Makira. As a result, the Upper Agglomerate, thought by Whitworth to be up 425 metres thick, is actually only about 240 metres thick. In particular the Walangani Beds, thought by Whitworth to be below the Rusinga Agglomerate represent the lower of the two sedimentary intercalations within the Rusinga Agglomerate Formation. The revised stratigraphy and correlations with Rusinga are presented in figure IV–2. Future workers may well wish to make bed by bed comparisons between the two islands, in particular between the Wayondo and Kiahera equivalent level of Mfwangano and the sequence on the Kiakanga Peninsula of Rusinga, about which some doubts remain.

Many levels at Mfwangano yield fossils. In general the agglomeratic horizons yield quantities of fossil wood while the sedimentary horizons yield a greater variety of fossils including mammals. The stratigraphic distribution of fossil sites is listed in fig. IV–4.

The Pleistocene Waware strata of Mfwangano are comparable in their lithology and fossil content to the Wasiriya Beds of Rusinga. Fossils occur at many sites in these beds in various parts of the Island.

Structure

The Miocene strata on Mfwangano have a regional depositional dip of about 2.5° – 3° northwest and strike about 037°. Locally however, folding and slumping has led to variations from the regional structure. The Sena Beds dip a few degrees to the southeast in their type area. At Site T1, the Walangani Beds and Rusinga Agglomerate have been folded in to an anticlinal flexure so that on the eastern limb the strata dip a few degrees to the northeast (fig. IV–5). In slump structures northwest of Site U, the Hiwegi beds dip up to 60° northwest.

Biostratigraphy

The mammalian faunas from the Makira Beds, the Walangani Beds of the Melanite (=Rusinga) Agglomerate and the Hiwegi Formation on Mfwangano are all rather similar if somewhat limited in variety and abundance (fig. IV–6). With few exceptions (in particular the absence of aquatic faunal elements) the Mfwangano faunas are closely comparable to those found on Rusinga. The exceptions are the presence on Mfwangano of *Dorcatherium songhorensis* and *Orycteropus minutus* which occur at Songhor and Koru. *D. songhorensis* has however been found in the Wayondo Formation on Rusinga but is not reliably reported from the Hiwegi Formation sites.

Pickford (1981) has already discussed the biostratigraphic placement of the Mfwangano faunas, pointing out that they are clearly of Faunal Set II affinities, with the two exceptions noted above. Both *Dorcatherium songhorensis* and *Orycteropus* *minutus* seem characteristic of Set I faunas. In the Wayondo Formation on Rusinga, *Teratodon enigmae* is a further taxon with Set I affinities so it is possible that the Wayondo Formation is intermediate in biostratigraphic content between the Songhor suite of faunas and that from Hiwegi.

New radiometric age determinations tend to confirm that the Rusinga Group strata (Wayondo, Kiahera, Rusinga and Hiwegi Formations) accumulated during a relatively short period (200,000 years) about 17.9 m.y. ago. The Songhor and Koru strata seem to have accumulated two million years earlier.

Plants

Mfwangano Island yields plant fossils of various kinds at many localities (fig. IV–7). Chester's (1957) wrote a monograph on the plant fossils from Rusinga in which she discussed a few specimens from Mfwangano. Among the species she recognised were:

Entandophragma palaeocarpum
Menispermaceae
Antrocaryon pulchrum
Euphorbiospermum rhynchonelloides
Celtis rusingense

Not only are the sediments plant–bearing, but fossil tree trunks are also common in the agglomerates suggesting that the flanks of Kisingiri Volcano were frequently covered in vegetation. The commonest plant fossils are wood fragments, but leaves, seeds, fruits, twigs and lianas are common in some localities.

Plant bearing localities noted during the 1984 survey are indicated in Table IV–1.

Pleistocene Localities of Mfwangano

Like Rusinga, Mfwangano possesses significant thickness of fossiliferous Pleistocene strata. In 1955, Whitworth and Savage collected limited faunas from two localities in the eastern coastal plain of Mfwangano (Whitworth, 1961). These sediments, here called the Waware Beds, accumulated at a time when Lake Victoria was about 17 to 18 metres deeper than it now is. They are therefore probably coeval with the Wasiriya Beds of Rusinga and the Apoko Formation of the Homa Peninsula.

During the 1984 survey, fossils were seen in many places in the Mfwangano coastal plains (fig. IV–8). A few of the more important occurrences have been mapped (Sites S1 to S12). The faunal remains are all of extant taxa, but few of the mammal species still occur on Mfwangano today. The exceptions are vervet monkeys and rock hyrax, which were evidently as common in the past as they are today. Two fossils, a jaw and a toe bone, were recognised as human.

Fossil gastropods, predominantly terrestrial in affinities are very abundant in the Waware Beds. All taxa seen still occur on Mfwangano today, but only in the small patch of relict forest at Kwitutu. Fossil freshwater molluscs also occur at some of the lower altitude sites (15–16 metres above lake level).

Site Designation of Mfwangano

Pre–war collections from Mfwangano were not subdivided by areas of collection: All fossils were merely labelled Mfwangano. The British–Kenya Miocene Expedition subdivided the island into various collection areas but no maps were made until 1955, and even then the sites were not marked on them. The 1952 field catalogue has the following information:

'A' – Area the region of the mangoes and on toward where the big caterpillar came from
'B' – Area the site and gully of the pedipalpid etc., across to site of fossil beetle
'C' – Area the site and area of Mary's big seeds
'D' – Area the »far sites«
'X' – Beyond area A small exposure

None of these designations can now confidently be identified. It is not known whether the 1955 expedition, which also used the letters A–D for Makira sites, was sampling the same areas as defined during the earlier expeditions. For the Walangani/Kakiimba area the 1955 expedition members drew field sketches (reproduced here) which help to identify the precise areas where collections were made. For the Makira sites however, site locations were provided much later by Dr. R.J.G. Savage (figs IV to 9–10). His maps, which are reproduced here, do not seem to tally with other data recorded in the field catalogue. For example, site D in Savage's sketch is the richest fossil area on the island, yet yielded very few fossils in 1955. Site A in Savage's sketch has few small exposures of Miocene strata yet yielded the second largest assemblage of fossils collected during 1955. It could be of course, that the rather obvious 'D' gully had been assiduously collected in 1952, clearing it of the lag of fossils, thereby making it appear less fossiliferous in 1955. Some doubt remains however, about all collections from the Makira area. Numerical subdivisions of areas A to E defined by the 1955 expedition, are depicted in the accompanying figure (IV–10).

As it appears, the collecting areas at Makira were not defined on a basis of stratigraphy, so in any case fossils from various levels have been badly mixed. Generally speaking areas 'A', 'D' and 'E' of Savage yield fossils from Lower Makira strata assigned to the Wayondo Formation comprising the lower red clays, the cross–bedded tuffs and the upper red clays. Areas 'B' and 'C' of Savage yield fossils from the upper Makira levels assigned to the Kiahera Formation as well as from the upper red clays, the grey tuffs and possibly the limestone horizons.

In 1984, all the fossil insects I saw at Makira, the bulk of the fruits and seeds, and most of the mammals, were eroding from the upper red clays especially in sections near their contact with the overlying grey tuffs. Both of Collinson's 1981 Makira collections came from these same levels in areas D and C.

The 1955 collections from the Walangani–Kakiimba Area are not subject to as much doubt as those from Makira (figs IV–11 to 12). However, collections made in that area prior to 1955 have no detailed data concerning their provenience. Thus fossils collected from the Walangani Beds and the Hiwegi Formation prior to 1955 were mixed together.

1955 COLLECTIONS OF FOSSILS FROM MFWANGANO

Site	Cocoons*	Fruits*	Snails*	Insects*	Mammals*
A	84	698	347	49	125
B	38	1954	756	100	226
C	3	152	37	2	38
D	77	90	309	23	10
E	33	28	2	1	0
K	0	100	58	9	3
L	0	24	98	2	124
M	0	27	34	4	7
N	2	142	39	0	35
O-1	2	663	235	3	37
O-2	0	0	0	0	4
O-3	0	34	41	3	74
O-4	0	20	7	2	4

Table IV–1

1955 Collections of fossils from Mfwangano

* Cocoons of various sorts were in 1955 called gastropod eggs. The low number of coccons in this table are misleading. Cocoons are, after plant remains, the commonest Mfwangano fossils. Fruits in the 1955 collection include large quantities of termite fungus chambers. Snails include quantities of Pleistocene and Miocene urocyclid shells which in 1955 were called snail operculae.

Insects, especially vermiform varieties, include termite foraging tubes. The mammal count is inflated by unidentifiable bone fragments. Apart from two crocodile fragments, the entire Mfwangano fossil assemblages are terrestrial in affinities.

MIOCENE FOSSIL LOCALITIES: MFWANGANO ISLAND

Site	Grid Reference	Site	Grid Reference
A	Area 176470	O-1	158509
B	Area 174469	O-2	162510
C	Area 170468	O-3	163508
D	Area 177471	O-4	161508
E	Area 180472	P	152513
F	141464	Q	164497
G	183475	R	163491
K-1	(? not used)	T-1	169503
K-2	Area 148533	T-2	168501
K-3	151531	T-3	167497
L-1	153523	T-4	173491
L-2	Area 154523	U	166497
L-3	Area 154520	V	097473
M	150519	W	173475
N	150516		

Table IV–2
Miocene fossil localities: Mfwangano Island

PLEISTOCENE FOSSIL LOCALITIES: MFWANGANO ISLAND

Site	Grid Reference	Site	Grid Reference
S1	179491	S7	135517
S2	182482	S8	178471
S3	177497	S9	181472
S4	164506	S10	185477
S5	161513	S11	155522
S6	159512	S12	172501

Table IV–3
Pleistocene fossil localities: Mfwangano Island

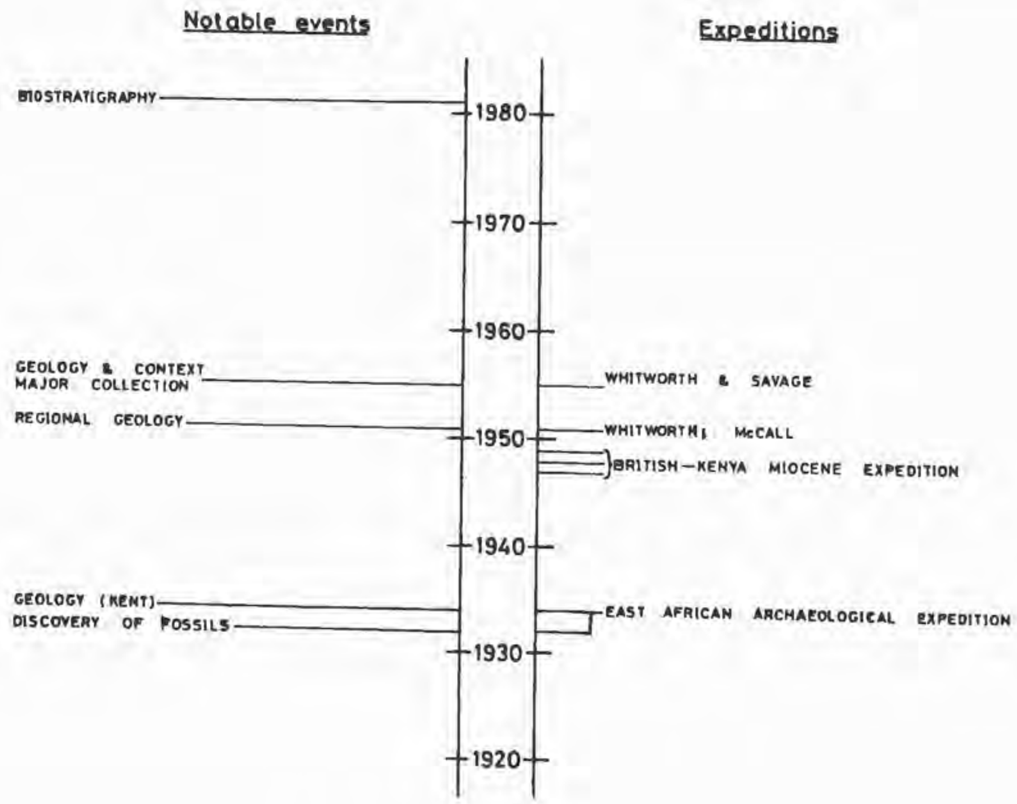


Fig. IV–1
Historical Chart: Mfwangano

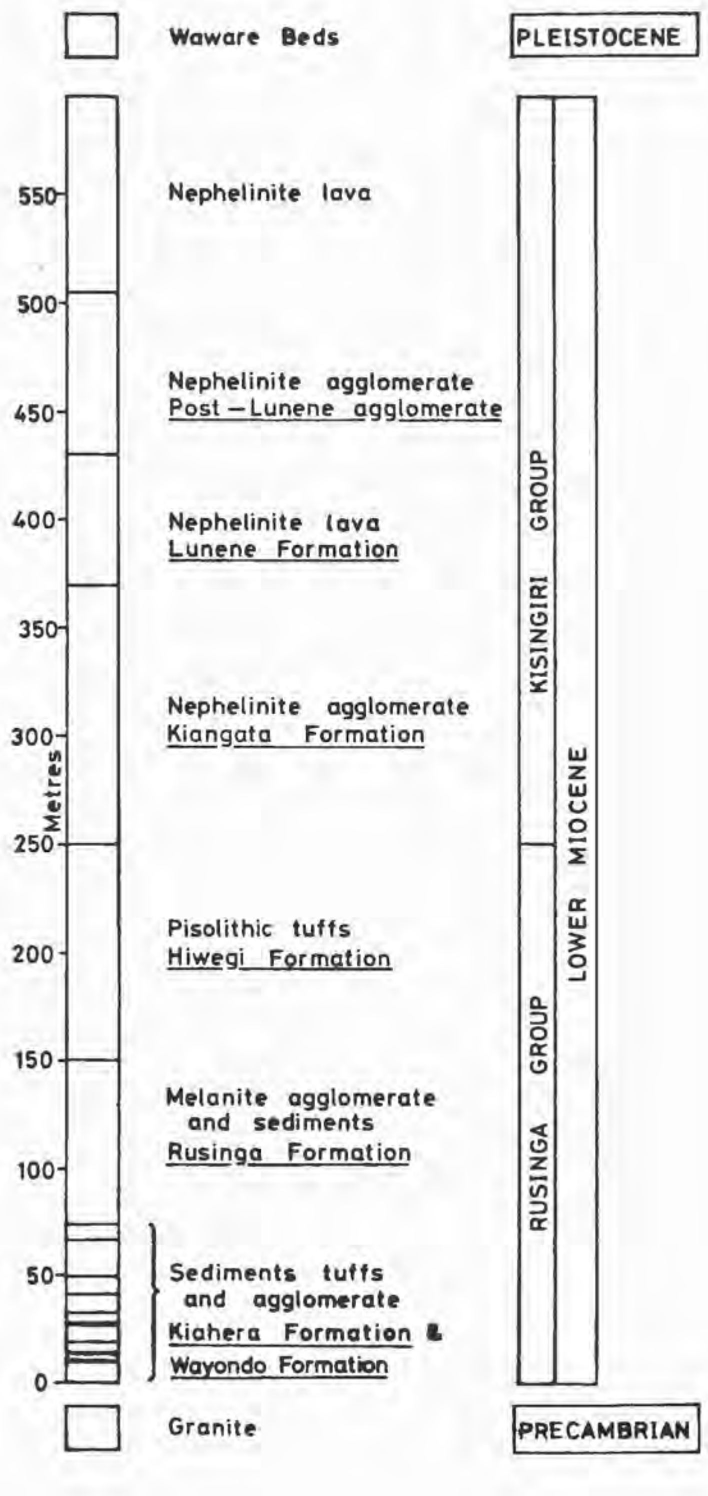


Fig. IV–2
Stratigraphy: Mfwangano

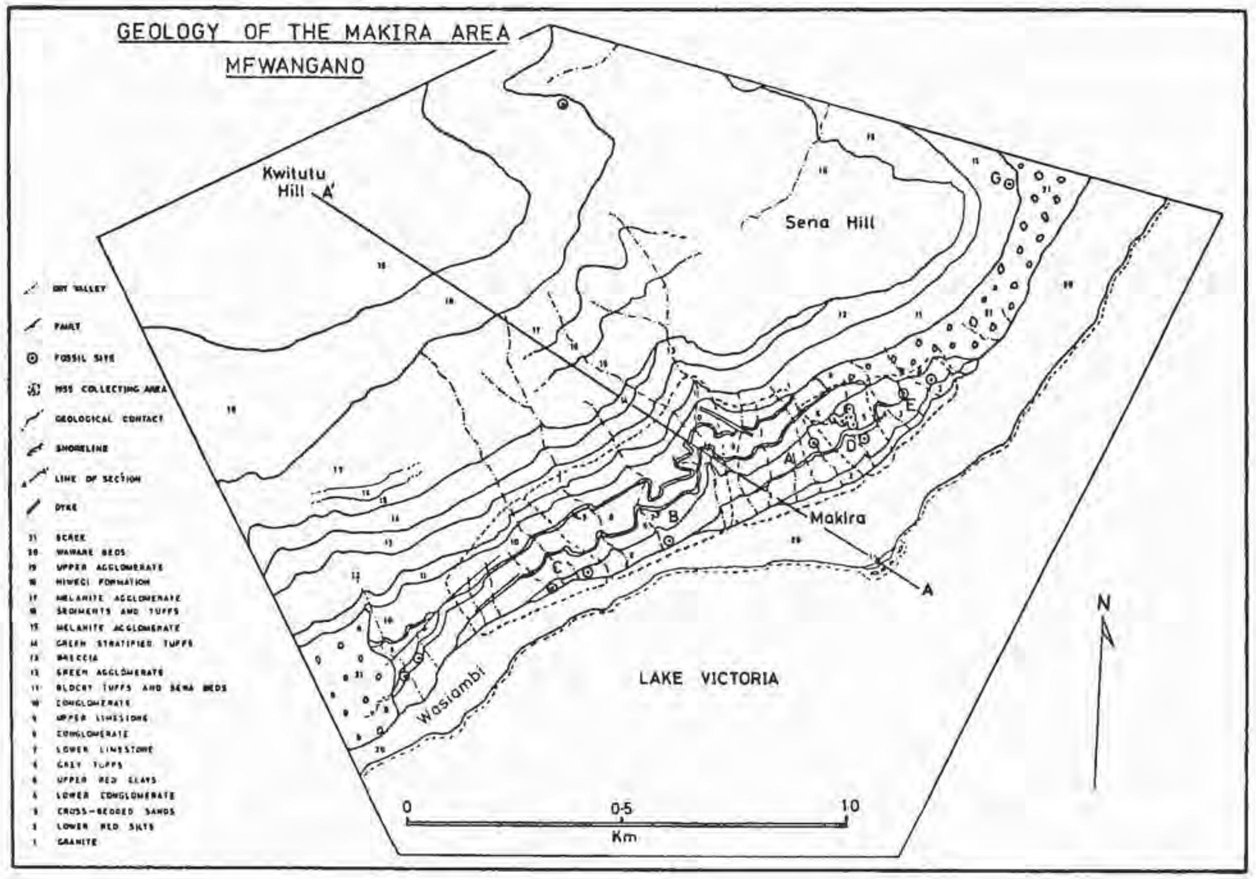


Fig. IV–3

Geology of the Makira Area: Mfwangano

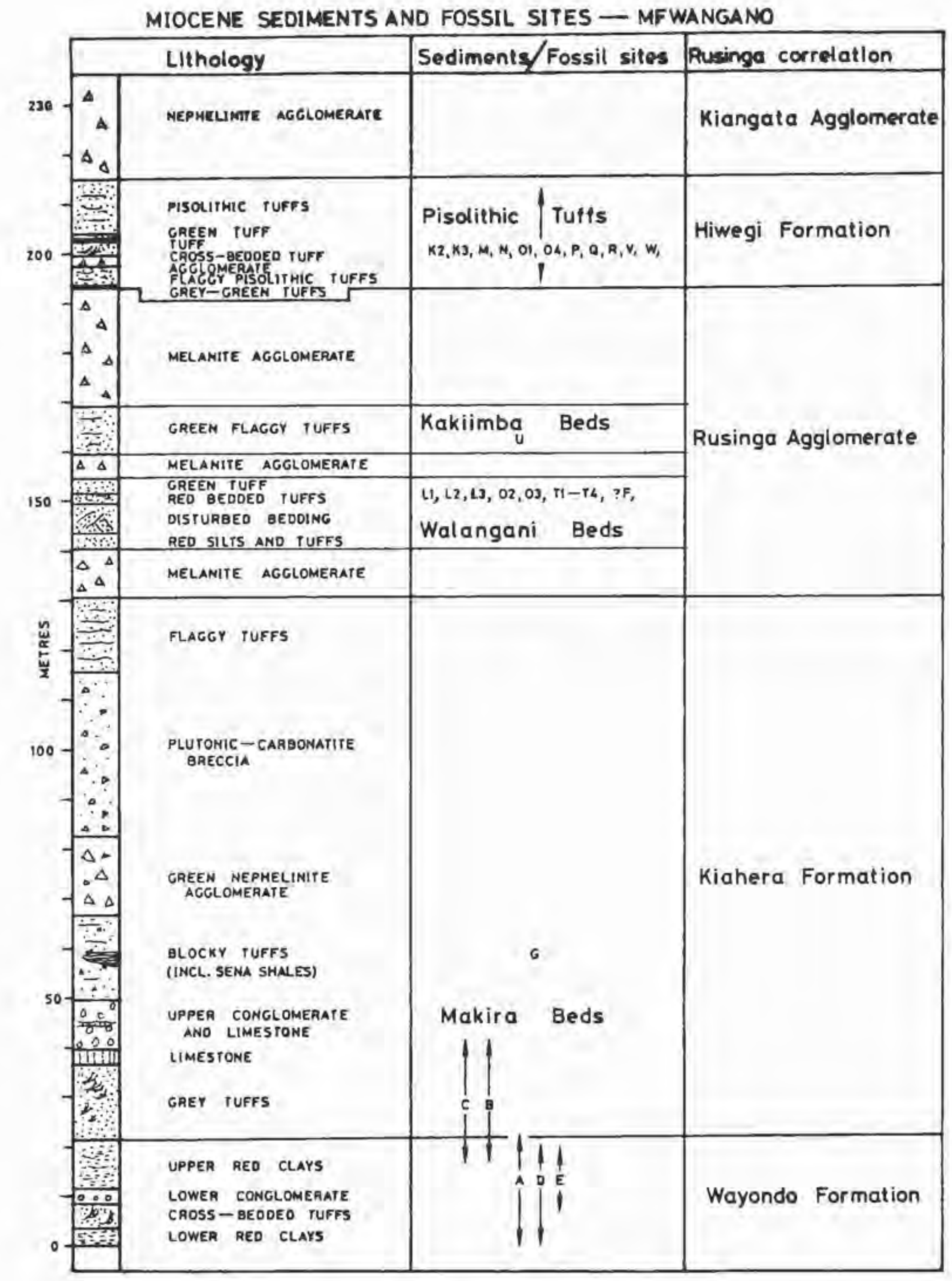


Fig. IV–4

Miocene sediments and fossil sites: Mfwangano

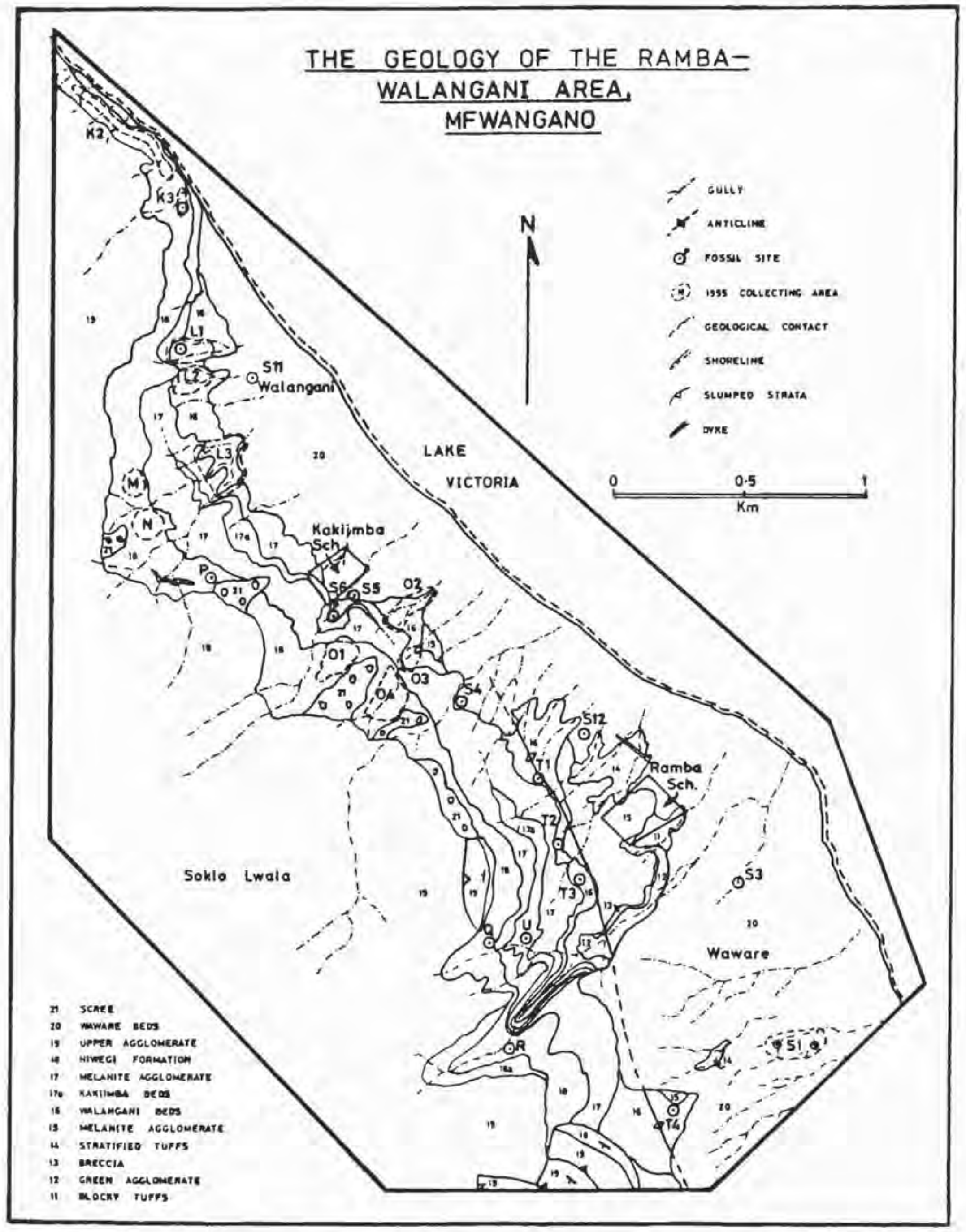


Fig. IV–5
Geology of the Ramba–Walangani Area: Mfwangano

FAUNAL LIST
MFWANGANO

		Mokira	Walangani	Kakiimba	Hiwegi	Unknown
Insecta	Acridoidea	■				
	Blattoidea	■				
	Isoptera	■	■	■	■	
	Homoptera	■				
	Heteroptera	■				
	Reduviidae	■				
	Coleoptera	■	■			
	Scarabaeidae	■	■			
	Melolonthinae	■				
	Scarabaeinae	■				
	Anachalcos mfwangani	■				
	Rutelinae	■				
	Tenebrionidae	■				
	Chrysomelidae	■				
	Anthribidae	■				
	Eumolpinae	■				
	Curculionidae	■				
	Noctuidae					■
	Sphingidae					■
	Hymenoptera	■				
	Formicidae	■				
	Oecophylla leakeyi	■				
Arachnida	Arachnidae	■				
Myriapoda		■			■	
Gastropoda	Edouardia	■	■			
	Maizania	■	■		■	
	Homorus	■	■	■	■	
	Limicolaria ?	■	■		■	
	Burtoa nilotica	■	■		■	
	Cerastus majus	■	■		■	
	Bloyetia	■				
	Trochonanina	■	■			
	Thapsia	■	■			
	Urocyclid slugs	■	■		■	
	Gonaxis protocavalii				■	
	Gonaxis (Marconia) costata	■			■	
	Gulella leakeyi	■	■			
	Gulella sp.	■				
	Ptychotrema fusiforme	■				
	Chlamydarion	■			■	
Pisces		■				
Crocodylia		■	■			
Chelonia	Testudinidae		■		■	
Lacertilia	Gerrhosaurus cf. major	■			■	
Varanidae		■				
Aves			■		■	
Mammalia	Myohyrax oswaldi	■			■	
	Miorhynchocyon rusingae	■	?			
	Komba robustus	■				
	Dendropithecus macinnesi	■	■		■	
	Rangwapithecus gordoni				■	
	Proconsul nyanzae	■	■		■	
	Kenyalagomys rusingae	■				
	Paraphiomys piggoti	■	■		■	
	Paraphiomys stromeri	■				
	Diamantomys leuderitzi	■	■		■	
	Simonimys genovefae	■				
	Megapedetes pentadactylus	■	■		■	
	Paranomalurus soniae					■
	Creodont indet.	■				
	Hecubides euryodon	■	■			
	Kichechia sized carnivore				■	
	Orycteropus minutus	■	■		■	
	Orycteropus africanus	■				
	Archaeobelodon	■	■			
	Prodeinotherium hobleyi	■			■	
	Megalohyrax championi	■				
	Meroehyrax bateae				■	
	Chalicotherium rusingense		■		■	
	Dicerorhinus leakeyi					■
	Brachypotherium heinzelini					■
	Brachyodus aequatorialis	■			■	
	Anthracothere nov. gen.				■	
	Nguruwe kijivium	■	■		■	
	Dorcatherium parvum	■	■			
	Dorcatherium piggoti				■	
	Dorcatherium chappuisi		■			
	Dorcatherium songhorensis	■	■		■	
	Propalaeoryx nyanzae	■			■	
	cf. Canthumeryx	■				
	Walangania africanus	■	■		■	

Fig. IV–6
Faunal List: Mfwangano

DISTRIBUTION OF FLORA AT MFWANGANO

	A	B	C	D	E	F	K2	K3	L1	M	N	O1	O2	O3	O4	P	Q	R	T1	V
Wood	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Leaves	■	■	■	■							■	■		■	■		■	■		
Fruits	■		■	■		■		■		■		■		■			■	■		■
Seeds	■	■	■	■		■		■		■		■			■		■	■	■	■
Lianas			■	■													■	■	■	

Fig. IV–7
Distribution of Flora at Mfwangano

FAUNAL LIST
WAWARE BEDS

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	Surface
Maizania elatior							■						
Limicolaria sp.	■	■	■	■	■	■	■	■	■	■	■	■	■
Oreohomorus nitidus		■		■	■	■							
Subulona clara			■	■		■							
Halolimnohelix cf. percivali		■											
Thapsia sp.				■									
Urocyclid slugs	■	■		■									
Gulella sp.			■	■									
Pila ovata			■							■			
Melanoides tuberculata									■				
Corbicula africana									■				
Bellamya costulata									■				
Caelatura sp.									■				
Rodentia		■											■
Homo sapiens			■										■
Cercopithecus aethiops	■												
Colobus abyssinicus	■												
Procavia capensis		■		■							■	■	
Equus burchelli	■							■					
Hippopotamus amphibius		■						■				■	
Potamochoerus porcus													■
Hylochoerus meinertzhageni			■										
Kobus cf. kob	■										■		
Alcelaphini sp.		■						■				■	
Syncerus sp.		■											
Tragelaphus sp.	■												
Gazella granti		■						■					

Fig. IV–8
Faunal List: Waware Beds

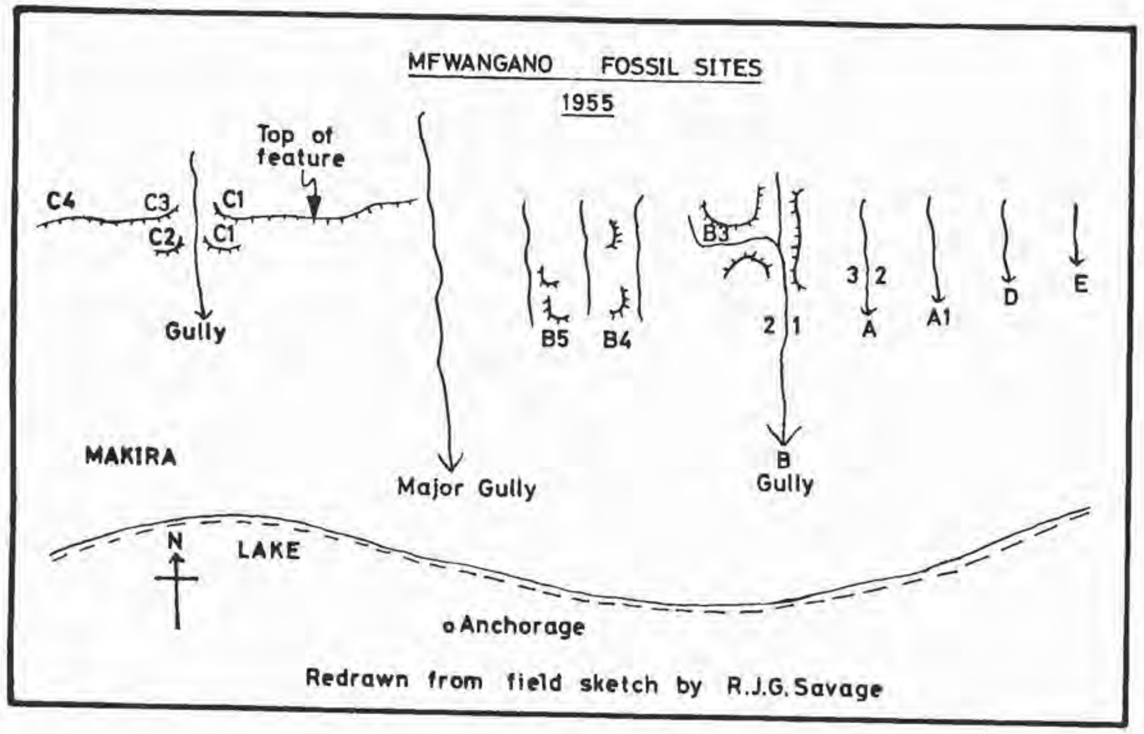


Fig. IV–9

Mfwangano Fossil sites: 1955

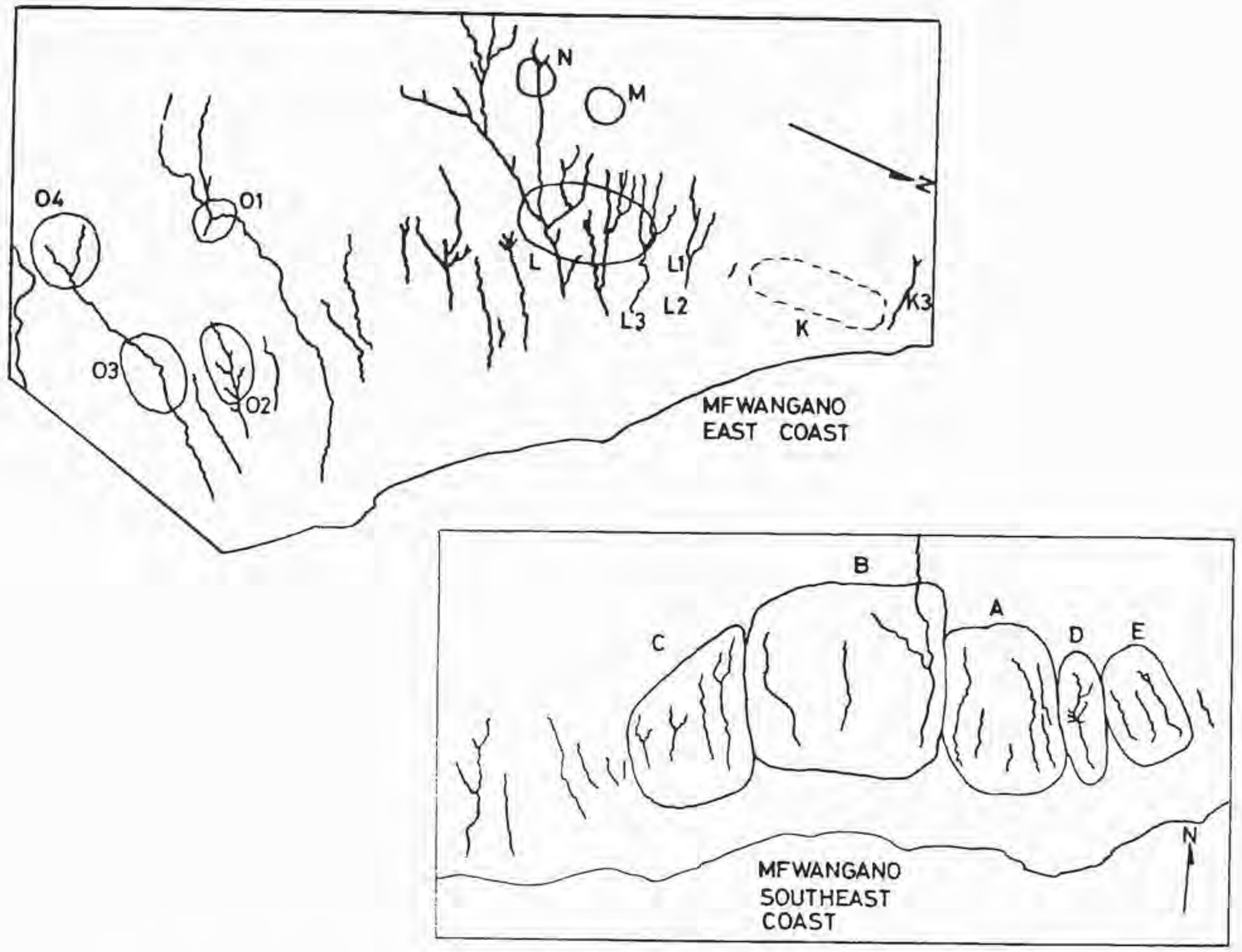


Fig. IV–10

Overlay tracing of maps: Whitworth, 1961 – Mfwangano collecting areas

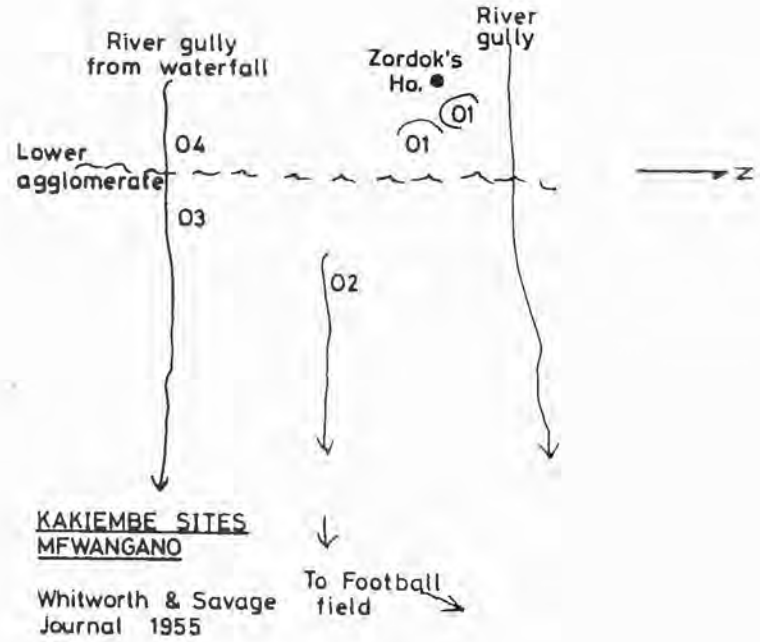


Fig. IV–11

Kakiembe Sites: Mfwangano – 1955

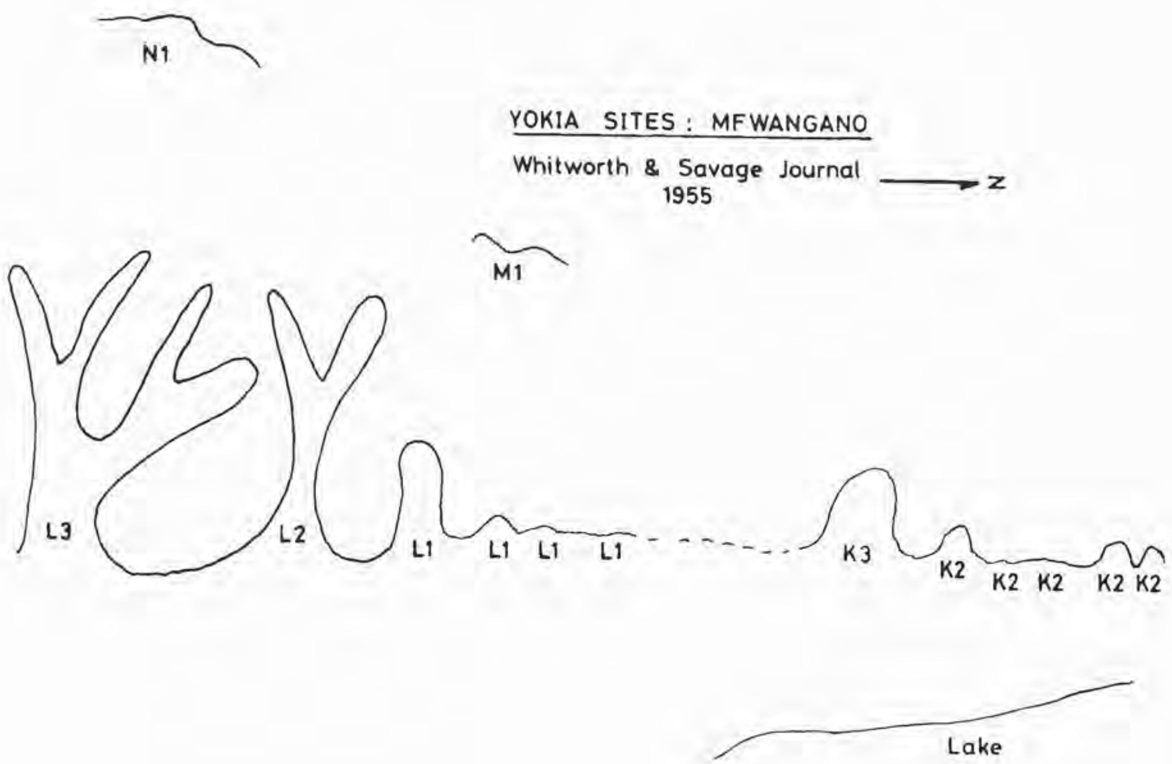


Fig. IV–12

Yokia Sites: Mfwangano – 1955

CHAPTER 5

AREA IV

UYOMA PENINSULA

History

Two main fossiliferous areas have been known in the Uyoma Peninsula for many years (figs V–1 to 2). Recently several more sites have been found. Archdeacon Owen first found fossils on the peninsula at Chianda (Arongo) and Nyakongo (fig. V–2). Almost his entire collection was sent to the British Museum in 1936. The British–Kenya Miocene Expedition visited the area in 1947 and 1948 but became discouraged by the paucity of fossils, and little further research was carried out until 1973 when Andrews made a small collection.

In 1981, the author mapped Uyoma Peninsula, discovering fifteen new fossil localities in the process.

Geological Map

The only published geological map of the Uyoma Peninsula (McCall, 1958) does not differentiate between the various lithologic units. It merely shows that the whole peninsula is comprised of volcanic debris related to Gwasi (Rangwa or Kisingiri) Volcano, the centre of which lies to the southwest.

The 1:50,000 map accompanying this report was made by the author in a two week period and must therefore be considered preliminary. The detailed maps at larger scale may be considered accurate.

Stratigraphy

The stratigraphy of Uyoma is regionally simple but locally complex. In the north on the mainland are well exposed granites and metavolcanics of the Nyanzian Shield. The main area of the peninsula which has been downfaulted along the Uyoma fault, is comprised of volcanics and sediments of lower Miocene age, unconformably overlain by late Middle Pleistocene sediments and Recent soils and alluvium.

The lowest unit within the Miocene sequence is exposed on the Magare headland (fig. V–3). This appears to equate in part with the Hiwegi Formation of Rusinga Island. This is overlain by an agglomerate which is in turn overlain by the Misori beds which contain pink limestone locally quarried for roadstone and building stone. Above these beds comes another agglomerate overlain by Rangoye beds (figs V–4 to 6) comprised of green tuffaceous strata which are generally well–bedded. I provisionally equate the Rangoye beds with the Kulu Formation on Rusinga since they have approximately comparable lithologies and both lie with unconformity on the older agglomeratic rocks.

Above the Rangoye beds comes the Upper Agglomerate which I tentatively equate with the Kiangata Agglomerate. This is overlain in the Naya and other areas by a nephelinite lava with huge augite phenocrysts rather similar to one of the Lunene lavas on Hiwegi Hill, Rusinga.

Northwards, near Nyakongo, however there are three lava flows with sediments intercalated between them. Whether these sediments compare with the Kawass beds between the two lavas on Hiwegi Hill, Rusinga Island, or not, remains to be established. Both are however highly calcified by calcrete pedogenesis.

In the northeast corner of the peninsula the Upper Agglomerate overlies the Chianda beds with unconformity. The lithology of the Chianda beds (fig. V–7) is unique in the peninsula, but closely resembles the Gumba red beds of Rusinga Island and the Karungu sequence. I provisionally place them at about the same position as the Nyakongo beds and the Rangoye beds, and think it possible that the differences in lithology reflect differences in depositional facies and sediment sources. Nyakongo is lacustrine, Rangoye is subaerial becoming lacustrine upwards while Chianda is swampy floodplain. The position of the Kunya beds (fig. V–8) and the Wayaga beds seems to be within the Upper Agglomerate.

Partly filling an incised topography in the Miocene platform, are many patches of Pleistocene strata, often with fossils, although I saw no artefacts *in situ* and very few on the surface. These late middle Pleistocene sediments occur up to 130

feet (40 m) above present lake level. They do not appear to be well bedded and are frequently characterised by kunkar nodules, suggesting a largely subaerial depositional environment.

Unconformably on the Pleistocene and Miocene strata occurs a littoral band of alluvium up to 10 metres above present lake level. This deposit frequently backs onto a cliff feature developed in many places along the coast of Uyoma.

Over much of the peninsula there is a one to two metre thick black cotton soil. There are abundant artefact sites all over the region, usually with grindstones and pestels, but also with subfossil bones and abundant pottery.

Biostratigraphy

The main sequence on Uyoma is very clearly lower Miocene in age (figs V–9 to 10); its closest affinities being to Faunal Set II of Pickford (1981). Since it seems that at least the Magare, Misori and Rangoye beds are equivalent to the Hiwegi and Kulu Formations on Rusinga this correlation is not too surprising.

The Pleistocene strata contain a number of taxa most of which are extant (fig. V–11). I therefore place the beds closer to the late Pleistocene than to the early Pleistocene.

MIOCENE FOSSILIFEROUS LOCALITIES, UYOMA PENINSULA

	Site Designation	# of Fossils	Map Reference	Source
1.	Chianda N	313	506744	Owen, 1939
2.	Chianda S	35	513738	Owen, 1939
3.	Nyakongo	4	422705	Owen, 1939
4.	Ruma	5	486761	
5.	Nyamsore N	5	544719	
6.	Nyamsore C	3	544714	
7.	Nyamsore S	3	540712	
8.	Kunya	186	556685	
9.	Wayaga	4	505665	
10.	Kagwa	43	397736	
11.	Nyakongo West	14	408701	
12.	Nyabera	29	430664	
13.	Misori	29	420638	
14.	Angulo	45	429629	
15.	Rangoye	156	gully 4463	
16.	Magare	250	418618	
17.	Magare Beach	24	416617	

Table V–1

Miocene fossiliferous localities: Uyoma Peninsula

PLEISTOCENE FOSSILIFEROUS LOCALITIES, UYOMA PENINSULA

Site Designation	Map Reference	Source
1. Chianda N (Pleist)	506745	MacInnes, 1953
2. Chianda S (Pleist)	513738	
3. Kagwa (Pleist)	401738	
4. Rangoye (Pleist)	439633	
5. Misori (Pleist)	419643	
6. Nyakongo (Pleist)	423703	

Table V–2

Pleistocene fossiliferous localities: Uyoma Peninsula

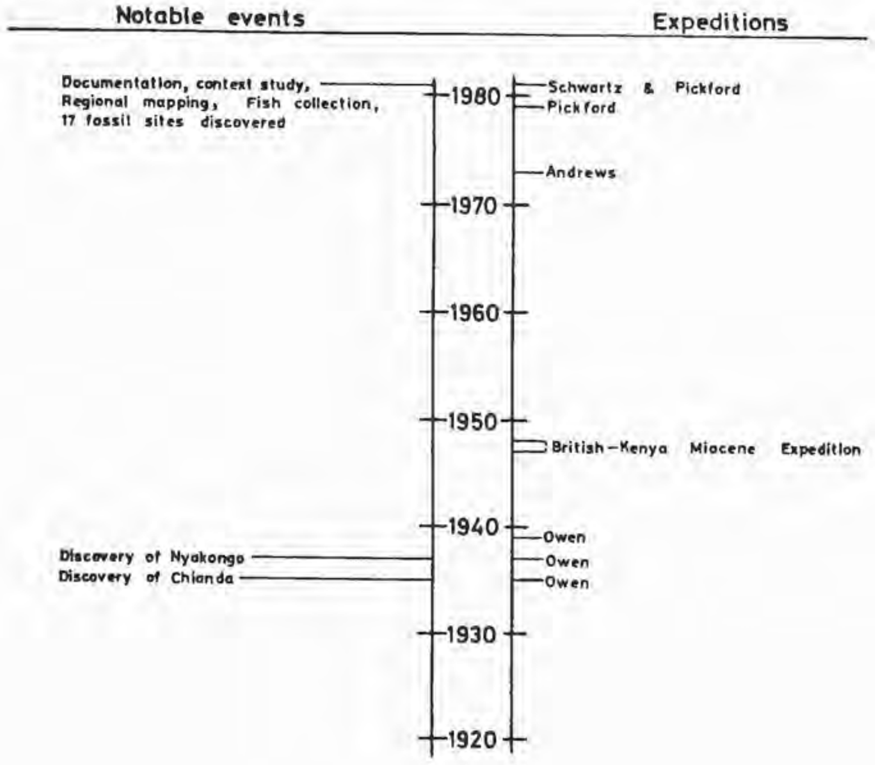


Fig. V–1

Historical Chart: Uyoma Peninsula

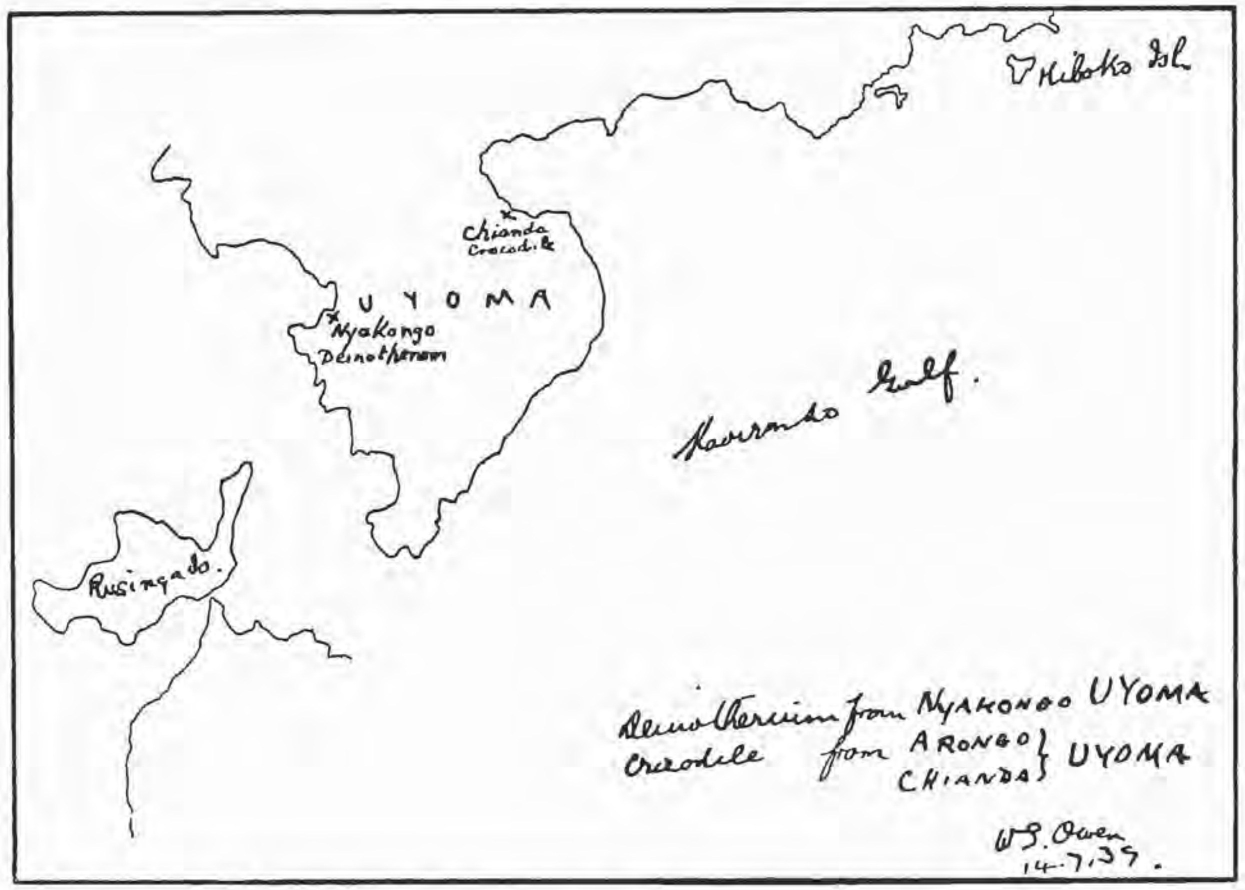


Fig. V–2

Fossil localities recorded by Owen, 1939

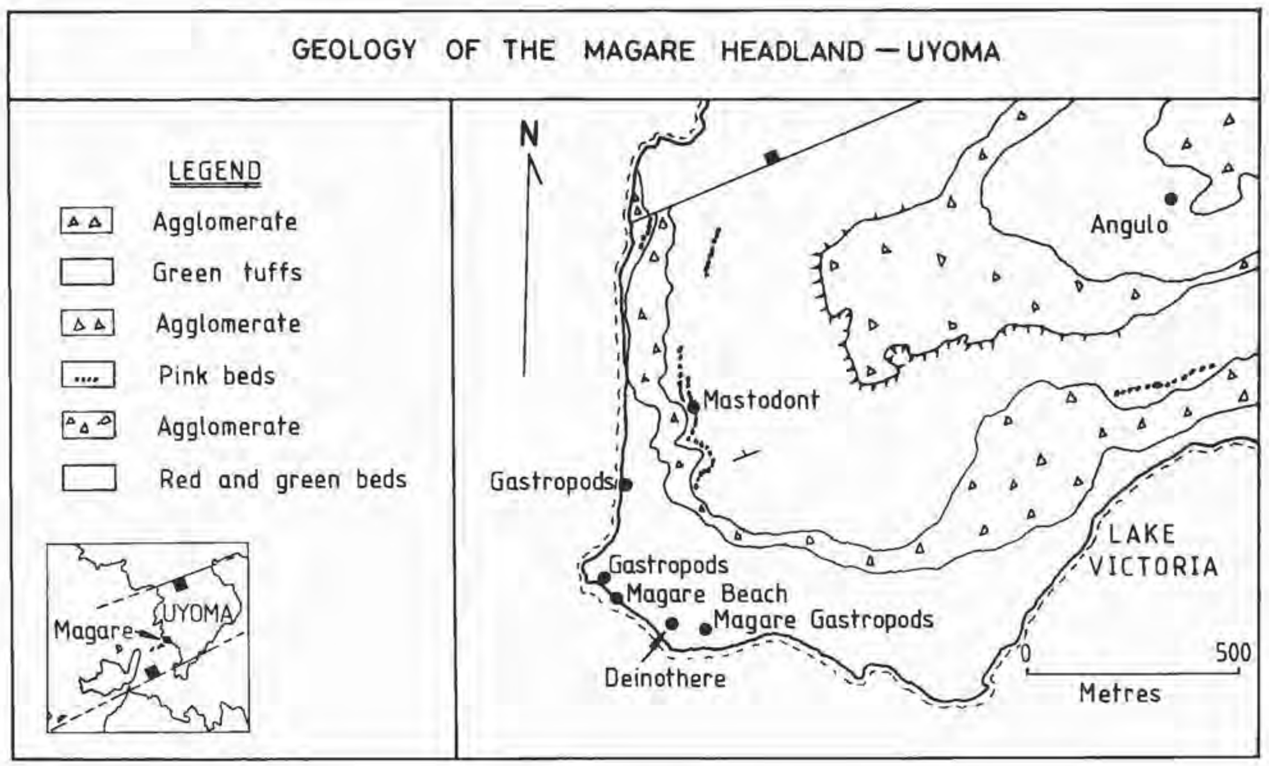


Fig. V–3

Geology of the Magare Headland: Uyoma

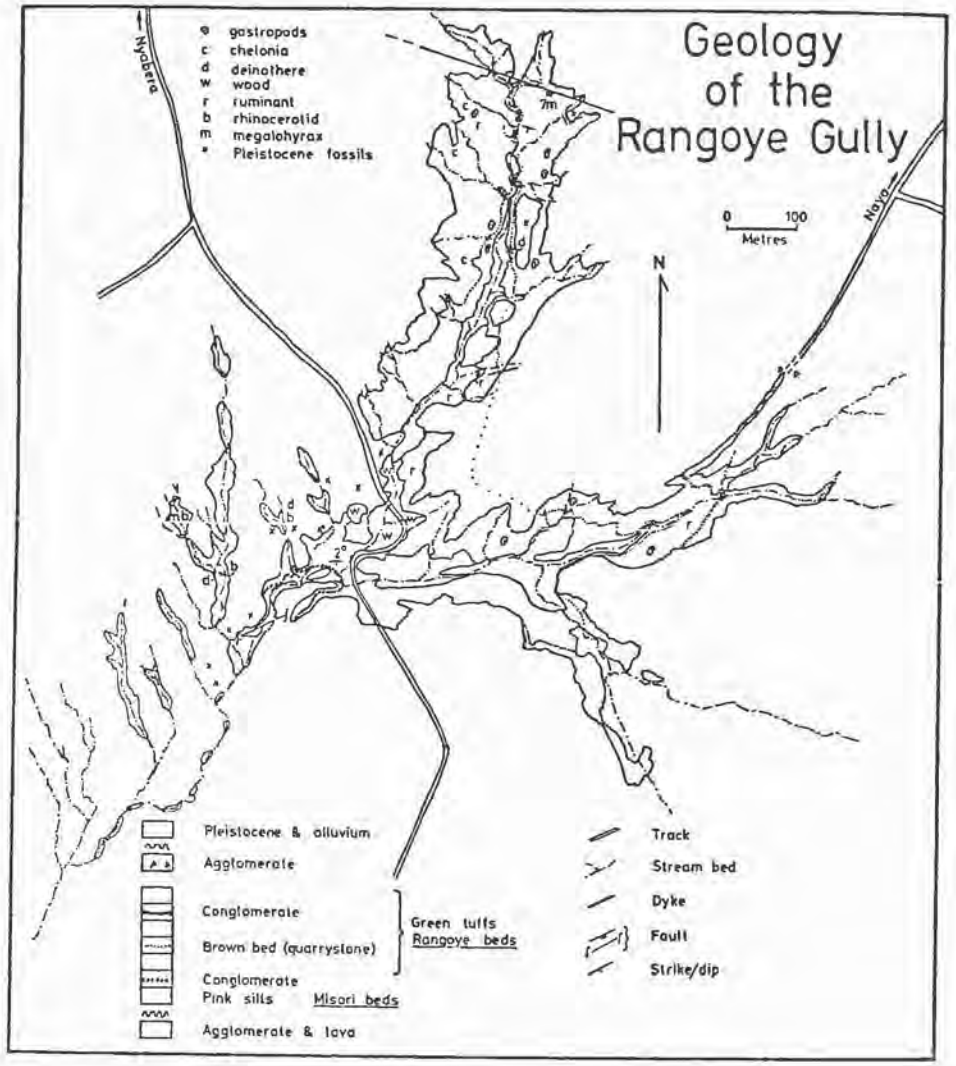


Fig. V–4
Geology of the Rangoye Gully

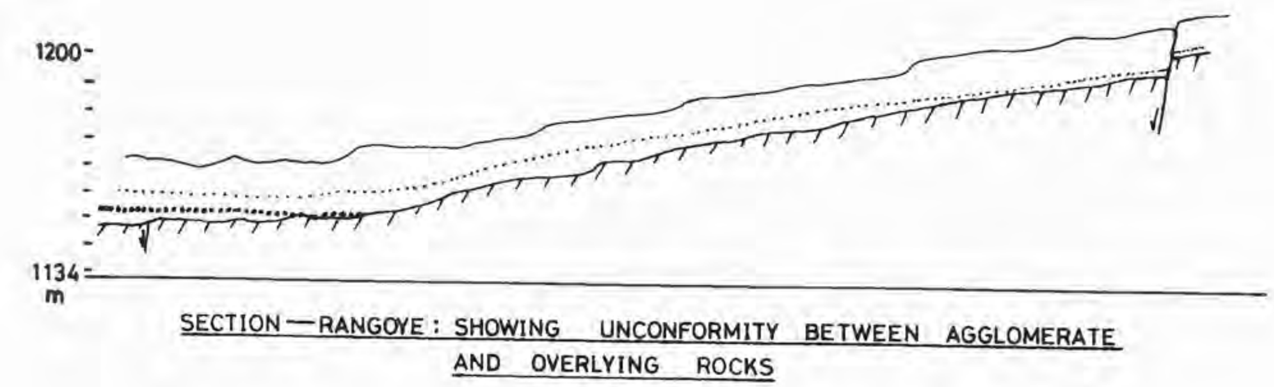


Fig. V–5
Section: Rangoye

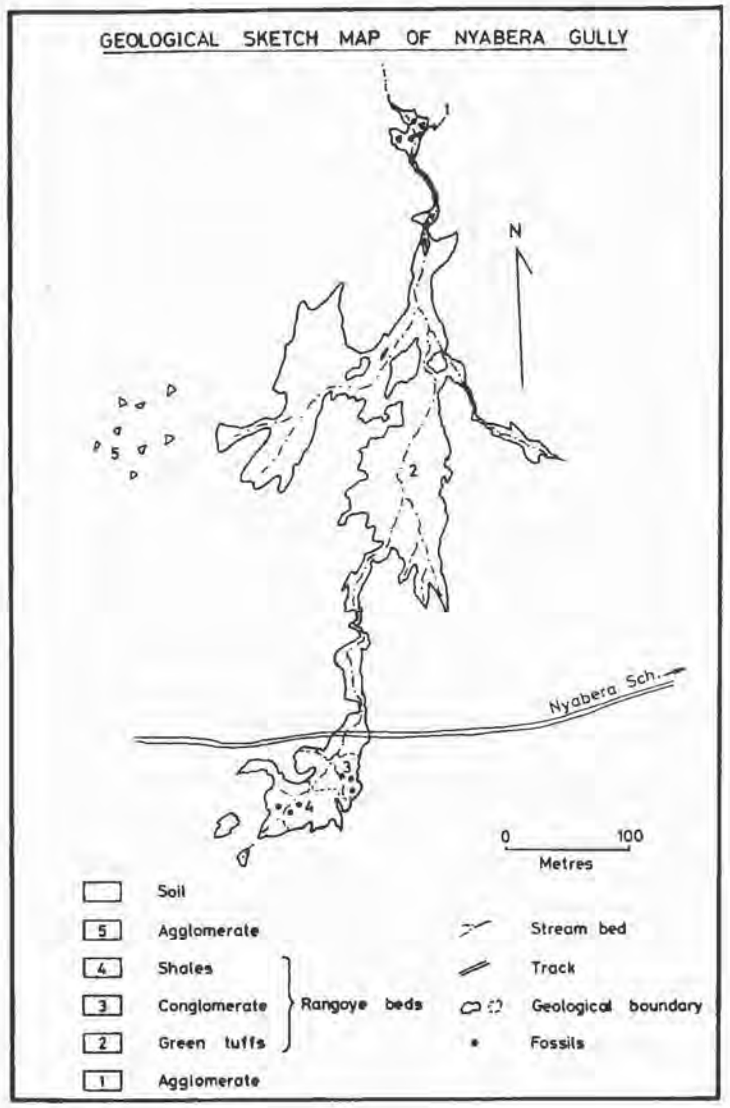


Fig. V–6
Geological sketch map of Nyabera Gully

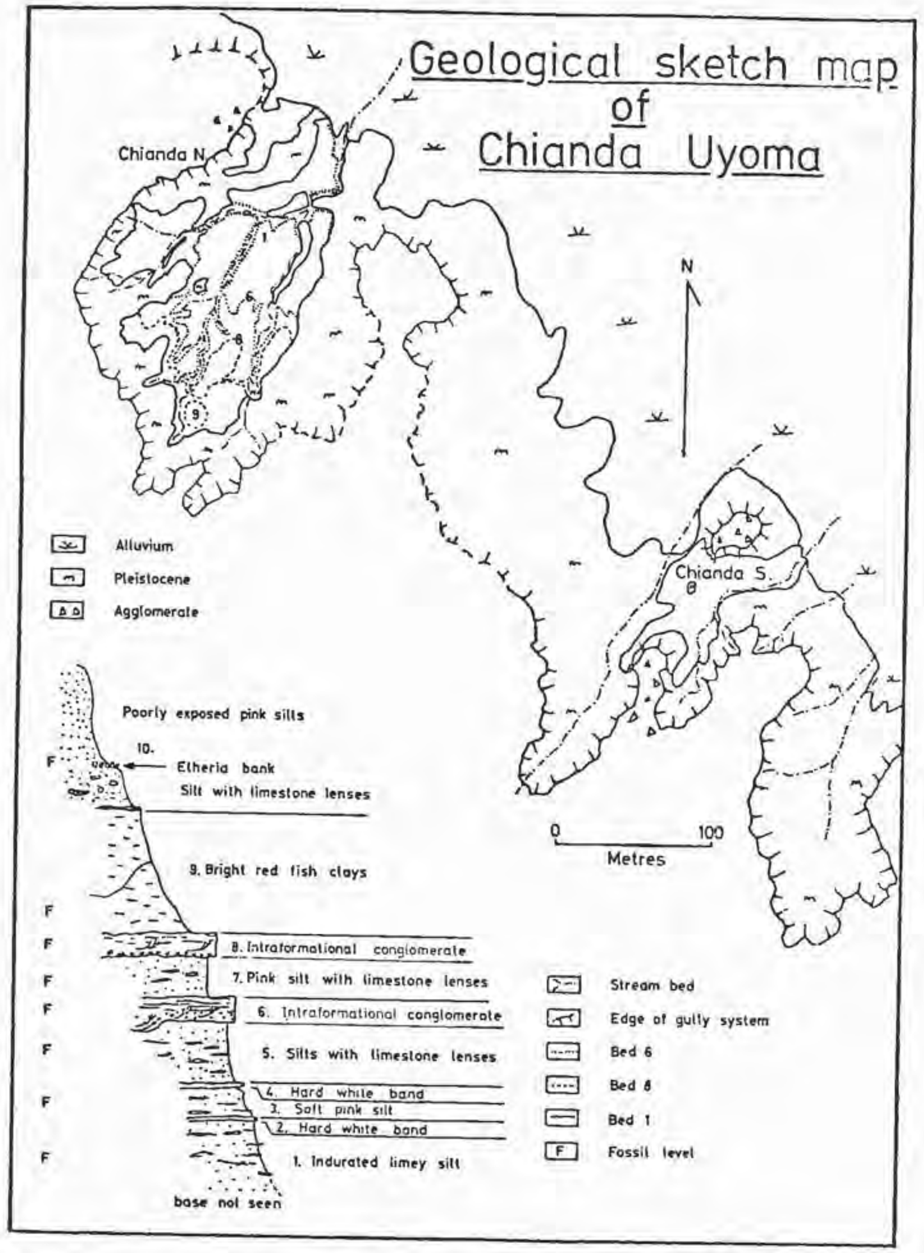


Fig. V–7
Geological sketch map of Chianda, Uyoma

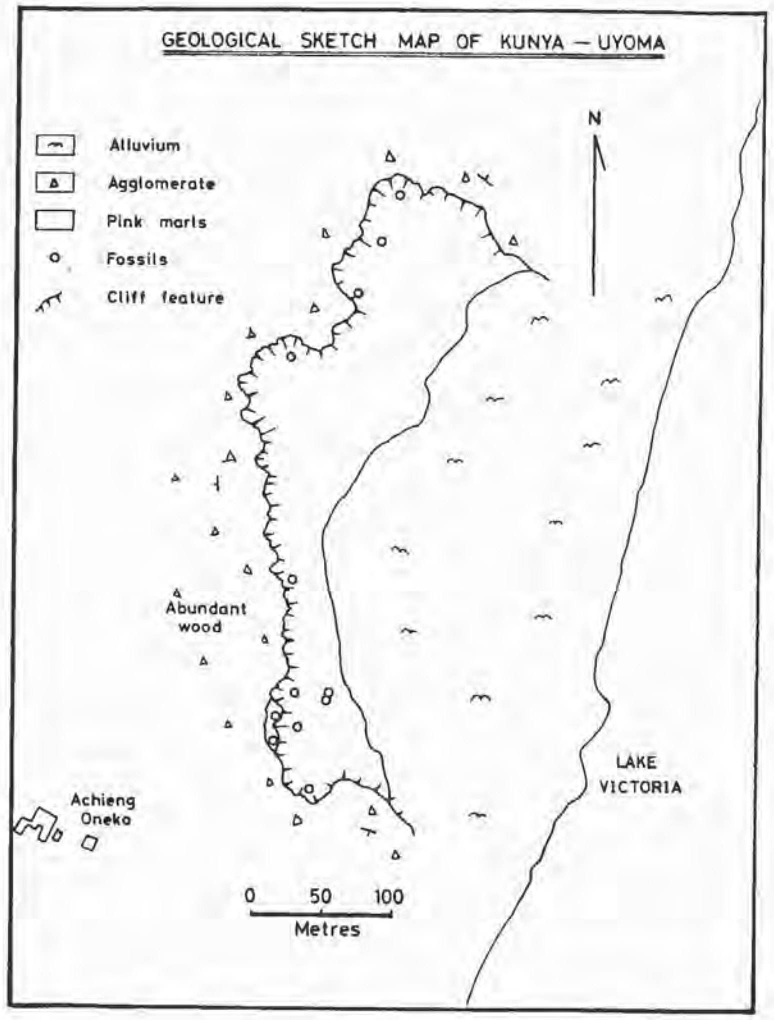


Fig. V–8
Geological sketch map of Kunya, Uyoma

NON-MOLLUSCAN FAUNA OF THE UYOMA PENINSULA	Chiande N	Chiande S	Nyakongo	Ruma	Nyamsore N	Nyamsore C	Nyamsore S	Kunya	Wayaga	Kagwa	Nyabera	Misori	Angulo	Rangoye	Wagare	Wagare Beach
Cocoons and brood cells								■				■	■	■	■	■
Sphyngidae															■	
Coleoptera								■								
Cryptodesmidae								■							■	
Potamidae	■															
Gymnarchus	■															
Protopterus	■	■														
Lates	■	■														
Polypterus	■	■								■						
Clariidae	■															
Heterotis	■															
Synodontis	■	■														
Schilbeidae	■															
Trionyx	■	■		■	■	■	■			■						
Cycloderma	■					■	■									
Pelomedusidae	■	■		■	■	■	■				■					
Testudinidae														■		
Euthecodon	■	■														
Crocodylus	■	■									■					
Varanidae	■															
Ophidea	■															
Phoenicopteridae	■	■														
Proconsul ?	■															
Dendropithecus macinnesi													■			
Megapedetes pentadactylus																■
Paraphiomys pigotti										■						
Rodentia small sp.								■			■		■			
Creodonta	■															
Carnivora											■			■		
Prodeinotherium hobleyi	■		■	■			■				■			■	■	
Archaeobelodon	■	■													■	■
Megalohyrax championi								■						■		
Brachypotherium heinzelini	■										■					
Aceratherium or Dicerorhinus	■															
Rhinocerotidae indet.	■	■	■										■	■		■
Anthracotheriidae indet.	■									■				■		
Brachyodus aequatorialis	■	■														
Diamantohyus africanus	■															
Libycochoerus jeanelli											■					
Kenyasus rusingensis	■												■			
Dorcatherium pigotti	■															
Dorcatherium parvum	■							■								
Propalaeoryx ? nyanzae	■							■			■			■		
Canthumeryx ?	■															

Fig. V–9

Non–Molluscan Fauna: Uyoma Peninsula

MOLLUSCAN FAUNA UYOMA PENINSULA	Chiande N	Chiande S	Ruma	Nyamsore C	Nyamsore S	Kunya	Wayaga	Kagwa	Nyakongo N	Nyabera	Misori	Angulo	Rangoye	Wagare	Wagare Beach
Lanistes carinatus	■	■		?	?			■							■
Pila ovata										■					■
Bellamya/Cleopatra															■
Mutela/Aspatharia	■							■							
Etheria elliptica	■	■	■					■							
Maizania						■		■				■			
Tropidophora (= Ligatella)						■			■			■	■		
Cerastua				■		■	■	■	?	■		■			
Edouardia						■						■	■	■	
Burtoa nilotica						■		■			■		■	■	
Limicolaria						■	■	■	■	■	■	■		■	■
Homorus				■		■						■	■		
Edentulina						■						■			
Trochonanina						■						■	■		
Bloyetia						■									
Thapsia	■					■						■	■		
Chlamydarion														■	
Gonaxis protocavalli						■								■	
Gulella														■	

Fig. V–10

Molluscan Fauna: Uyoma Peninsula

FAUNAL LIST PLEISTOCENE SITES UYOMA	Chiande N	Chiande S	Kagwa	Rangoye	Misori	Nyakongo
Limicolaria			■			
Homo sapiens		■				
Lepus veter	■					
Canis sp.						■
Connochaetes taurinus			■	■		■
Alcelaphus buselaphus				■		■
Gazella thomsoni				■		
Bovidae indet.	■	■		■	■	■

Fig. V–11

Faunal List: Pleistocene Sites – Uyoma

CHAPTER 6

AREA V

KARUNGU

History

Karungu must certainly vie as one of the earliest discovered mammalian fossil sites in Kenya, perhaps only being pipped at the post by Morendat (Ridgeway, 1909) where a fossil equid jaw was found by Hollis in 1906. Karungu was first prospected by G.R. Chesnaye, a surveyor (fig. VI–1). Oswald (1914) described in detail the history of the site up to 1911 when he visited it in order to enlarge the collections of the British Museum. Andrews (1911) was however, the first to publish anything about the site when he erected the new species *Deinotherium hobleyi*. Andrews (1914) continued his interest in the site by publishing an enlarged paper on the vertebrates collected by Oswald (1914). Newton (1914) described the gastropods. Between the three of them, Oswald, Andrews and Newton produced a report on Karungu which still stands as the definitive work on the geology and palaeontology of the area. A large number of additional publications has appeared in the ensuing seventy years.

During the 1930–1940 decade Owen (1936) worked on Pleistocene sediments in the Karungu area, where he found Middle Stone Age artefacts and human remains. He collected a few Miocene fossils at the same time, sending most of his collection to the British Museum of Natural History.

The British–kenya Miocene Expedition made small collections at Karungu in 1948 and 1950. The area was mapped by McCall (1958) but little further work was done until Andrews excavated at Nira in 1973. In 1980, Schmidt–Kittler excavated at Nira and the principal gullies were remapped at large scale by the author in 1981 (fig. VI–2).

Geological Map

The geological maps of Karungu have been prepared by the author from field observations, and from notes by Oswald (1914) and McCall (1958).

Stratigraphy

The overall rock sequence at formational level is simple, the local base being comprised of PreCambrian volcanics. A soil profile of variable thickness is preserved between the PreCambrian and Tertiary rocks. Above this comes the Karungu Formation comprising the lower, middle and upper series of Oswald (1914), overlain by nephenilitic agglomerates and lavas. Overlying these rocks, especially in partly buried valleys, occurs a variable and discontinuous sequence of middle to late Pleistocene strata (fig. VI–3), which usually contain one or two distinct tuffaceous beds which appear to be the same as the Nyando ashes of the Kano Plains area.

Overlying the Pleistocene sediments are alluvial deposits fringing the shores of Lake Victoria. These contain shell mounds rich in human remains and artefacts. In detail, the strata of the Miocene Karungu Formation are seen to be discontinuous laterally. the depositional environment was largely fluviatile, and there was consequently a great deal of cut and fill. One or two beds however are recognisable over a large area, in particular bed 30, a conglomerate composed of algal balls of various sizes. Bed 14 is widespread in the Nira exposures, but I cannot guarantee that what is mapped as bed 14 at Kachuku represents the same stratum.

The Pleistocene sequence would be difficult to establish were it not for the widespread occurrence of two tuffs at many outcrops. These tuffs occur in virtually every section in the Karungu area, but also occur at many points along the coast northwards to Kaksingiri (Kisingiri), then eastwards to the Homa Peninsula and the Kano Plains. They are almost always associated with artefacts of Levallois typology. At several places clays in the sequence contain abundant faunal and human remains.

Biostratigraphy

Miocene

Pickford (1981) has recently proposed that the Karungu fauna fits best into Faunal Set II for which an age of about 17.7 m.y. would be appropriate. This notion was in contrast to a KAr date of 22.5 to 23 m.y. published by Bishop *et al.* (1969). A sample obtained recently comprising fresh large biotite books from bed 5 at Nira, has yielded a date of 17.5 m.y. in support of the faunal correlations voiced earlier. The entire Miocene sequence at Karungu seems to have accumulated in a biostratigraphically limited time period, the faunas from all beds being similar, except that the lower and middle series yield abundant aquatic elements, while the upper series yields only terrestrial elements.

Miocene fossiliferous localities in the Karungu Area

A total of five Miocene localities occurs in the Karungu area. Most of these localities are comprised of many fossiliferous levels within each limited area, but no major attempts have been made to keep the faunas from each bed separate.

Pleistocene

All the fauna collected from the Pleistocene succession can be closely identified as belonging to modern taxa (fig. VI–6). Gentry and Gentry (1978) recognised *Gazella thomsoni* at Aringo and Pickford (unpub. 1981) recognised *Phacochoerus*, *Redunca reduca*, *Struthio* and several other taxa (see faunal lists). It seems more likely that the deposits are broadly late Pleistocene than middle Pleistocene, but additional work is necessary.

MIOCENE FOSSIL SITES AT KARUNGU

Site Designation	# of Fossils	Map Reference	Source
Nira	1222 (Nira and Kachuku)	Area 3205	Oswald, 1914
Kachuku		Area 3304-3404	Oswald, 1914
Magungu (=E Kachuku)	3	Area 3503	Oswald, 1914
Nyagwena (=Kikongo)	15	Area 4004	Oswald, 1914
Mifware	3	Area 3705	

Table VI–1

Miocene fossil sites at Karungu

PLEISTOCENE FOSSIL SITES AT KARUNGU

	Site Designation	Map Reference	Source
(1)	Aringo	Area 3107	Owen, ms.
(2)	Owich	gully 2312	Owen, ms.
(3)	Kasimwa	gully 3206	Owen, ms.
(4)	Tea Gully	unknown, but near Nira	Owen, ms.
(5)	Nyatambi	gully 2114	Owen, ms.
(6)	Kisaaka	gully 2611	Owen, ms.
(7)	Karemo	gully 2908	Owen, ms.
(8)	Aoch Nyasaya	376053	Owen, ms.
(9)	Nira	area 3404	Owen, ms.
(10)	Maguna	gully 2016	Owen, ms.
(11)	Obware	area 3705	Owen, ms.
(12)	Sore	285065	Owen, ms.
(13)	Onge	gully 3207	Owen, ms.

All these sites except number 4 were relocated by Pickford in 1981, with the help of notes and photographs in the Owen Archives kept in the National Museum Archives.

Table VI–2

Pleistocene fossil sites at Karungu

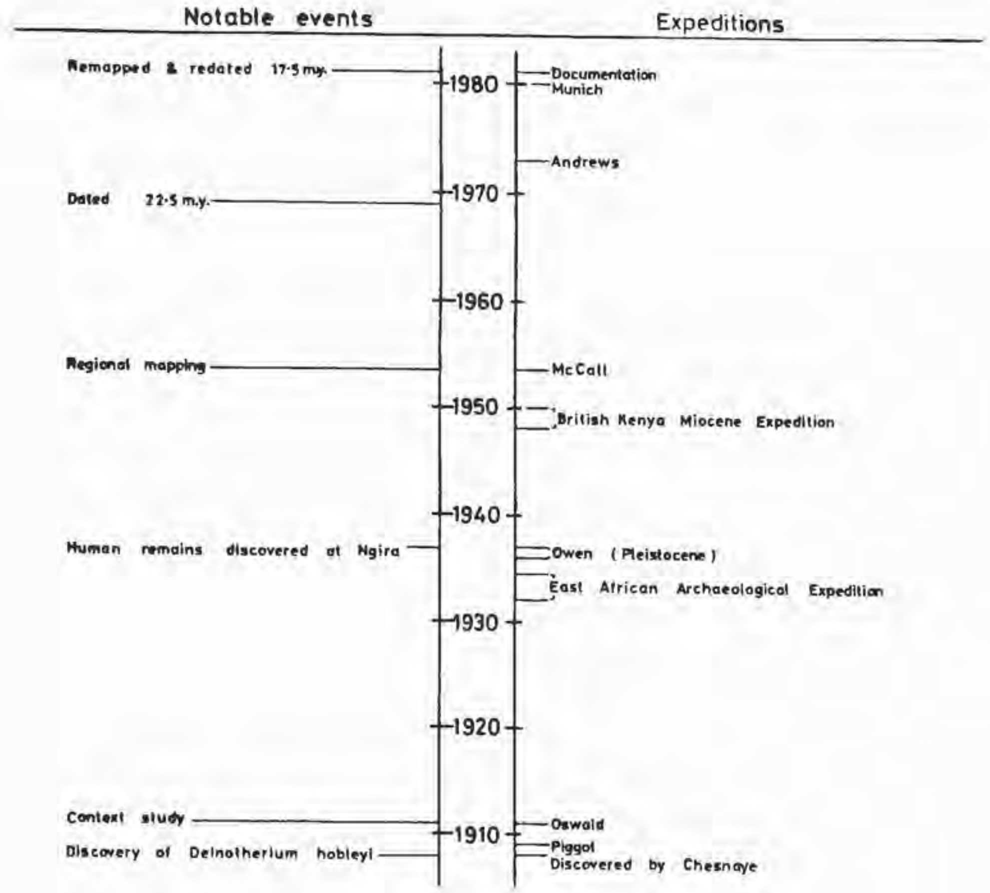


Fig. VI–1

Historical Chart: Karungu

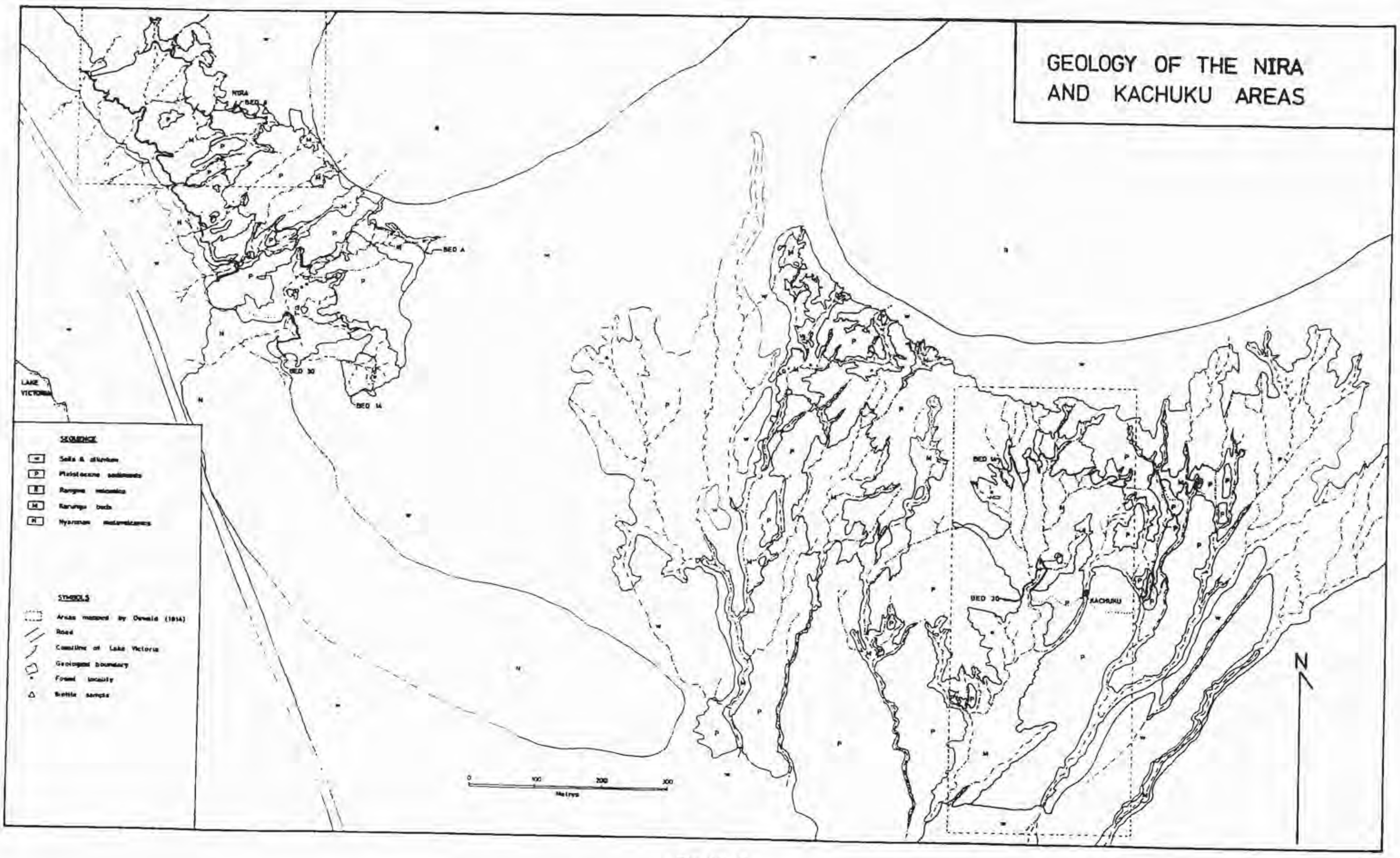


Fig. VI–2
Geology of the Nira and Kachuku Areas

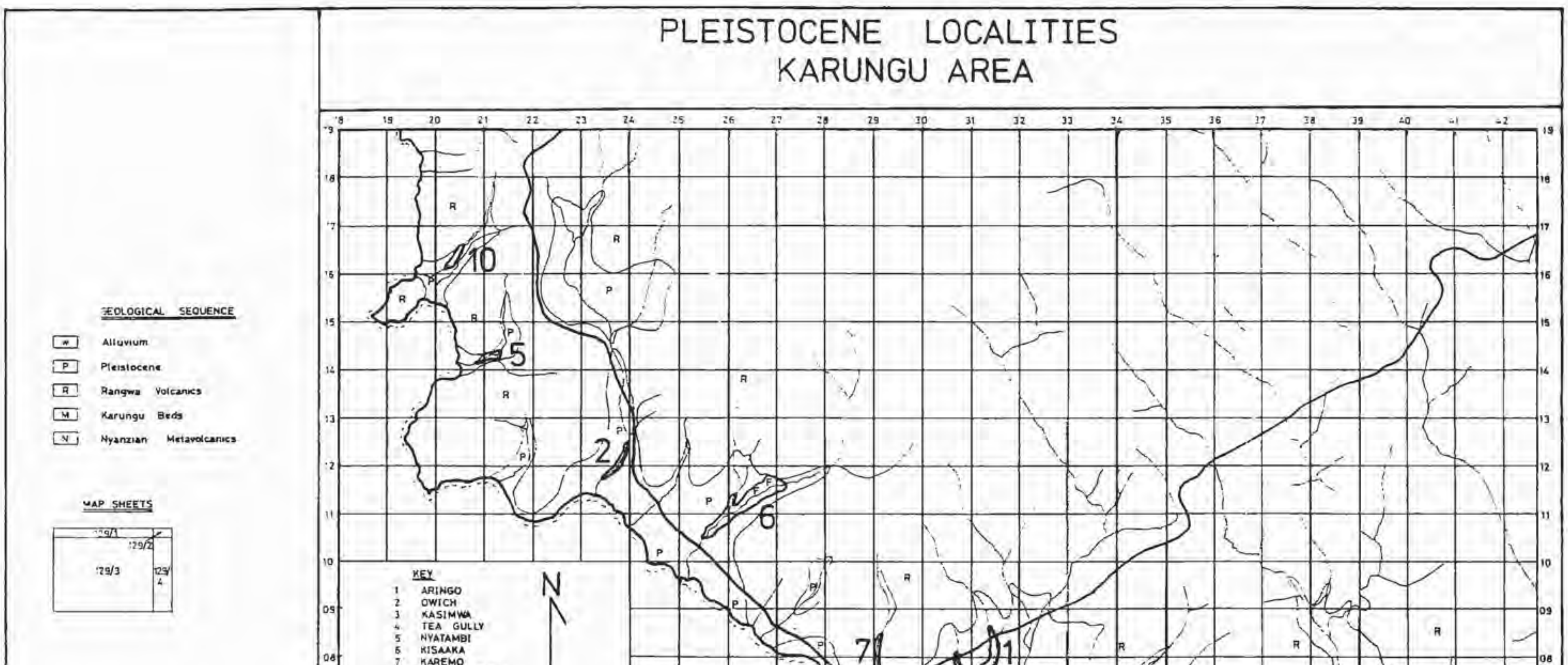


Fig. VI–3
Pleistocene localities: Karungu Area

VERTEBRATE FAUNAL LIST KARUNGU FORMATION	Nira and Kachuku	Nyagwena	Nifare
Clariidae	■		
Lates karungae	■		
Protopterus	■		
Ophidea	■		
Varanidae	■		
Crocodylus	■	■	
Euthecodon	■		
Cycloderma victoriae	■		
Trionyx	■	■	■
Pelomedusidae	■	■	■
Testudo crassa	■		
Erinaceidae	■		
Myohyrax oswaldi	■		
Proconsul nyanzae	■		
Dendropithecus macinnesi	■		
Kenyalagomys	■		
Diamantomys leuderitzi	■		
Paraphiomys pigotti	■		
Paraphiomys stromeri	■		
Anasinopa leakeyi	■		
Metapterodon sp.	■		
Large creodont	■		
Pseudaelurus africanus	■		
Kichechia-sized carnivore	■		
Orycteropus africanus	■		
Prodeinotherium hobleyi	■		
Archaeobelodon	■		
Megalohyrax championi	■		
?Meroehyrax bateae	■		
Rhinocerotidae	■	■	
Dicerorhinus leakeyi	■		
Aceratherium acutirostratum	■		
Brachypotherium heinzelini	■		
Brachyodus aequatorialis	■	■	
Hyoboops africanus	■		
Diamantohyus africanus	■		
Kenyasus rusingensis	■		
Libycochoerus jeanelli	■		
Dorcatherium parvum	■		
Dorcatherium chappuisi	■		
Propalaeoryx nyanzae	■		
?Canthumeryx sirtensis	■		
Walangania africanus	■		

Fig. VI–5

Vertebrate faunal list: Karungu Formation

INVERTEBRATE FAUNAL LIST KARUNGU FORMATION	Nira and Kachuku	Nyagwena
Insect Cocoons	■	■
Etheria elliptica	■	
Lanistes carinatus	■	■
Pila ovata	■	
Ligatella miocenica	■	■
Cerastua sp.	■	■
Maizania sp.	■	
Limicolaria sp.	■	■
Burtoa nilotica	■	
Homorus sp.	■	
Thapsia sp.	■	
?Zingis sp.	■	
Urocyclidae	■	
Edentulina sp.	■	
Edouardia sp.	■	
Cleopatra exarata	■	
Potamidae	■	
Myriapoda	■	

Fig. VI–4

Invertebrate faunal list: Karungu Formation

FAUNAL LIST KARUNGU PLEISTOCENE SITES	Aringo	Kasimwe	Kisaaka	Ngira	Obware	Onge
Melanoides		■				
Bellamya		■				■
Mutela		■				
Corbicula		■				
Achatina			■	■		
Limicolaria			■	■	■	
Urocyclid slugs				■		
Homorus					■	
Biomphalaria					■	
Pila ovata					■	
Bulinus					■	
Pisces			■			
Struthio			■		■	
Loxodonta		■	■			■
Cercopithecoidea						■
Homo sapiens				■		■
Tachyoryctes splendens			■	■	■	■
Equus	■	■	■	■		
Hippopotamus amphibius				■	■	■
Phacochoerus aethiopicus		■		■	■	■
Potamochoerus porcus					■	
Redunca			■	■		
Syncerus				■	■	
Small bovid	■	■	■	■	■	■
Medium bovid	■	■	■	■	■	■
Large bovid	■	■	■		■	■
Gazella	■					

Fig. VI–6

Faunal List: Karungu Pleistocene Sites

CHAPTER 7

AREA VI

GWASI-HOMA BAY AREA

History

Fossils were first found in the Kisingiri volcanic area at Rusinga in 1908 (Maufe) and in 1909 (Oswald, 1914) at Karungu. Fossils were recorded much later from the Gwasi Peninsula proper (Kent, 1944; McCall, 1958). Despite the detailed mapping of Le Bas *et al.*, (1977) no additional fossil mammal sites were found, although many wood–bearing deposits were identified. In 1983, the author made a survey of the Gwasi area with the aim of locating additional fossil–bearing deposits. There are now eight sites known to occur in the region, but none approaches in richness the well–known sites at Rusinga, Mfwangano and Karungu.

Geological Map

The geological map is a simplified version of McCall's (1958) survey, with additional data from Le Bas (1977) and the author's own observations. In general, rock exposures are not good, being obscured by vegetation and scree or soil, but enough is visible to provide a general idea of the sequence of depositional events.

Stratigraphy

The Tertiary rocks of the Gwasi area lie on or intrude PreCambrian rocks of the Nyanzian and Kavirondian Systems (McCall, 1958). The Sediments at Ikoro, Kanyamwia, Goyo and Ragwe are intercalated between nephelinite agglomerates and are generally overlain by nephelinite lavas and agglomerates. They are therefore higher in the succession than the Karungu Formation which lies between PreCambrian rocks below and nephelinite agglomerates above; and their position is analogous to that of the Hiwegi and Kulu Formations on Rusinga.

In reaching this conclusion, I differ from McCall (1958) who thought the sediments at Kanyamwia and Goyo were direct equivalents of the Karungu sequence.

It now seems that after initial volcanic activity at the Rangwa Centre, there was a period of volcanic quiescence accompanied by erosion, now known to be represented on all sides of the Rangwa Cone. As sediments were stripped from the edifice of the cone, they were transported radially away from it and deposited on the lower slopes and in the arena. A renewal of volcanic activity represented by the Kiangata Agglomerate resulted in the burial of this system under a thick blanket of nephelinite agglomerates and lavas.

Sedimentary outliers on the Wasaki Peninsula are more difficult to correlate with the main Gwasi sequence since they are so far removed from it, but the overall lithology of the strata and the nephelinitic lavas overlying them suggest a tentative correlation with part of the Gwasi sequence.

A long period of erosion followed, during which the Rangwa Volcano was deeply incised to more or less its present day configuration. In the late Pleistocene, Lake Victoria came into existence, which led to the drowning of the lower slopes of the incised Gwasi highlands, with the result that sediments accumulated in valleys which radiate outwards from the centre. At about the same time, Lambwe Valley was formed by tectonic activity with the result that great thicknesses of sediment accumulated in the downthrown wedge, now represented by the Lambwe alluvial plain. Whether the Lambwe system was ever controlled by the Lake Victoria base level is an arguable point, and Pickford (1982) suggests that it may have behaved as an entirely separate entity, its base level being controlled by an outlet some metres higher than the highest level recorded for Lake Victoria.

The sediments back–filling many of the radial valleys which drain into Lake Victoria, on the northern and western shores of the Gwasi Peninsula, occur at altitudes up to 140 metres above present day lake level (a.l.l.). Despite this, they seem to have been graded to a base level some 50 to 60 ft. (15–19 metres) a.l.l. and therefore probably accord in age with well exposed strandlines and other lake level indicators to the north and south of Gwasi (Temple, 1964; Kendall, 1969).

At many points along the shore northwards from Karungu, there are exposures of tuffs, clays, silts and gravels lying unconformably on a variety of Miocene and PreCambrian rocks. Two tuffaceous horizons outcrop in many of the gullies as far north as God Bura, and the clays intercalated between the tuffs often yield artefactual flakes of Levallois typology and a diverse fauna including remains of *Homo*.

Latest Pleistocene to Holocene sediments occur in many places along the shores of the Gwasi Peninsula, and in some places concentrations of fossil molluscs are found, as for example at Kikubi. Former strandline features represented in the Gwasi area provide a fertile field for future research.

Radioisotopic Dating

A number of radioisotopic samples from the Gwasi area has been analysed (Le Bas, 1977). Drake *et al.* (in prep.) discuss the hazards of obtaining KAr dates from biotite crystals collected from carbonatite/nephelinite suites. It seems that potassium is preferentially leached from biotite, possibly as part of a »fenitization« phenomenon, leaving samples relatively enriched in argon. Such crystals tend to yield dates which are too old. A relatively simple regression line relates K content to dates obtained so that the less K in a biotite crystal the greater its apparent age. If the K content is about 7% the apparent age approximates the actual age. Samples of biotite with only 2% K in contrast, yield apparent ages up to 10% too old (e.g. the difference between 19 m.y. and 17.5 m.y.). These findings should be kept in mind when examining the published dates.

Biostratigraphy

Miocene Sites

The biostratigraphic position of the Gwasi Miocene fossil localities is difficult to assess since few diagnostic fossils have been found (fig. VII–1). If it were not for their relationships to Miocene agglomerates and lavas, the position of the strata would present great problems.

At Simenya, near Homa Bay, a gastropod fauna with *Cerastua miocenica* recalls that of Rusinga, but the evidence is not clear cut. At Nyenga, a suid tooth which might represent *Kenyasus rusingensis* was seen, which might indicate Faunal Set II affinities (Pickford, 1981). Otherwise little can be said in the present state of our knowledge.

The Pleistocene Sites

The Pleistocene to Holocene valley fill sediments contain an essentially modern fauna (fig. VII–2) and artefacts of Levallois typology. They are therefore probably late Pleistocene in age, but a more precise estimate is not yet possible.

The bulk of fossils and artefacts comes from clays intercalated between two prominent horizons of volcanic ash which provide most useful marker horizons outcropping from Kachuku in the south to at least as far north as God Bura, a distance of 20 km. In the absence of these airfall tuffs, it would be virtually impossible to arrive at convincing fine scale correlations between valley fill deposits which are not physically connected to one another.

Unconformably above the clays with tuffs comes a series of deposits of latest Pleistocene to Recent age including alluvial and littoral sediments. These often contain fossil to sub-fossil remains of molluscs and mammals, and some shell mounds are known, e.g. at Nira which yield human remains with Late Stone Age artefacts.

MIOCENE FOSSIL SITES OF GWASI PENINSULA

Site Designation	Map Reference	Source
Nyenga	231223	
Nyabkuro	227193	
Kanyamwia	493288	McCall, 1958
Goyo	519333	McCall, 1958
Simenya	633432	
Ragwe	207365	
Petokiri	547365	
Mirunda	506463	McCall, 1958
Nyangoma	?36517	Kent, 1944

Table VII–1

Miocene fossil sites of Gwasi Peninsula

PLEISTOCENE FOSSIL SITES OF GWASI PENINSULA

Site Designation	Map Reference	Source
Kasigunga	328468	
Kaksingiri	303429	
Rongo	183221	
Kikubi (upper)	183216	
Kikubi (lower)	184217	
God Bura	202194	
Ikoro	227202	
Akijo	5822	Kitson, 1934

Table VII–2

Pleistocene sites of Gwasi Peninsula

DISTRIBUTION OF FOSSILS; MIOCENE BEDS OF THE GWASI PENINSULA	Kaniamwia	Nyenga	Goyo	Simenya	Petokiri	Mirunda	Ragwe	Nyabkuro
Wood		■		■	■	■		■
Leaves		■						■
Fruit				■	■			
Insect cocoons	■	■		■				
Coleoptera				■				
Myriapoda	■			■				
Ligatella	■			■				
Lanistes				■				
Pila	■			■				
Limicolaria?				■				
Burtoa nilotica		■		■				
Subulinid	■			■				
Pseudoglessula				■				
Krapfiella				■				
Cerastua miocenica				■				
Cerastua? majus				■				
Trochozonites				■				
Urocyclidae slug				■				
Thapsia				■				
Pseudopeas?	■			■				
Crocodylus				■				
Chelonia				■				
Rodentia		■		■	■		■	■
Hominoidea				■				
Deinotheriidae				■				
Gomphotheriidae				■				
Rhinocerotidae				■				
Suidae		■						
Dorcatherium				■				
Pecora		■		■				■

Fig. VII–1

Distribution of fossils:
Miocene Beds of the Gwasi Peninsula

DISTRIBUTION OF FAUNAS IN THE PLEISTOCENE OF GWASI PENINSULA	Kikubi (upper)	Kikubi (lower)	Rongo	God Bura	Ikoro	Kasigunga	Kaksingiri
Melanoides tuberculata	■						
Corbicula africana	■						
Succinea				■			
Limicolaria			■	■	■	■	
Euonyma				■			
Subulinid		■					
Urocyclid slug			■				
Ophidea		■					
Struthio eggshell				■			
Tachyoryctes splendens			■	■			■
Lepus capensis		■	■				
Homo sapiens				■			
Loxodonta africana		■					
Ceratotherium simum				■			
Equus sp.		■	■	■	■		
Phacochoerus aethiopicus				■			
Hippopotamus amphibius		■					
Redunca sp.		■	■	■		■	
Alcelaphini				■			
Syncerus caffer			■	■	■		

Fig. VII–2

Distribution of Fauna
in the Pleistocene of Gwasi Peninsula

CHAPTER 8

AREA VII

MABOKO-OMBO AREA

History

During the early 1930's several fossiliferous localities were found in the Maboko–Ombo area by W.E. Owen (fig. VIII–1). Among these were the sites of Mariwa, Ombo, Bur Siala, Majiwa and Maboko Island. Owen sold most of his collection of fossils from these sites to the British Museum. D.G. MacInnes is known to have visited the area in the mid 1930's, probably during the East African Archaeological Expedition and made collections at Maboko and Majiwa. In addition L.S.B. Leakey sent a large collection of fossils from Ombo to the British Museum at about the same time.

P.E. Kent visited the area in 1934, and included Majiwa and Ombo in his 1944 publication. Little was done after the outbreak of war in 1939, until the British–Kenya Miocene Expedition of 1947–1956 which worked at the various sites as follows:

Maboko	1949	253 catalogue entries
	1951	32 catalogue entries
Ombo	1949	no catalogue compiled

Saggerson (1952) included these sites in his regional mapping report, and mentions a small collection of fossils he made at Ombo, which is now housed in the Geological Survey of Kenya.

In 1965, Bishop visited the area long enough to collect radioisotopic date samples from the phonolite which caps the sediments in the area, and to make a collection of 148 bones from Ombo.

In 1973, a team working out of Yale University excavated at Maboko, collecting more than 1400 fossils. They also made small collections at Majiwa and other sites in the area (Andrews *et al.*, 1981).

In 1979 to 1984, Pickford mapped all the sites in the area in detail and made collections at Maboko (geol. map VI in end folder), Ombo (fig. VIII–2), Majiwa (fig. VIII–3) and Kaloma (fig. VIII–4). Ombo was visited in 1981 with H. Schwartz in order to collect additional fish material. B. Mboya (1983) remapped the regional geology at 1:50,000, and showed that only one flow of phonolite occurred in the Maboko–Ombo area. To the east, in the neighbourhood of Kisumu this phonolite (the Ombo Phonolite) is overlain by a single flow of Kisumu Phonolite, (Mboya, 1983).

Geological Map

Saggerson (1952) produced the first regional geological survey of the Maboko–Ombo area. In its broad outlines the map is sufficiently accurate, but in detail the sediment and lava outcrops require revision. Mboya (1981, 1983) therefore remapped the area at 1:50,000 and Pickford mapped the fossil sites at an even greater scale.

Stratigraphy

The regional stratigraphy is simple. On a foundation of granite and metavolcanics of Nyanzian/Kavirondian age lies the Maboko Formation (figs VIII–5 to 7), a middle Miocene sedimentary deposit which is thickest towards the axis of the Nyanza Rift Valley (i.e. in the south) but thins out and becomes discontinuous on the shoulders of the rift in the north. Above the Maboko Formation comes the Ombo Phonolite, a widespread flow which came from the southeast across what is now the Nyanza Rift Valley. Not exposed in the Maboko area, but well developed in the Kisumu area is the extensive Kisumu Phonolite, which also came from the Kericho area in the southeast.

Above the phonolites comes a series of patchy late Pleistocene deposits. In a few places these have yielded »Middle Stone Age« artefacts (e.g. at Muguruk) and a modern fauna (e.g. at Kaloma, Majiwa and Maboko). The most recent deposits in the area contain »Late Stone Age« implements but few fossils, except in rockshelters (e.g. Nyarindi).

Biostratigraphy

Although the Maboko deposits were traditionally included in »the lower Miocene« it has become increasingly obvious over the years that the fauna from the area is substantially different from those obtained at Rusinga and Songhor (fig. VIII–8).

Hopwood (1948) was the first to document the presence of middle Miocene (Helvetian) forms at Maboko. More recently Pickford (1981) analysed the entire faunal assemblage from Maboko, Kaloma, Majiwa and Ombo (figs VIII–9 to 10) and concluded that it was early middle Miocene in age, earlier than Fort Ternan, but appreciable later than Rusinga. He placed it in Faunal Set III, tentatively dated about 15 to 16 m.y. old.

The Pleistocene deposits contain an essentially modern fauna (fig. VIII–11), and are therefore likely to be late Pleistocene in age. The deposits on Maboko Island lie some ten metres above present lake level, which possibly correlates with the second stage in downcutting of the Lake Victoria outlet at Jinja (Kendall, 1969). The association of fossils with »Middle Stone Age« artefacts in several places around the edge of the Winam Gulf is of interest to archaeologists, but the Ombo–Maboko area seems not to be of great potential in this respect.

MIOCENE FOSSIL LOCALITIES OF THE MABOKO-OMBO AREA

Site Designation	# of Fossils	Map Reference	Source
Maboko Main	3000+	788824	Owen, 1939
Maboko West		788826	
Maboko West 2.		788826	
Maboko North		787826	
Maboko Southwest		787824	
Maboko South		788823	
Maboko Southeast		788822	
Maboko far South		790820	
Maboko Cliffs		790825	
Maboko East		794825	
Maboko Urocyclid Site		792825	
Majiwa	510	784838-788842	Kent, 1944
Kaloma	490	787850	Saggerson, 1952
Uchuwegwe	2	764856	
Bur Siala	1	752920	Owen, m/s
Ombo	1000+	740927	Owen, m/s
Mariwa	3	727947	Owen, m/s

Table VIII–1

Miocene fossil localities of the Maboko–Ombo Area

PLEISTOCENE FOSSIL SITES OF THE MABOKO-OMBO AREA

Site Designation	# of Fossils	Map Reference
Maboko	15	791824
Kaloma	2	784838
Majiwa	2	787850

Table VIII–2

Pleistocene fossil sites of the Maboko–Ombo Area

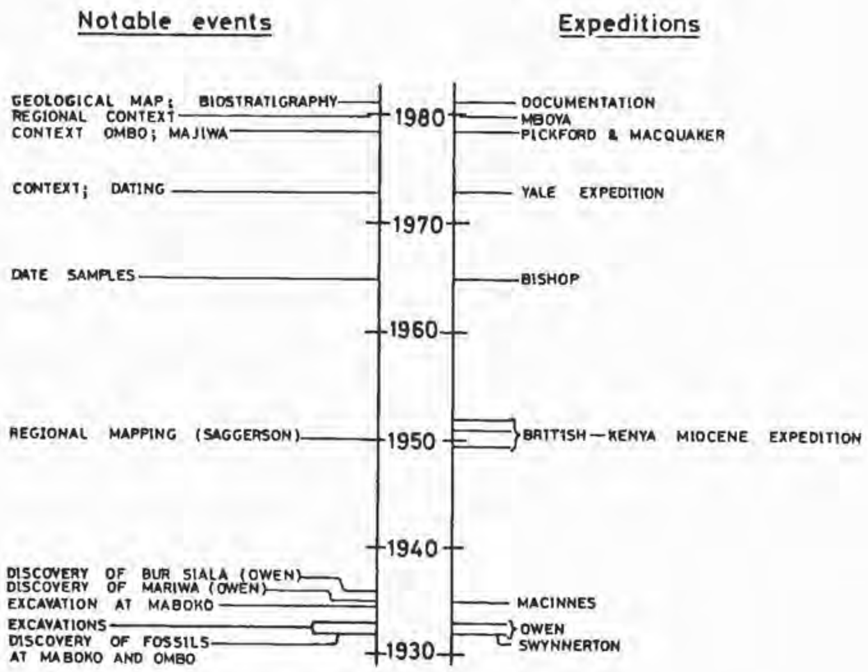


Fig. VIII–1

Historical Chart: Maboko Formation

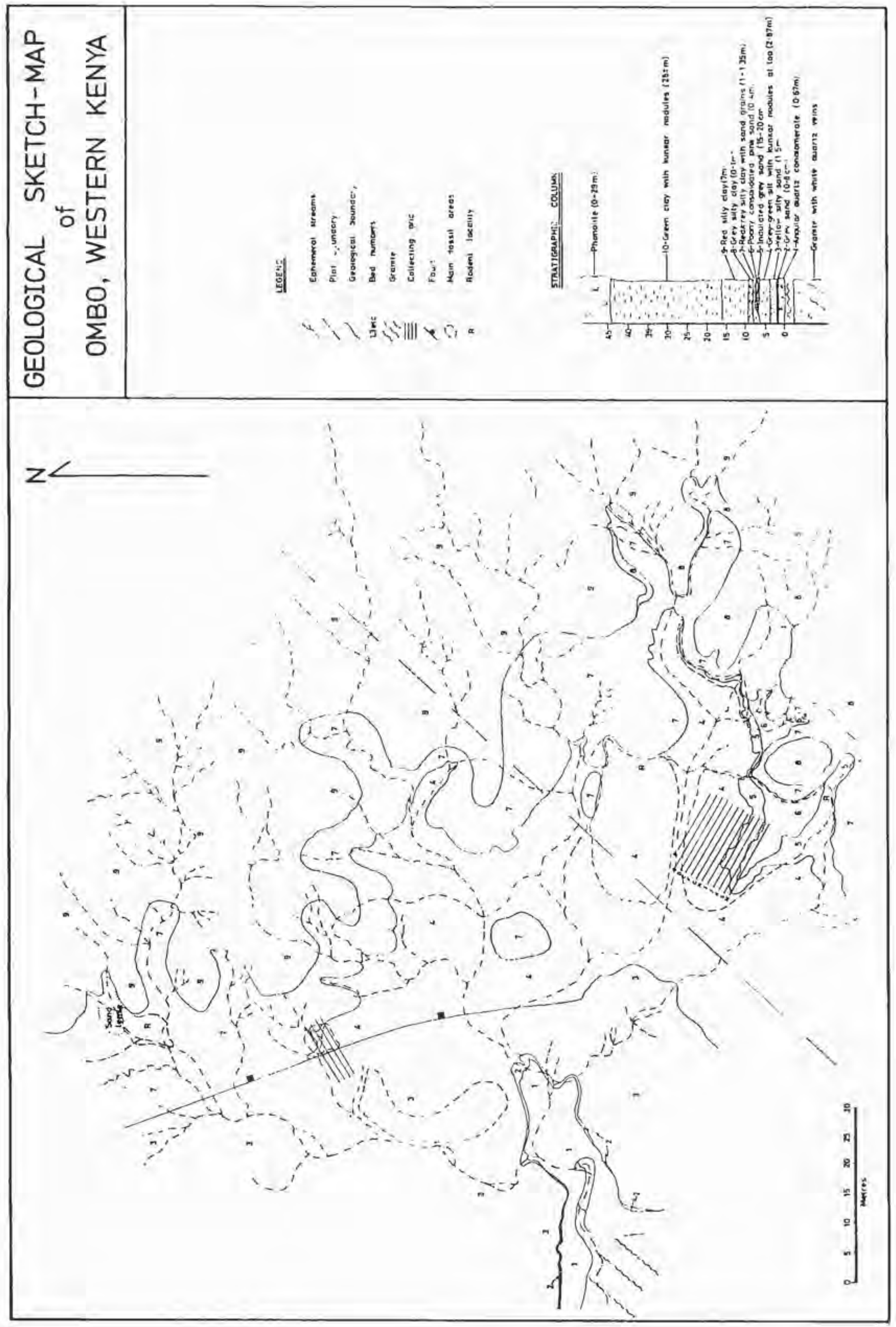


Fig. VIII–2

Geological sketch map of Ombo, Western Kenya

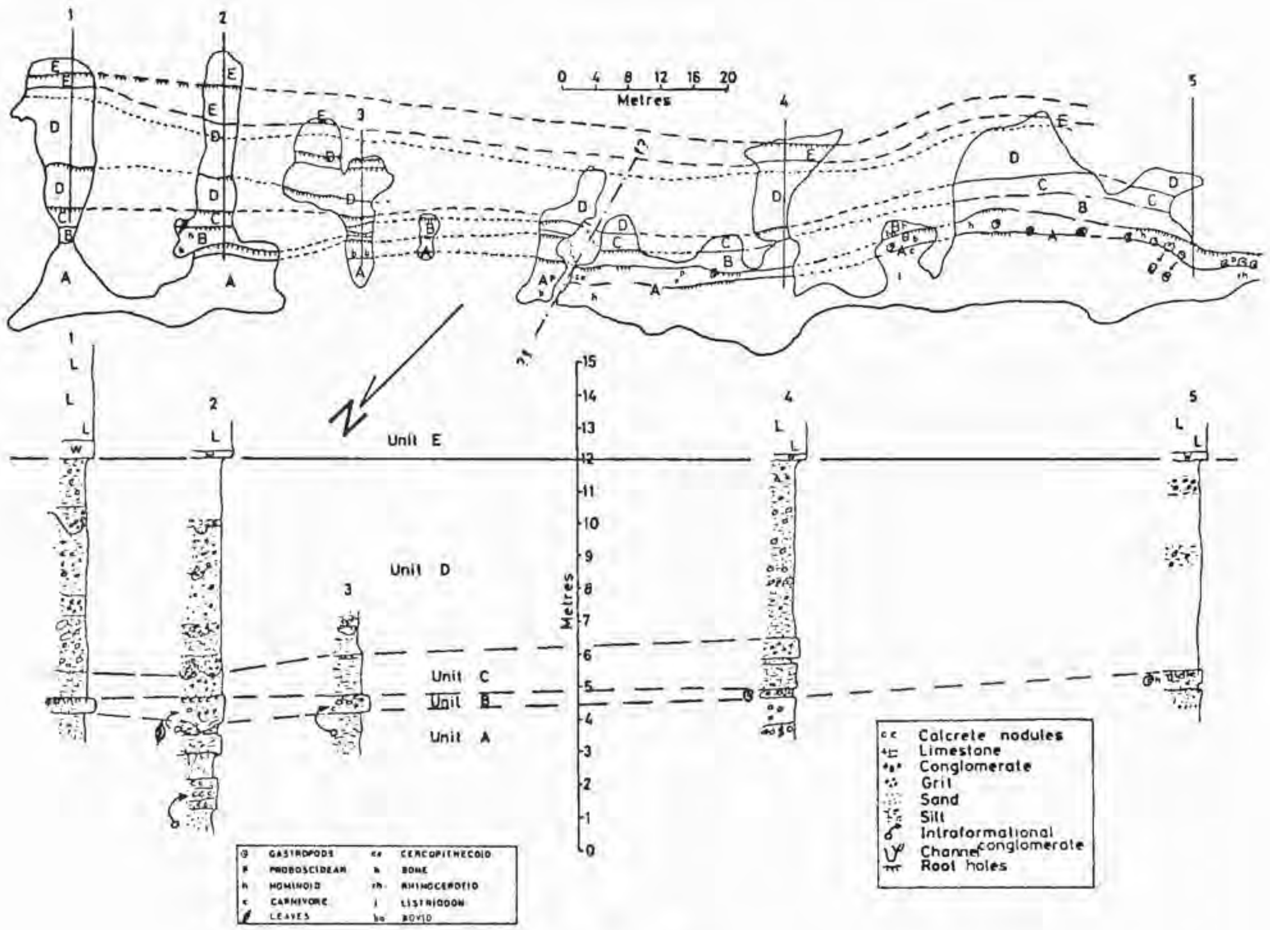


Fig. VIII–3

The Geology of Majiwa Bluff

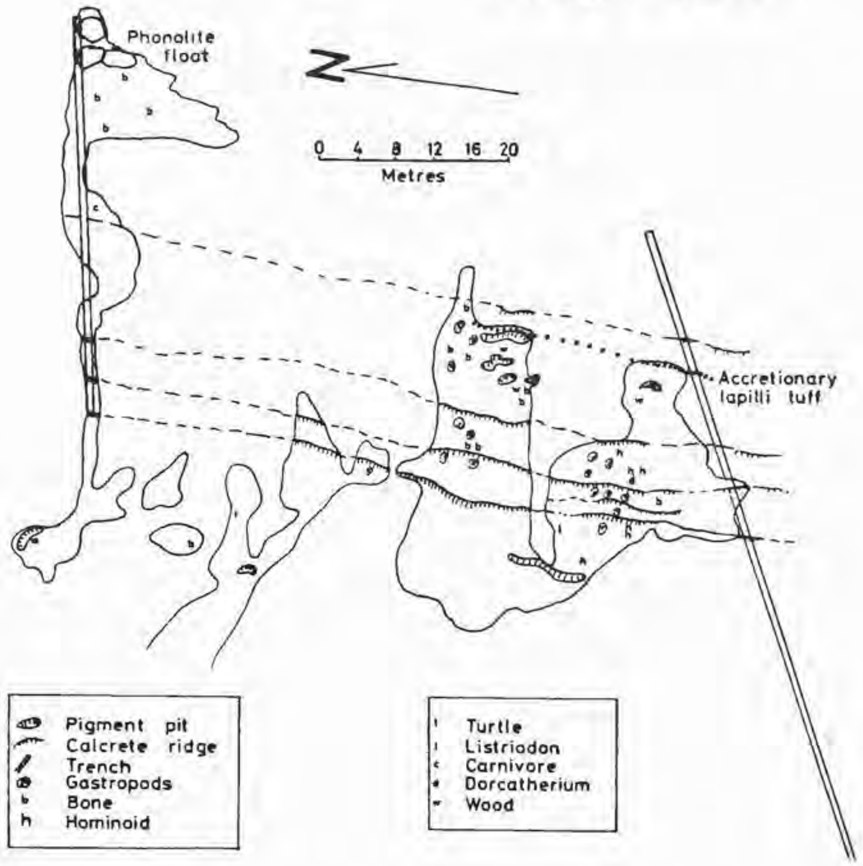


Fig. VIII–4

The Geology of Kaloma

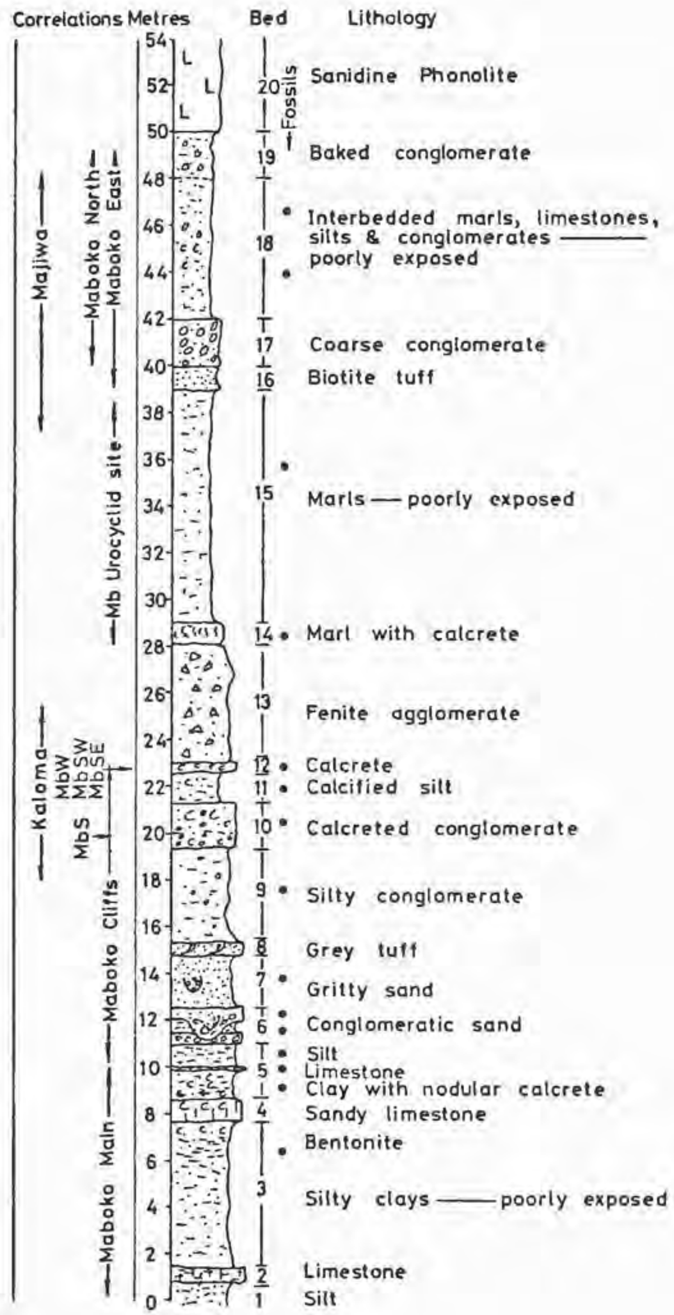


Fig. VIII–5

The geologic sequence at Maboko Island

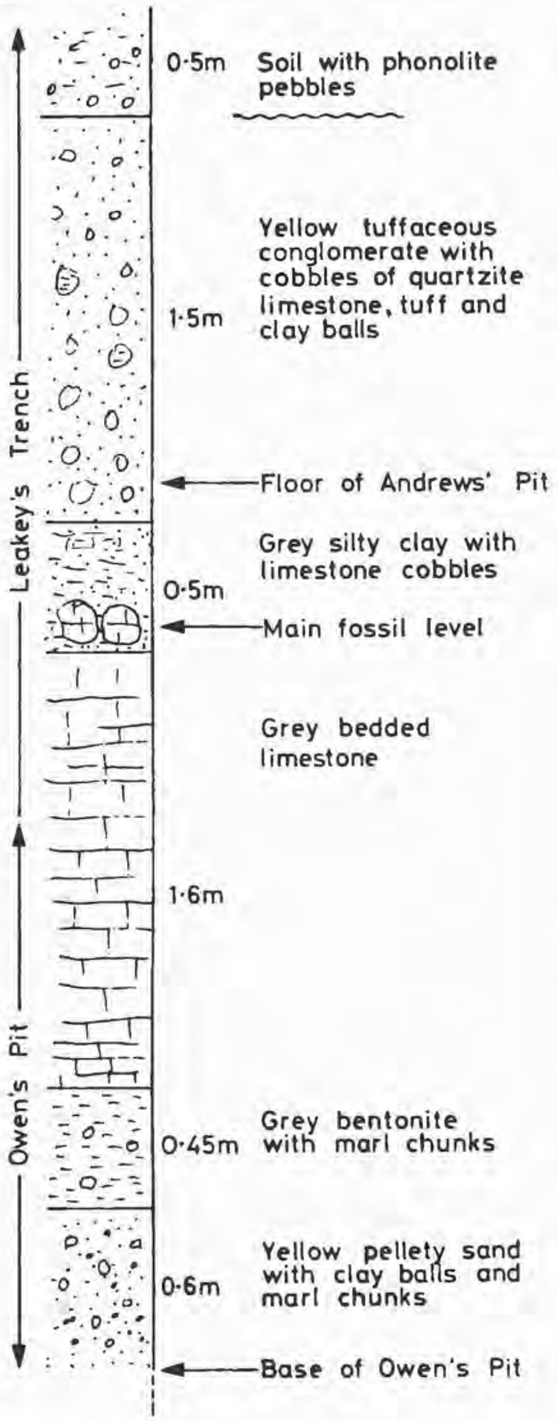


Fig. VIII–6

Stratigraphy of Leakey's Trench: Maboko

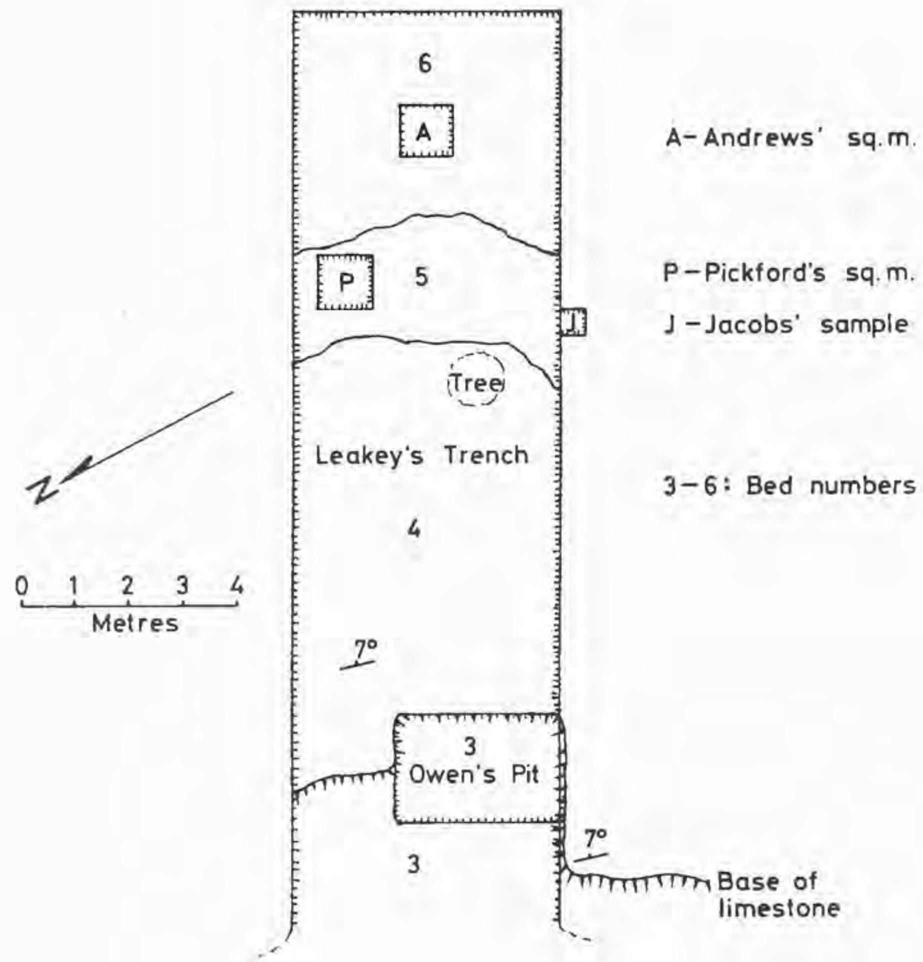


Fig. VIII–7

Leakey's Trench – Maboko: 1984

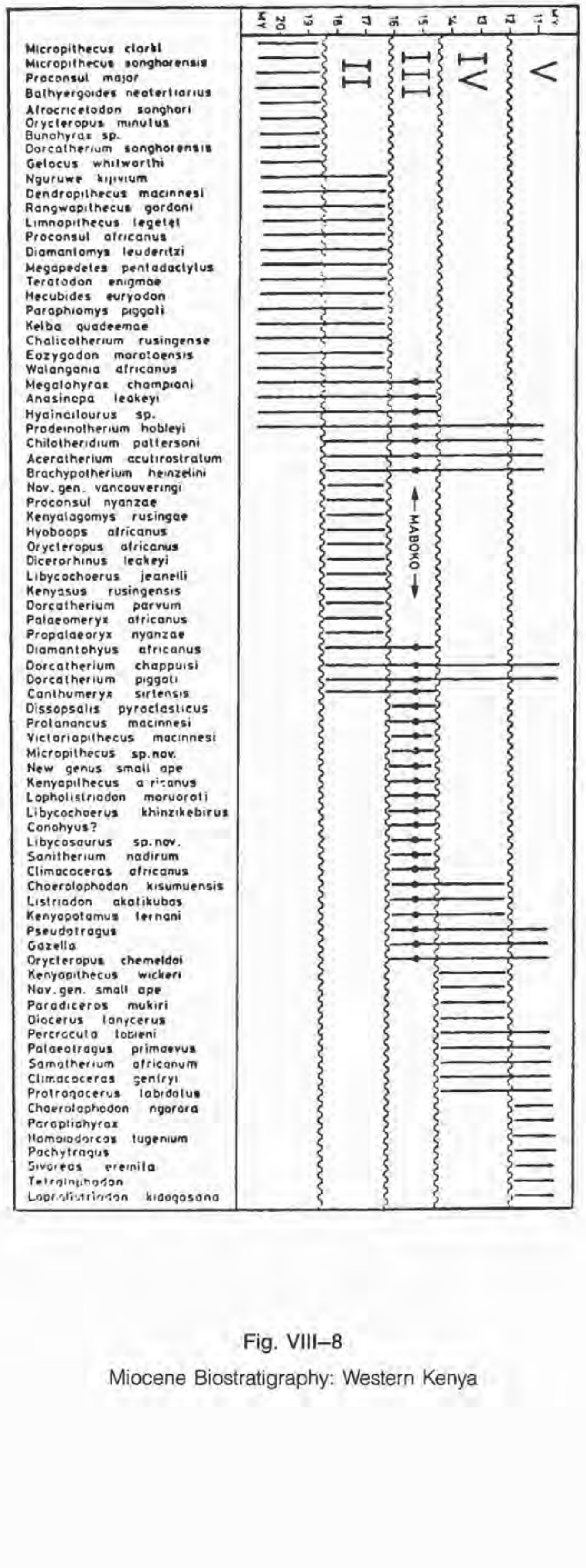


Fig. VIII–8

Miocene Biostratigraphy: Western Kenya

NON-MOLLUSCAN FAUNA OF THE MABOKO FORMATION

	Maboko	Majiwa	Kaloma	Uchuegwa	Bur Siala	Ombo	Mariwa
Insect cocoons	■	■					
Millipedes	■	■					
Apidae	■						
Blattidae	■						
Potamidae						■	
Amphibia	■					■	
Gymnarchus						■	
Clarias						■	
Protopterus	■					■	
Polypterus	■					■	
?Hydrocyon	■						
Crocodylus	■	■				■	
Euthecodon	■					■	
Ophidea	■	■				■	
Varanidae	■					■	
Pelomedusidae	■	■		■		■	
Trionychidae	■	■		■		■	
Ciconia	■						
Chlamydotis undulatus	■						
Ardeidae	■						
Phasianidae	■						
Burhinidae	■						
Bucerotidae	■						
Insectivora	■						
Chiroptera	■						
Victoriapithecus macinnesi	■	■			■		
Victoriapithecus leakeyi	■						■
Micropithecus	■	■					
?Limnopithecus legetet	■						
Nyanzapithecus pickfordi	■						
Kenyapithecus africanus	■	■					
Paraphiomys	■					■	
Pedetidae	■					■	
Small rodent	■	■				■	
Dissopsalis pyroclasticus	■						
Anasinopa leakeyi	■						
Hyaenodon andrewsi	■					■	
Hyainailourus nyanzae	■					■	
Amphicyonidae	■						
Felidae	■						
Orycteropus chemeldoi	■						
Prodeinotherium hobleyi	■	■	■			■	■
Protanancus macinnesi	■	■	■			■	
Choerolophodon kisumuensis	■	■					
?Primelephas		■			■		
Megalohyrax championi	■						
Aceratherium acutirostratum	■	■				■	
Dicerorhinus leakeyi	■					■	■
Chilotheridium pattersoni	■	■	■			■	
Brachypotherium heinzelini	■						
Anthracothere sp. nov.						■	
Diamantohyus africanus	■	■					
Sanitherium nadirum						■	
Libycochoerus khinzikebirus	■	■	■				
Listriodon akatikubas	■	■	■				
Lopholistriodon moruoroti	■	■					
?Conohyus	■						
Kenyapotamus sp.	■						
Dorcatherium large cf. chappuisi	■	■	■			■	
Dorcatherium medium cf. piggoti	■	■					
Climacoceras africanus	■	■	■				
Nyanzameryx pickfordi	■						
Canthumeryx sirtensis	■					■	
Walangania africanus						■	
Bovidae	■	■					

Fig. VIII–9

Non–Molluscan Fauna of the Maboko Formation

MOLLUSCAN FAUNAS OF THE MABOKO FORMATION

	Maboko	Majiwa	Kaloma	Ombo	Mariwa
Ligatella	■		■		
Melanoides tuberculata	■				
Pila ovata	■	■	■	■	
Lanistes carinatus				■	■
Lanistes purpureus	■				
Lymnaea	■				
Succinea			■		
Pupoides	■		■		
Edouardia			■		
Rhachistia aff. rhodotaenia	■	■	■		
Pseudoglessula			■		
Opeas	■				
Subulinidae aff. Homorus	■	■	■		
Nothapalinus	■				
Achatina	■				
Burtoa	■	■	■		
Limicolaria	■	■	■		
Urocyclid slugs	■		■		
Trochozonites			■		
Trochonanina		■	■		
Zingis	■	■	■		
Thapsia	■				
Gonaxis (Pseudogonaxis)			■		
Edentulina		■			
Ptychotrema	■				
Gulella small	■		■		
Etheria elliptica	■				

Fig. VIII–10

Molluscan Faunas of the Maboko Formation

FAUNAL LIST PLEISTOCENE SITES MABOKO-OMBO AREA

	Maboko	Majiwa	Kaloma
Corbicula africana	■		
Melanoides tuberculata	■		
Haizania elatior	■		■
Clariidae	■		
Protopterus	■	■	
Potamochoerus porcus			■
Hippopotamus amphibius	■	■	

Fig. VIII–11

Faunal list: Pleistocene sites – Maboko–Ombo Area

CHAPTER 9

AREA VIII

THE SONDU-KERICHO-MUHORONI AREA

History

Sediments now assigned to the Nyakach Formation were first noted by Wayland (1931) who provided a diagrammatic section of the scarp which separates the Kabondo Plateau (Nyabondo) from the Nyakach flats. However, Wayland illustrated two lavas in his section, separated by tuff, whereas in fact there is no basal lava. He presumably sampled one of the slipped masses which are common along the scarp of the plateau. The next geologist to visit the area was Shackleton (1951) who stated »still farther west is the Sondu outlier ... It was clearly once part of the main Lumbwa phonolite sheets and has been separated by erosion. It rests on stratified fine–grained tuffs, one bed of which is white and apparently trachytic, and may belong to a group of trachytic volcanic rocks found by Wayland a little further west (Wayland 1931, p. 10).« He continues »the stratified beds under the phonolites appear, moreover, to be waterlain and are probably lacustrine«.

Soon afterwards, Saggerson (1952) mapped part of the Nyakach Formation as Nyakach gravels but he considered them to be middle Pleistocene in age and unfossiliferous. Both their fossil content and their position below the Nyabondo Phonolite flow indicate a middle Miocene age for these and other patches of sediments to the northeast.

Binge (1962) recorded the outcrops of Nyakach Formation at Kibogat (now known as Cherwa) as »a bed of tuff, ... highly calcitised and containing fossil wood«. He correctly referred them to the same general group of strata earlier recognised by Shackleton. However, some important outcrops of this formation at Koimoroon and Kaimogool were mapped by Binge as Pleistocene, who further claimed that Wayland (1931, p. 9) had found artefacts therein. However, abundant fossils from both exposures indicate a middle Miocene age for the deposit. There are however, artefacts in the same general area, eroding out of black cotton soils, which are widespread.

Little interest was shown in the sediments even after Mr. Da Silva, a prospector, had found Miocene fossils at Chepetet and Mirogo (Van Couvering, unpub. rept. 1971) since they appeared to be poorly fossiliferous. Van Couvering rightly recognised that some of the areas were middle Miocene in age.

In 1981, the author studied the Nyakach area, finding a further 19 fossiliferous sites while mapping the formation at a scale of 1:50,000.

Geological Map

Published geological maps of the Nyakach area (Shackleton, 1951; Binge, 1962; Saggerson, 1952) provide a reasonable assessment of the regional geology, although a number of errors was made concerning tectonic style and distribution of sediments. The map accompanying this report was made by the author in 1981 on aerial photographs at a scale of 1:12,500 and reduced to 1:50,000 for reproduction. It is contiguous with maps of the Fort Ternan area and the Songhor–Koru–Muhoroni area to the southeast and east respectively.

Stratigraphy

The regional stratigraphy is simple. On an eroded surface of Nyanzian Metavolcanics and intrusives occurs the mid–Miocene Nyakach Formation. Overlying this is a variety of phonolite and trachyphonolite lavas. Above these comes a series of late Pleistocene to Recent sediments, especially in the Kano Plains to the north.

In detail however, the stratigraphy of the Nyakach Formation is complex, since it accumulated in a floodplain setting. Lateral discontinuities in rock units are the rule rather than the exception in this formation, but a white tuff, represented in most sections, (fig. IX–1) is a useful marker horizon.

In the middle Miocene the Plateau Phonolites covered a huge area in Western Kenya, completely burying the Nyakach Formation as well as the Maboko Formation on the opposite northern flanks of the Nyanza Rift Valley. There are strong reasons for correlating the Nyakach and Maboko Formations, not only on the basis of lithostratigraphy, but also on faunal grounds.

There are sediment patches within the Plateau Phonolites, at Soliat and Fort Ternan.

Unconformably overlying the Plateau Phonolites and associated rocks, are late Pleistocene and Recent sediments. The former vary tremendously in thickness depending on the local depositional setting, but they are almost always associated with two or more tuffaceous horizons, known as the Nyando ashes. These or very similar ashes have been traced from the Kipchorion Gorge near Fort Ternan, to Muhoroni, Songhor, Chemelil, Simbi, Kapsarok, Ndori, along the southern flank of the Winam Gulf to Bala, thence to Kaksingiri and Karungu. They almost invariably seem to have accumulated as airfall tuffs, although some reworking is evident in places (e.g. Kipchorion Gorge).

Biostratigraphy

The following localities have been found in the Nyakach Area. All were found by Pickford in 1981 unless stated otherwise.

MIOCENE FOSSIL SITES IN THE NYAKACH AREA

Site Designation	# of Fossils	Map Reference	Source
Kadianga West	77	126600	Saggerson, 1952
Kadianga East	9	133598	
Koimoroon 1	4	252600	
Koimoroon 2	4	253599	
Koimoroon 3	1	254601	
Koimoroon 4	1	254599	
Koimoroon 5	4	247596	
Kaimogool S	155	257594	Binge, 1962
Kaimogool N	84	258598	
Kaimogool E	20	256596	
Chepetet W	13	257612	
Chepetet E	3	261613	Van Couvering, ms.
Kaplelatet	9	265633	
Ewaret	10	278643	Van Couvering, ms.
Cherwa	28	263657	Binge, 1962
Mirogo	2	353620	
Pundo	27	222623	
Aiyoo East	7	214633	
Aiyoo West	6	211632	
Ramogi	2	179622	
Koiyabi S	4	459770	Binge, 1962
Koiyabi N	3	462773	Binge, 1962
Soliat	3	362642	

Table IX–1

Miocene fossil sites in the Nyakach Area

The fauna from the Nyakach Formation is most similar to that of Maboko, especially the suids, ruminants and choerolophodont proboscideans (fig. IX–2). I therefore place it in Faunal Set III (Pickford 1981). It is very satisfying to have found this fauna in mappable superposition to Fort Ternan which can be shown to be younger on purely lithostratigraphic grounds. Pickford (1981) placed Fort Ternan in Faunal Set IV on faunal evidence, and this placement now seems fully justified on stratigraphic grounds as well.

Pleistocene fossil localities

Much of the Nyakach area Pleistocene strata is hidden under Recent alluvium and black cotton soils. A few gullies are deep enough to expose the Pleistocene strata. All of these areas contain abundant Middle Stone Age implements as well as fossils belonging to extant taxa (fig. IX–3). Their close resemblance to sites elsewhere in the Nyanza area prompts me to correlate them all with the late middle Pleistocene or late Pleistocene.

PLEISTOCENE FOSSIL SITES IN THE NYAKACH AREA

	Site Designation	Map Reference	Source
1.	Kapsarok	295688	Binge, 1962
2.	Kapsomboch	298652	
3.	Ndori	244665	
4.	Simbi	333722	
5.	Ewaret (Pleistocene)	266648	

Table IX–2

Pleistocene fossil sites in the Nyakach Area

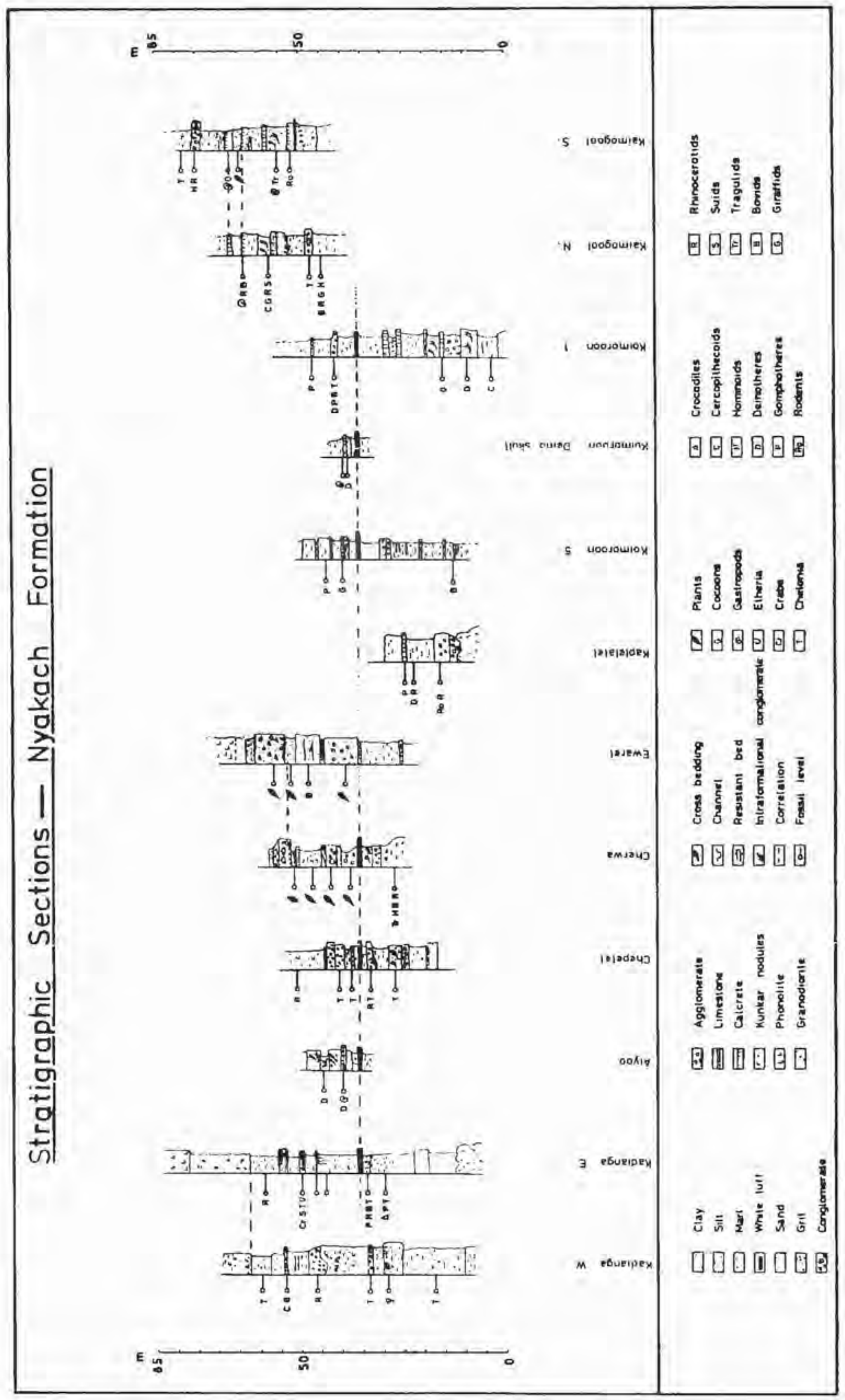


Fig. IX–1

Stratigraphic Sections: Nyakach Formation

FAUNAL LIST NYAKACH FORMATION	Kadianga W	Kadianga E	Koimoroon 1	Koimoroon 2	Koimoroon 3	Koimoroon 4	Kaimogool S	Kaimogool N	Kaimogool E	Chepetet W	Chepetet E	Kaplelatet	Ewaret	Cherwa	Nirogo	Pundo	Aiyoo E	Aiyoo W	Ramogi	Koiyabi
Plants							■				■		■				■			
Insect cocoons	■		■				■	■		■		■					■			
Potamidae		■						■		■										
Myriapods							■													
Mollusc opercula							■	■						■						
Etheria elliptica		■						■												
Lanistes carinatus	■																			
Pila ovata	■						■	■		■							■			
Melanoides tuberculata	■																			
Limicolaria							■	■	■									■		
Burtoa							■											■		
Edentulina							■													
Homorus							■													
Maizania							■													
Edouardia							■													
Cerastua							■													
Urocyclidae								■												
Coprolites																■				
Clarias	■																			
Dipnoi	■	■														■				
Trionyx			■					■	■		■					■	■	■	■	
Pelomedusidae			■					■	■		■					■	■	■	■	
Crocodylidae	■	■						■						■		■	■			
Varanidae								■							■					
Ophidia small	■						■	■		■										
Pythonidae							■	■												
Aves small																■				
Struthionidae	■																			
Victoriapithecus large	■							■						?				■		
Victoriapithecus small	■																			
Kenyapithecus								■		■										
Carnivora								■												
Rodentia			■				■	■												■
Orycteropodidae							■													■
Prodeinotherium hobleyi			■				■	■	■			■				■	■	■	■	
Choerolophodon kisumuensis							■													
Protanancus macinnesi	■		■		■		■		■			■	■			■			■	
Brachypotherium heinzelini						■						■				■				
Rhinocerotidae	■	■	■			■	■	■			■	■	■	■		■	■	■	■	
Anthracotheriidae			■					■												
Sanitheriidae	■																			
Libycochoerus khinzikebirus	■								■											
Lopholistriodon/Listriodon		■	■		■			■	■							■				
Bunodont suid (?Conohyus)									■											
Dorcatherium cf. piggoti					■		■	■				■		■						
Climacoceras africanus		■		■			■	■		■						■		■		
Canthumeryx sirtensis	■						■						■			■				
Nyanzameryx pickfordi	■					■														
?Palaeotragus							■													
Gazella	■	■					■	■						■				■		
?Protragocerus	■						■	■						■						
Caprotragoides sp.	■						■	■	■				■	■		■				
Tiny bovid	■																			
Bovidae indet.	■	■		■			■	■	■		■									

Fig. IX–2

Faunal list: Nyakach Formation

FAUNAL LIST PLEISTOCENE NYAKACH AREA	Kapsarok	Kapsomboch	Ndori	Simbi	Ewaret
Biomphalaria					■
Limicolaria					■
Unionidae	■				
Phacochoerus		■		■	
Bovidae	■	■	■	■	
Equus	■			■	

Fig. IX–3

Faunal list: Pleistocene – Nyakach Area

CHAPTER 10

AREA IX

FORT TERNAN

History

Despite the early discovery of fossils in the Fort Ternan region (Maufe, 1908; Shackleton, Field notes, 1947) little was done until Mr. F. Wicker found an important occurrence of mammalian fossils on his farm in 1957 (fig. X–1) which was subsequently investigated by L.S.B. Leakey from 1959 to 1965.

Binge (1962) mapped the quarter degree sheet in which Fort Ternan occurs, but his map is inaccurate and misleading in several respects, so that subsequent interpretations of the geologic history and geomorphology of the area based on his work are not of great value. The Fort Ternan fossil site was examined by Andrews, Walker, Shipman *et al.*, in 1974–1975, and Van Couvering studied the local geological setting. He was, however, too reliant on Binge's work and made little advance in understanding its context, especially as regards the significance of Tinderet Volcano. This volcano entirely post–dates the Kericho Phonolites and could not therefore have been a positive topographic feature during the deposition of the Fort Ternan beds.

Bishop *et al.*, 1969 provided dates for samples from Fort Ternan which indicated an age of about 14 to 14.7 m.y. for the period of accumulation of fossils. Shipman *et al.*, 1981, provided further dates.

The area was remapped at a scale of 1:12,500 and reduced to 1:50,000 by Pickford in 1980. During this survey several new occurrences of fossils were found, notably at Serek and Kapsibor.

Geological Map

The regional geological map of the Kericho area at 1:125,000 prepared by Binge (1962) is so inaccurate that it is of little use in determining the regional context of the Fort Ternan area. It was decided to remap the area at scales of 1:50,000 and 1:12,500. This new work reveals that some of the earlier reconstructions of the setting of the Fort Ternan beds are incorrect. In particular the sediments are much more widespread (fig. X–2) than visualised by Shipman *et al.*, (1981) and are not related to a horst structure.

It has been possible to recognise additional horizons in the sequence, in particular there are several phonolite flows below the Baraget Phonolite in Kipchorion Gorge. Strata above the Kericho Phonolites have been better defined and it has therefore been possible to place the Fort Ternan beds into a much longer and better defined stratigraphic sequence than was hitherto possible.

Stratigraphy

The oldest rocks in the map area are PreCambrian gneisses of the Mozambique belt, exposed only on the upthrown, western side of the Koru Fault. Above these come the lower Miocene sequence comprising the Muhoroni Agglomerates at the base, followed by the Koru Formation and the Kapurtay Agglomerates. Overlying the Kapurtay unit comes the Cliff Agglomerates. These two units outcrop extensively in the Fort Ternan area and in the Kipchorion Gorge section (fig. X–3) where they contain abundant wood. Augite rich lavas occur in these agglomerates as does an olivine–phyric nephelinite lava.

The deposition of the Cliff Agglomerate was followed by a period of erosion during which substantial relief was developed, in which the area north of the Baraget River was highland while the area to the south was generally low–lying. On this eroded landscape there were soils and boulder lags, preserved in many places by the earliest local flows of phonolite which accumulated in the middle Miocene. This palaeoregolith is well preserved along the north facing cliffs parallelling the Baraget River.

The earliest local volcanic activity following the post–Cliff Agglomerate erosion period is a pink to purple sanidine rich tuff, well exposed in Kipchorion Gorge. This is overlain by three flows of flinty to glassy phonolite and autobrecciated phonolite which are capped by the Baraget Phonolite. In the section immediately to the south of the Baraget River the Baraget flow is the earliest local flow, indicating a steep rise in the palaeosurface from south to north against which the lower flows and tuffs pinched out.

Onto the surface of the Baraget Phonolite accumulated the Fort Ternan beds, (fig. X–4), the sediment being derived predominantly from the highlands to the north comprised of Cliff and Kapurtay Agglomerates (fig. X–5). There was contemporary volcanic activity as shown by the presence of primary tuffs in the sequence.

Sedimentation was interrupted by the deposition of the upper Kericho Phonolite, dated at 12.5 to 13 m.y. (Bishop *et al.*, 1969). Above the upper Kericho Phonolite comes the Tunnel Tuff which is in turn overlain by the Polymict Agglomerate which is a very thick lahar. This in turn is overlain by several flows of nephelinite lavas of the Kipsegi Formation followed by phonolitic nephelinites of the Lumbwa Phonolites dated at 8.9 and 9.2 m.y. (Baker *et al.*, 1970).

In the southwest, the upper Kericho Phonolite is overlain by four or more flows of Kapsoit Trachyphonolites which are overlain by Lumbwa Phonolites and Tugunon Agglomerates. The relationships of the Kapsoit Trachyphonolites to the Tunnel Tuff, Polymict Agglomerate and Kipsegi Formation are not clear since they have not been found in juxtaposition. It is possible that the Polymict Agglomerate and the Tugunon Agglomerate are related.

Above various units in the north come many flows of Tinderet Basanite dated younger than 10 m.y. The bulk of Tinderet Volcano was formed a considerable time after the deposition of the Fort Ternan Beds.

There followed a lengthy period of erosion which is still proceeding, although there are patches of transient sediment in the headwater system of the Kano Plains drainage. Important patches of late Pleistocene (Middle Stone Age) strata occur in Kipchorion Gorge and further west in the Nyando Valley. A Pleistocene calcareous spring 5.5 km west of Fort Ternan station led to the deposition of a substantial amount of calcareous tufa which contains abundant leaves and a few mammals.

Biostratigraphy

The oldest fossiliferous strata in the area are the Muhoroni Agglomerates (Meswa Bridge Locality), which are lower Miocene in age. Above these come the Koru Formation, the Legetet Carbonatites and the Chamtwara Member, all of which are lower Miocene. They were placed in Pickford's Faunal Set I (Pickford, 1981) on stratigraphic, radiometric and faunal grounds.

The next youngest fossiliferous units are the Kapurtay and Cliff Agglomerates which yield abundant wood but so far no mammals. Above these come the Fort Ternan beds with a fauna of markedly different aspect from the Koru assemblage. This fauna was placed in Faunal Set IV by Pickford on the basis of its radioisotopic age and the appearance of the fauna. Pickford considered it to be later than the Maboko fauna on the basis of differences in the fauna, and since then the discovery of a Maboko–like fauna at Nyakach confirms that Fort Ternan is younger than Maboko. The Nyakach Formation underlies glassy phonolites and Baraget Phonolite, while the Fort Ternan beds overlie the Baraget flow. The time difference between the two periods of sediment deposition was sufficiently great that significant evolution took place, with the result that the Nyakach and Fort Ternan faunas are biostratigraphically distinct, although related to each other. Differences in environment might account for some of the differences in the fauna, but time was probably of greater significance.

The new localities of Serek and Kapsibor in the Malaget Valley (figs X–6 to 7) and at Fort Ternan West (fig. X–8) are faunally comparable to Fort Ternan (fig. X–9), and map out as part of the same sedimentary unit. They are thus broadly the same age as the Fort Ternan Beds.

No fossils are known from the Fort Ternan area between the time of the Fort Ternan beds and the late Pleistocene. There are several localities in the area which yield stone tools of »Middle Stone Age« aspect with associated mammalian faunas. All the mammals so far examined from these young sites belong to extant species.

MIOCENE FOSSILIFEROUS LOCALITIES IN THE FORT TERNAN REGION

Site Designation	# of Fossils	Map Reference	Source
Fort Ternan (4 levels)	3000	603757	Churcher, 1970
Fort Ternan W (3 levels)	6	599756	
Fort Ternan Southwest	1	598749	
Serek (3 sites)	125	648778	
Serek North	3	653784	
Kapsibor	39	653782	

Table X–1

Miocene fossiliferous localities in the Fort Ternan Region

PLEISTOCENE FOSSIL SITES NEAR FORT TERNAN

Site Designation	Map Reference
Fort Ternan (Pleistocene)	566768
Kipchorion 1	519742
Kipchorion 2	533738
Kipchorion 3	539738

Table X–2

Pleistocene fossil sites near Fort Ternan

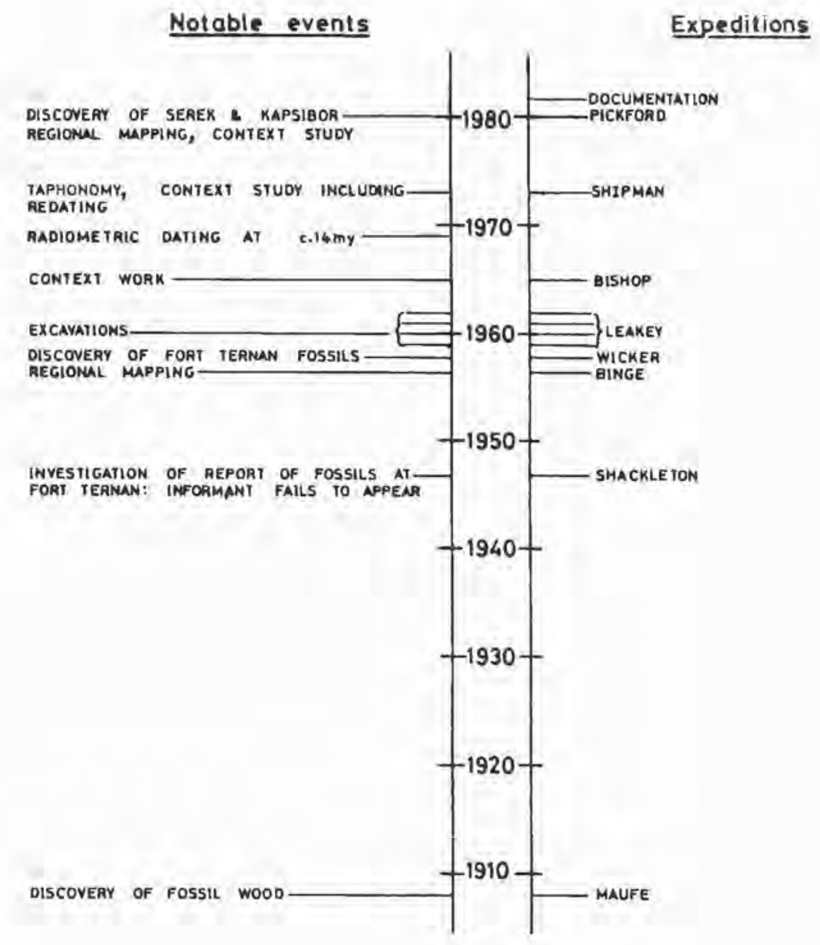


Fig. X–1

Historical Chart: Fort Ternan Area

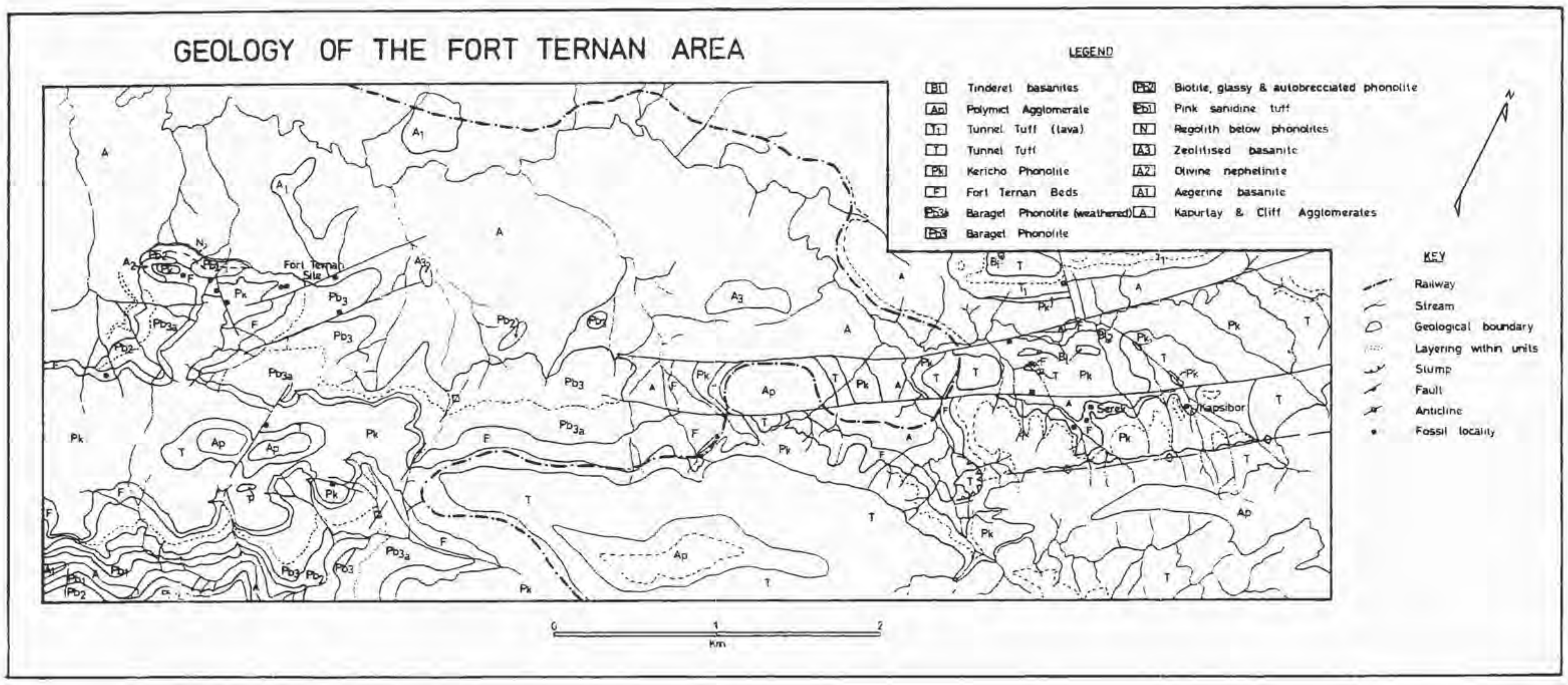


Fig. X–2
Geology of the Fort Ternan Area

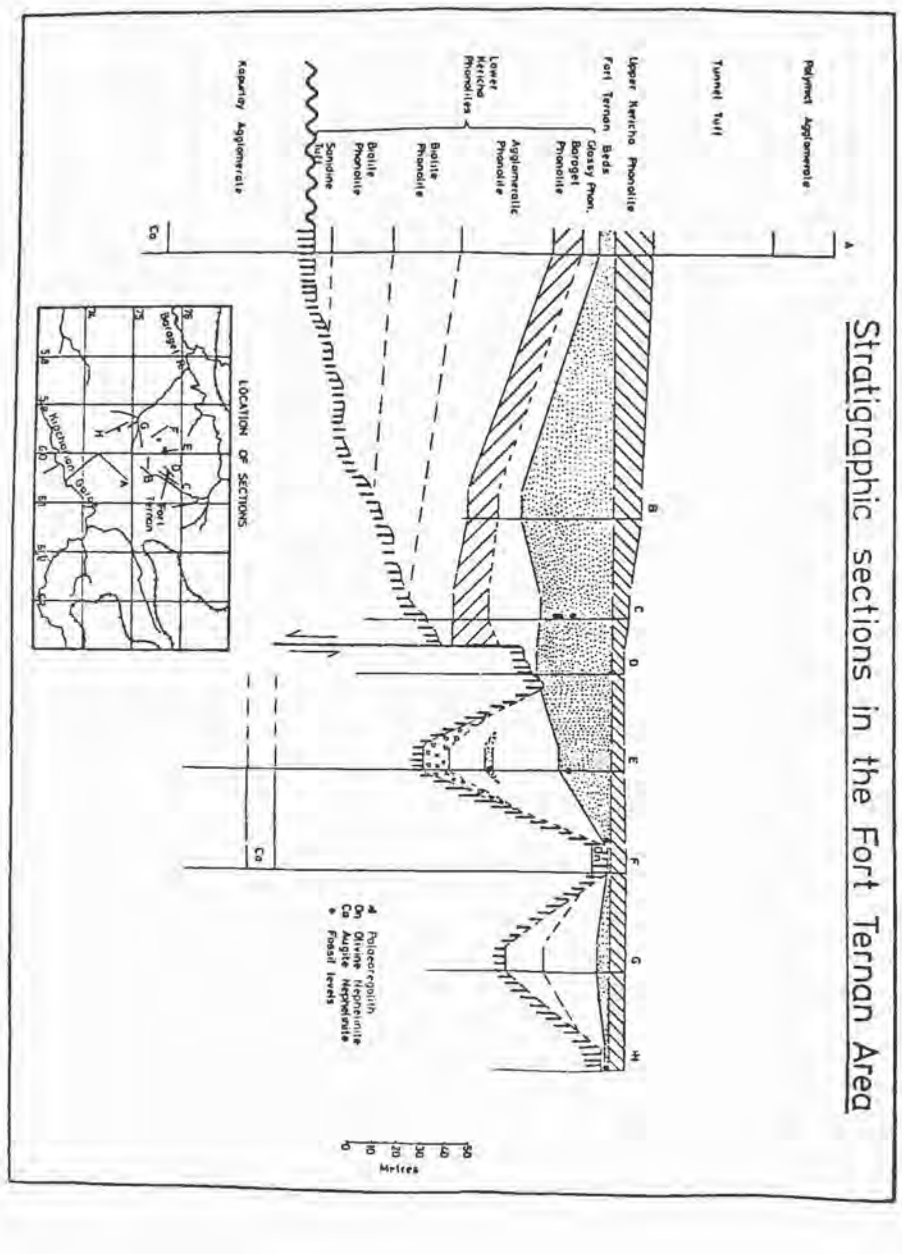


Fig. X–3
Stratigraphic sections in the Fort Ternan Area

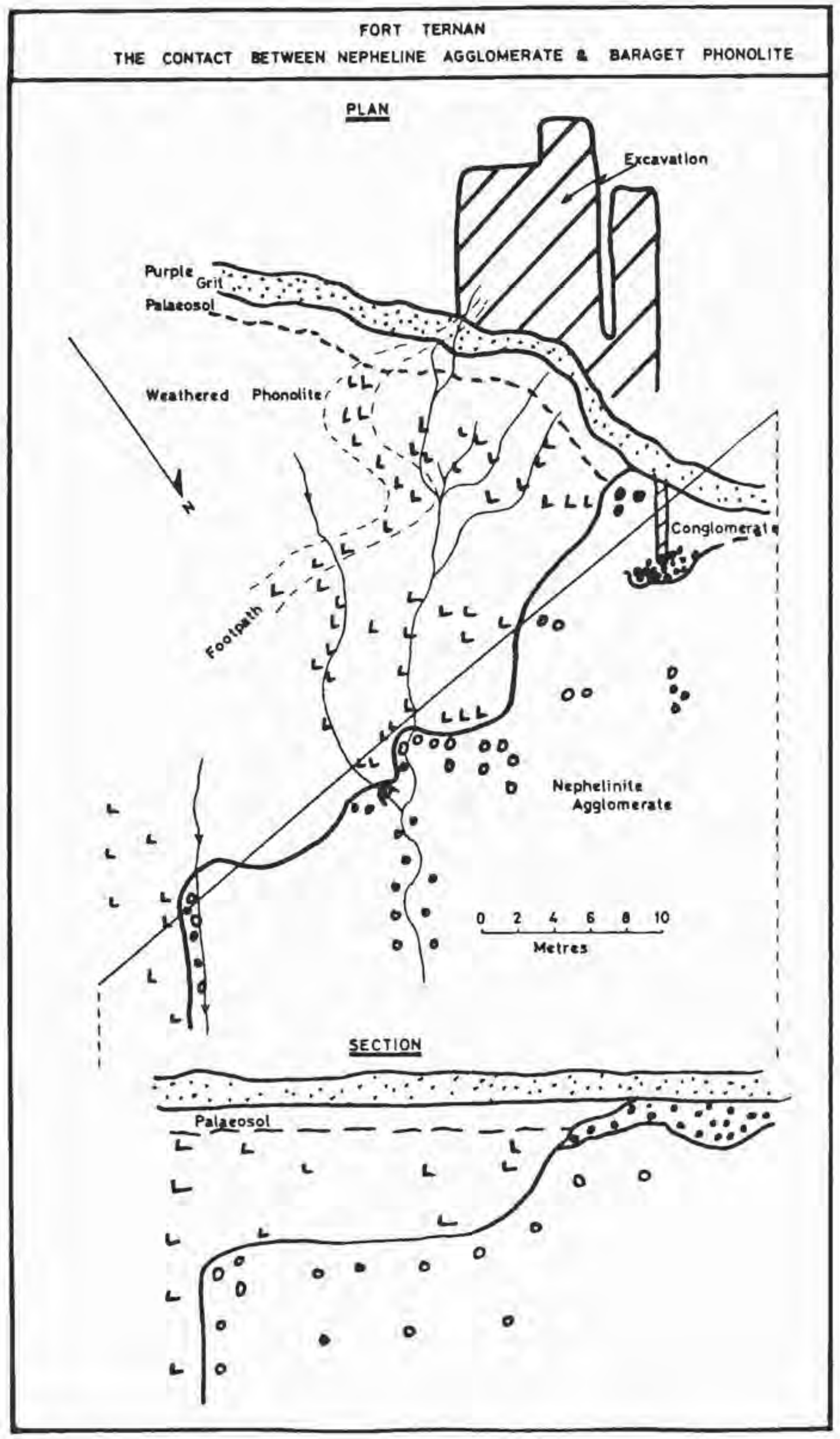


Fig. X–4
Fort Ternan: Contact between Nephelinite Agglomerate and Baraget Phonolite

SECTIONS AT FORT TERNAN REDRAWN FROM SHIPMAN PhD THESIS

Position of unconformity: X–Shipman, Y–Pickford

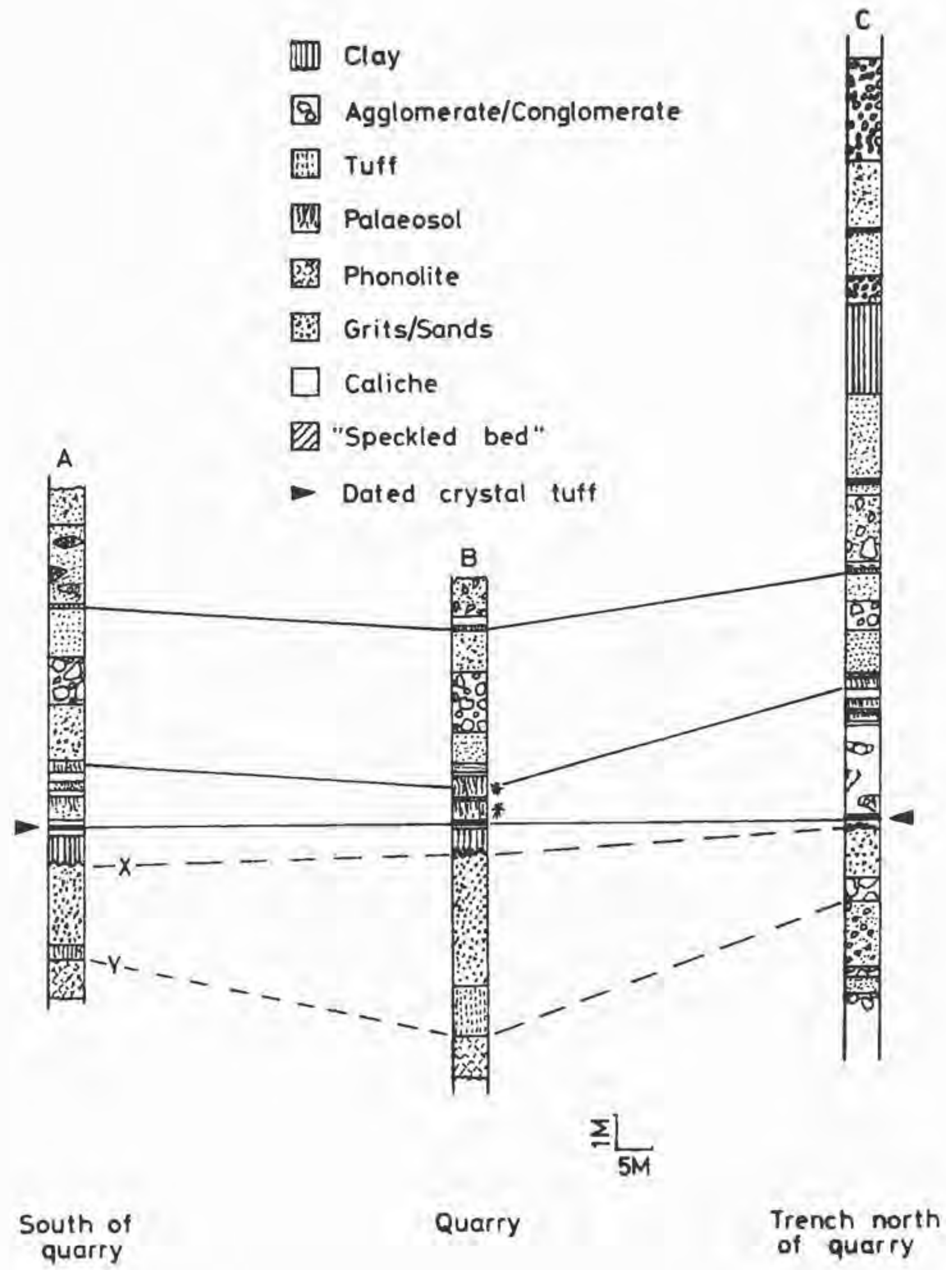


Fig. X–5
Sections at Fort Ternan

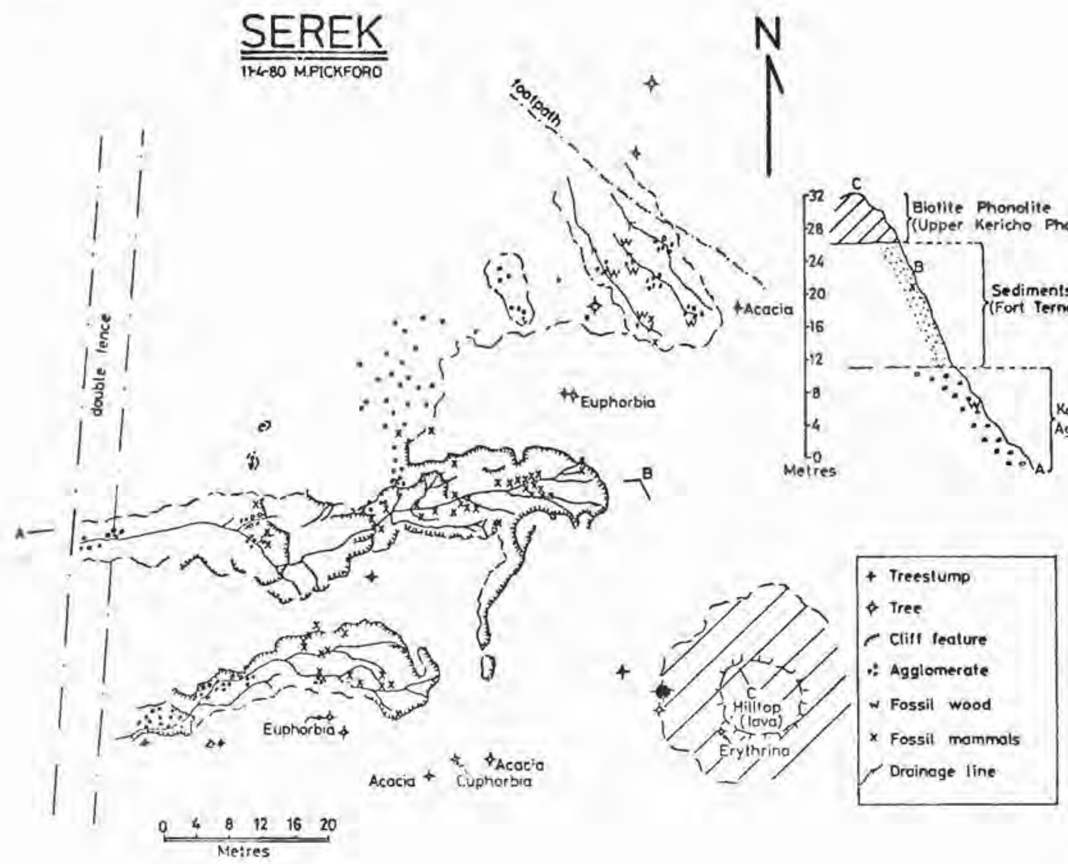


Fig. X–6
Serek

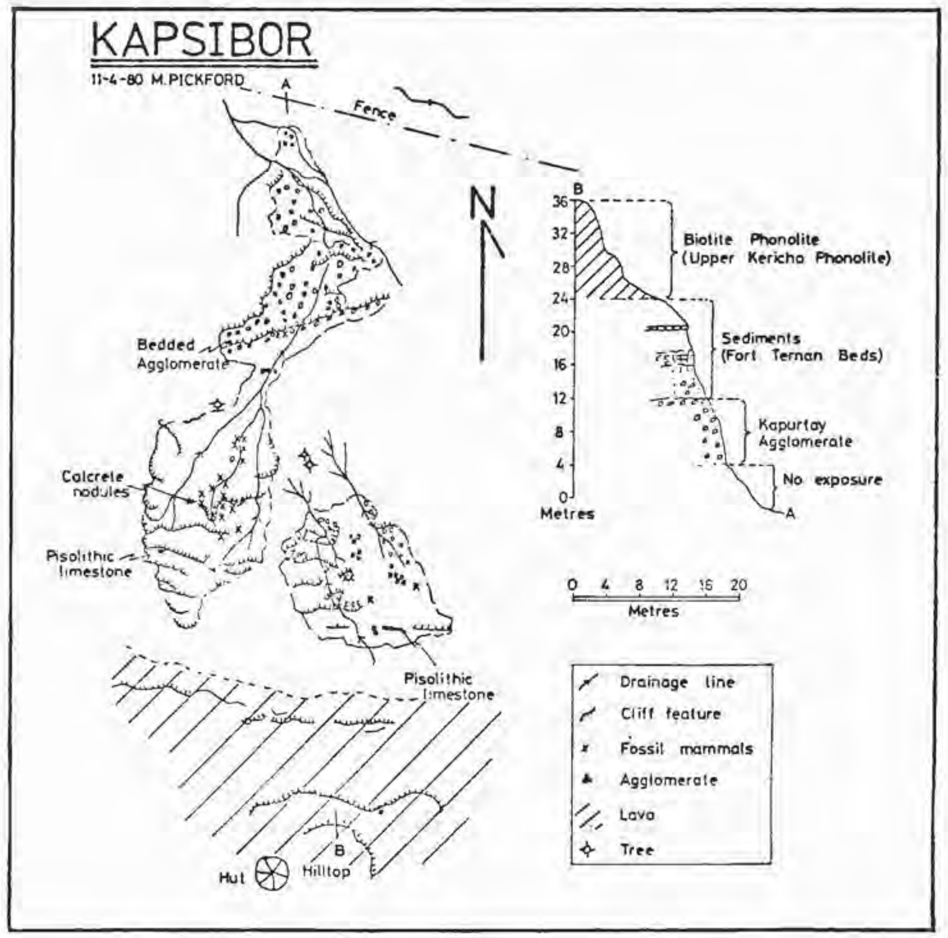


Fig. X–7
Kapsibor

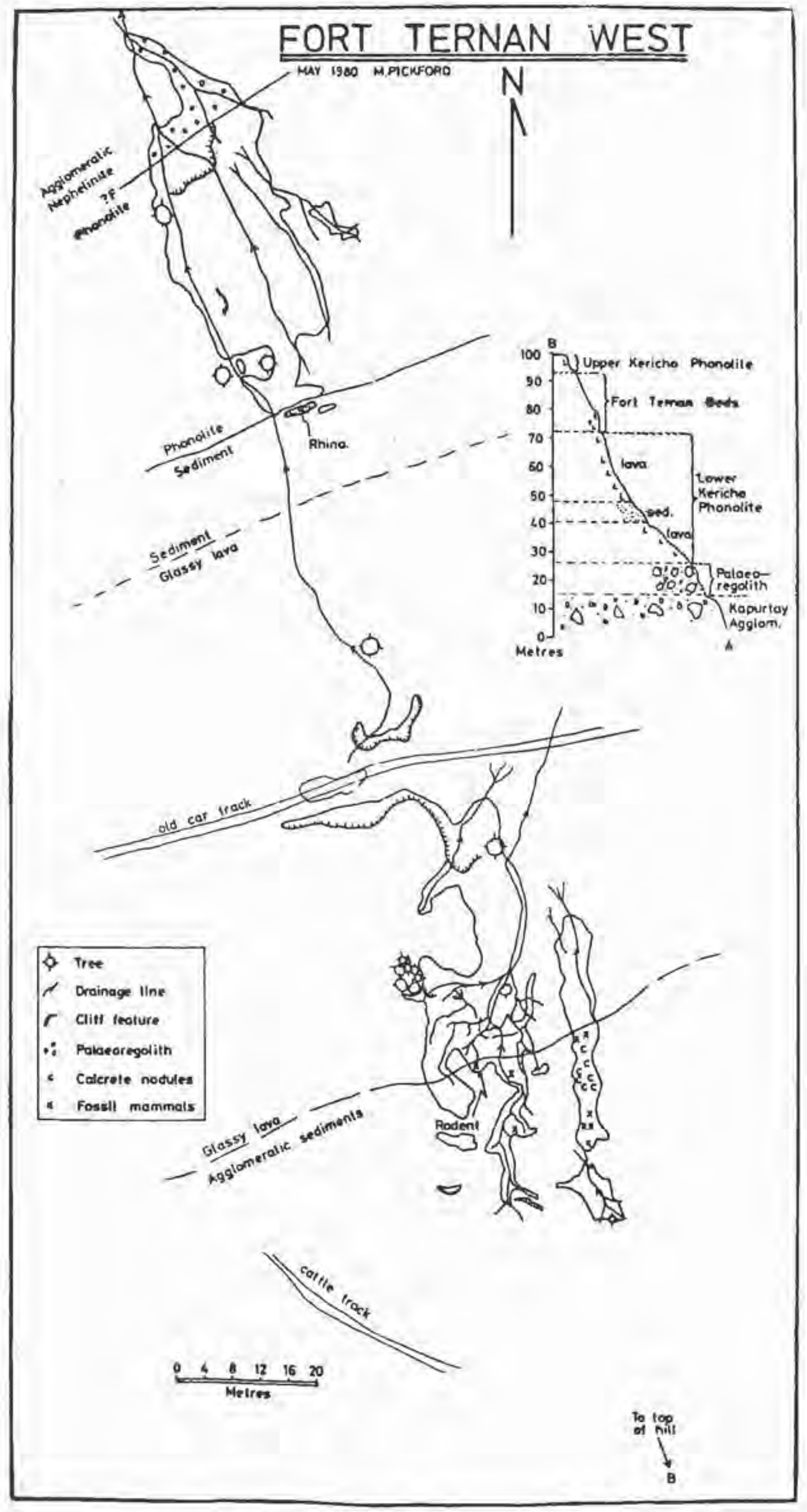


Fig. X–8
Fort Ternan West

FAUNAL LIST FORT TERNAN BEDS	Fort Ternan	Serek	Kapsibor
Helicarion	■		
Limicolaria	■		
Burtoa nilotica	■		
Curvella	■		
Homorus	■		
Thapsia	■		
Trochonanina	■		
Gulella small	■		
Insecta	■	■	■
Reptilia	■		
Chamaeleonidae	■		
Struthionidae	■		
Accipitridae	■		
Pronasilio ternani	■	■	
Kenyapithecus wickeri	■	?	
Micropithecus	■		
Oreopithecoidea	■		■
Proconsul ?	■		
Rangwapithecus ?	■		
Lorisinae	■		
Leakeymys ternani	■		
Paranomalurus	■	■	■
Sciuridae	■		
Pedetidae	■		
Phyomyidae	■		
Megistotherium ?	■		
Medium creodont	■		
Felidae	■		■
Hyaenidae	■		
Viverridae	■		
Amphicyonidae large	■		
Amphicyonidae small	■		
Orycteropus chemeldoi	■		
Manidae		■	
Choerolophodon ngorora	■	?	?
Deinotherium	■	■	■
Chalicotheriidae		■	
Chilotheridium		■	
Paradiceros mukirii	■	■	■
Kenyapotamus ternani	■		
Listriodon akatikubas	■		
Conohyus ?		■	
Tayassuidae	■	■	
Dorcatherium chappuisi	■	■	
Dorcatherium piggoti		■	
Climacoceras gentryi	■		
Palaeotragus primaevus	■		
Samotherium africanum	■		
Protragocerus labidotus	■	?	?
Oioceros tanyceras	■		
Caprotragoides gentryi	■		
Gazella	■		

Fig. X–9

Faunal List: Fort Ternan Beds

CHAPTER 11

AREA X

THE HOMA PENINSULA

History

The Homa Peninsula has been the subject of scientific research for seventy years (fig. XI–1). There have been six main expeditions to the area, and a large number of casual visits by individual scientists. As a result to these expeditions and visits there has been a large number of publications dealing with the geology, fauna and context of the fossils. The attached historical chart summarises the main research carried out in the peninsula.

Geological Map

The geology map of the Homa Peninsula was compiled from a number of sources. Regional geology is from Saggerson (1952) and updated from Le Bas (1977). Small scale maps were made by Kent (1942) and Clarke (Ms. 1966). Detailed maps of Kanam West and Kanjera were prepared by the author in 1981.

Stratigraphy

On a foundation of Nyanzian rocks (shattered and fenitised in many places) lies a mantle of late Tertiary rocks. There is also a number of intrusive masses forming the main mountainous edifice of Homa (fig. XI–2). The earliest dated volcanic activity in the area was 8.1 ± 2.0 m.y. ago. Intermittent volcanic activity continued at 4.5 ± 0.3 in the area of the main peak and at later periods in peripheral vents (2.9 ± 0.2 at Got Chiewo, SE of Homa Peak; 1.73 ± 0.06 and 1.3 ± 0.10 at Nyamatoto, north of Homa Peak and just south of the main Kanam exposures). Simbi crater in the east of the map area is obviously a recent feature.

The important thing to note about the Kanam area is that volcanic activity was occurring penecontemporaneously with the accumulation of the fauna which has elements older than 5 m.y., in the vicinity of 1.3 – 2.0 m.y. (Shungura, Member J.; Olduvai Bed II) and late middle Pleistocene to Recent. Contemporaneity of volcanic activity and sedimentation is indicated on stratigraphic and lithologic grounds. The Kanam area contains agglomeratic strata near the base of the sequence and dykes cut the fossil beds. The Kanam Formation includes three tuffs, at least one of which is demonstrably airfall in affinities (figs XI–3 to 4).

The Kanjera Beds overlie the Kanam Beds in the Kokoth area immediately east of the Kanam East gully. Their main exposures however are at Kanjera North and Kanjera South (fig. XI–5).

As in the Kanam area, the Kanjera Beds (figs XI–6 to 11) are not entirely lacustrine, but also contain lake marginal and sub–aerial facies. The *Theropithecus* fauna was collected mainly from a deltaic facies which is cross–bedded and comprised of coarse volcanic grit. It is in faulted contact with clay beds with kunkar nodules from which a younger fauna is derived. The whole is then capped by a black cotton soil of late middle Pleistocene to Recent age.

In the southwest corner of the Homa Peninsula is a series of gullies cutting through recent hillwash and soils, exposing shattered Nyanzian rocks and early to late Pleistocene strata (fig. XI–12). A fauna broadly equivalent to that of the Kanam Beds has been collected from this area, at Homa Lime and Bala Deino Site but no detailed survey work has yet been attempted. In addition, fossils were found high on Homa Peak by Clarke (1966) who considered that they may have accumulated in rockshelters in the carbonatites.

Biostratigraphy

The oldest fossil bearing strata in the area are the beds of the Kanam Formation including bed K5a (fig. XI–13) which contain a fauna suggestive of an age in excess of four million years. The Kanam Formation is overlain unconformably by the Homa Agglomerate, at the base of which is a fossiliferous palaeosol unit (bed HI) with a Pliocene fauna which Leakey (1935) claimed was the stratum from which the Kanam human remains came (label with specimens in BM(NH)). Above the Homa Agglomerate lies the Rawi Member, with no apparent discordance. The coarse base of the Rawi Unit is not known to be fossiliferous but the upper fluviatile and lacustrine facies contain abundant fossils (fig. XI–14). The Kanjera Beds are considered to correspond with the upper part of the Rawi beds, since bed Kj2 closely resembles an agglomerate in the Kanam East gully, the vent of which cuts lower Rawi strata, but which is itself covered by upper Rawi beds in the area of the vent.

Unconformably above the Rawi Member comes the widespread Apoko Formation which at its base is possibly as old as late middle Pleistocene. Palaeosols and fluviatile sediments in this formation are frequently fossiliferous (fig. XI–15), especially at Kanjera, Kanam West and in the southern portions of the peninsula (e.g. Luanda). The uppermost bed of this unit (Bed A4) is the modern black cotton soil in which organic remains are only partially fossilised. Along the shoreline of the peninsula occur widespread Recent alluvium and swamp deposits, with which are associated various shell mounds containing human remains and artefacts. Examples of these shell mounds occur at Kanjera, Kanam East and at other points along the shores of Lake Victoria.

FOSSILIFEROUS LOCALITIES IN THE HOMA PENINSULA

Site Designation	# of Fossils	Map Reference	Source
Kanjera North	500±	706633	Kent, 1942
Kanjera South	100±	712628	Saggerson, 1952
Kokoth	3	685630	Saggerson, 1952
Kokoth Dam (2 locs.)	?	700605	Saggerson, 1952
Kanam East	350±	area 6762	Kent, 1942
Kanam East Hot Springs	10±	area 6861	Kent, 1942
Kanam Central	100±	area 6661	Saggerson, 1952
Kanam Fish Cliff	35	667610	BM(NH) Faunal Catalogue
Rawe Fish Beds	?	area 6661	Saggerson, 1952
Kanam Museum Cliff	1	?	BM(NH) Faunal Catalogue
Kanam West (incl. Lake Cliff)	350±	663618	Leakey, 1935
Kagua (S2) (Ragua)	30	630580	Saggerson, 1952
GR 641579	few	641579	Clarke, 1966 (unpub)
Kuwur (Pier, Cliff)	few	637525	Saggerson, 1952
Homa Lime (variously named)	few	637525	Saggerson, 1952
HC 869	20	646537	Clarke, 1966 (unpub)
HC 845	16	645534	Clarke, 1966 (unpub)
HC 877	22	648533	Clarke, 1966 (unpub)
HC 843	1	651533	Clarke, 1966 (unpub)
HC 844	1	650532	Clarke, 1966 (unpub)
S I	few	645529	Saggerson, 1952
S II	few	643524	Saggerson, 1952
HC 854	1 pc. breccia	664543	Clarke, 1966 (unpub)
HC 824	10	682557	Clarke, 1966 (unpub)
B	1	675578	Clarke, 1966 (unpub)
G I	breccia	665573	Clarke, 1966 (unpub)
G II	breccia	661569	Clarke, 1966 (unpub)
Alara E (W Rongo)	few	649552	Saggerson, 1952
Alara S	few	642545	Clarke, 1966 (unpub)
Bala NE	30	699518	Clarke, 1966 (unpub)
Bala NW (2 locs.)	20	697518	Clarke, 1966 (unpub)
Bala S	10	696512	Clarke, 1966 (unpub)
Kimera	few	area 7761	Oswald, 1914; Sagg., 1952
Lathiri (Orieng)	few	area 8156	Saggerson, 1952
Simbi	few	area 8159	Saggerson, 1952
South East Gully	few	682608	Kent, 1942
Red Gully	few	685615	Kent, 1942
Bala Deino Site	6	693507	
Luanda Gully upper	many	area 6752	
Luanda Gully lower	many	area 6851	
Aura Kapundo Gully	many	657522	

Table XI–1

Fossiliferous localities in the Homa Peninsula

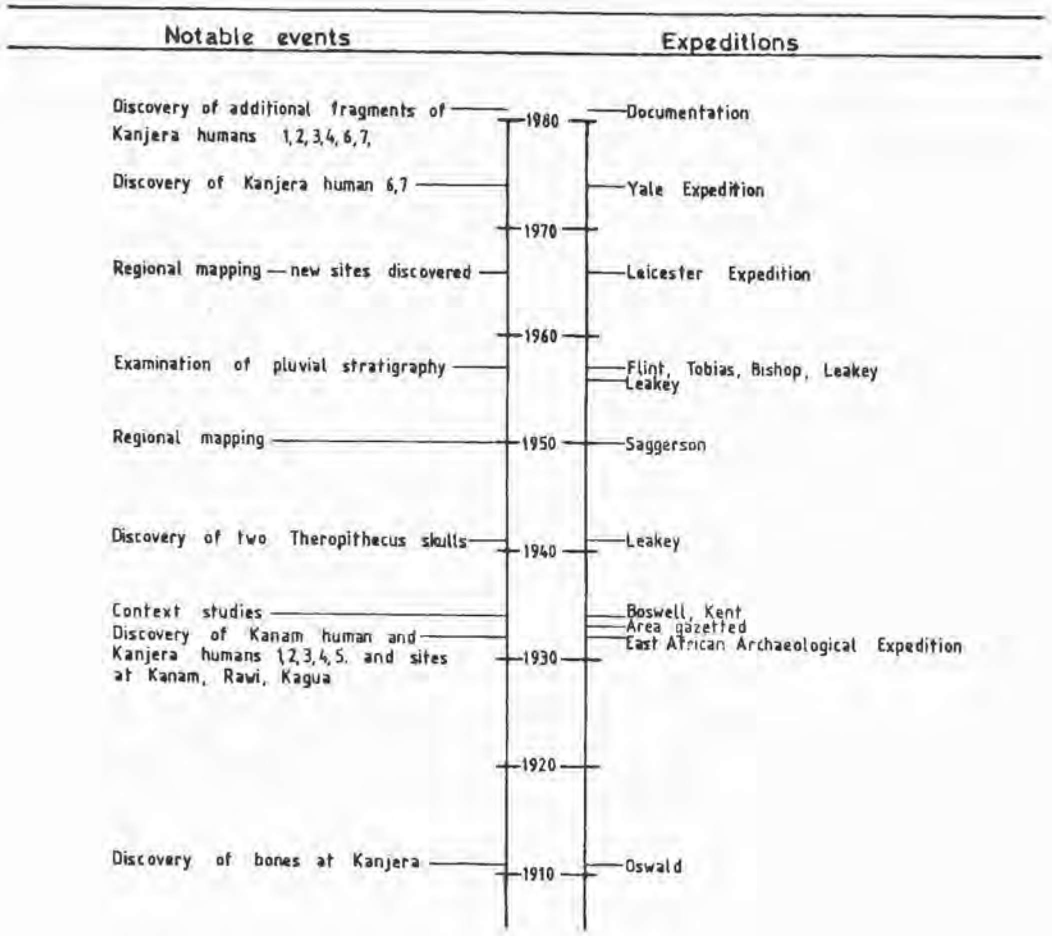


Fig. XI–1

Historical Chart: Homa Peninsula

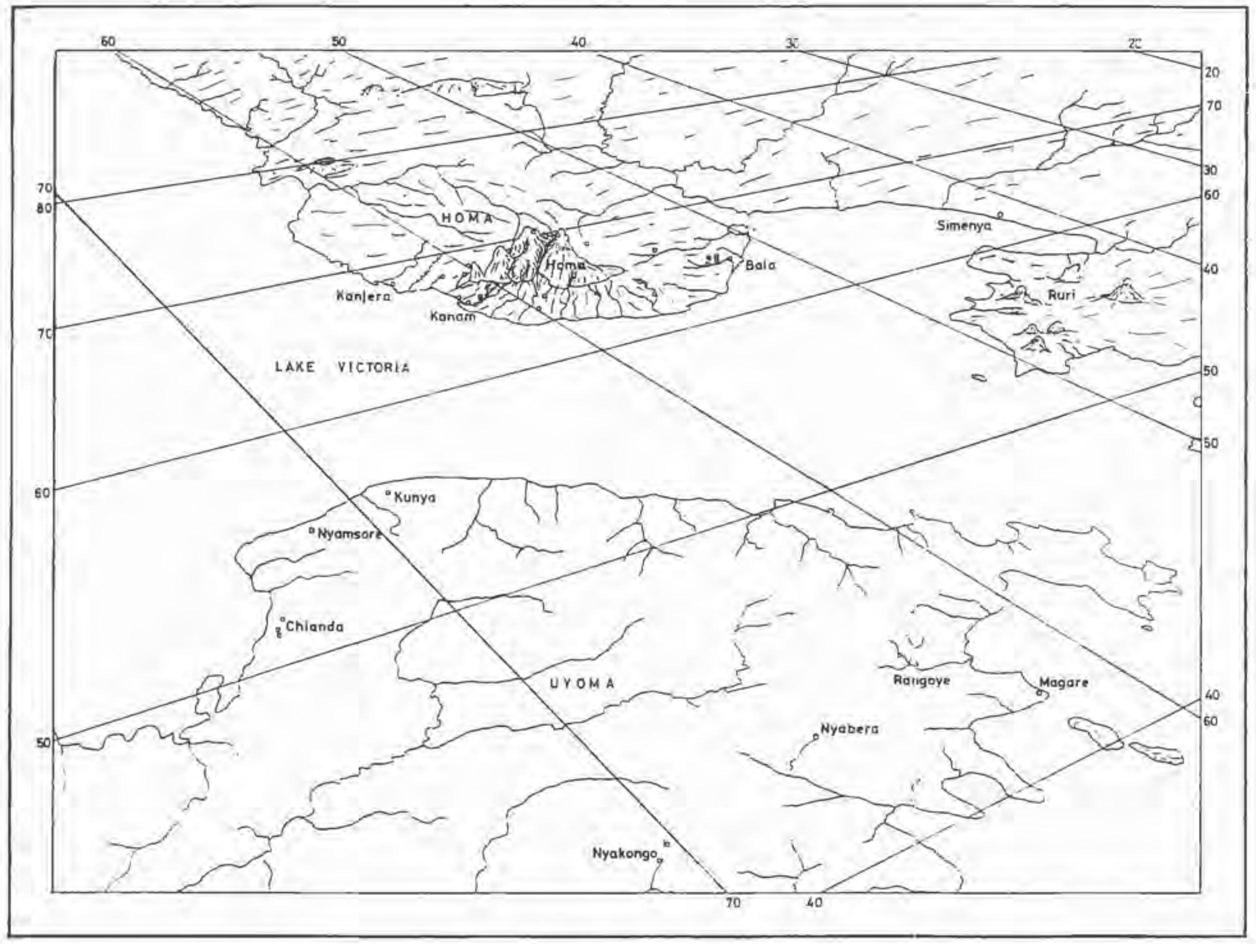


Fig. XI–2

o Fossil localities

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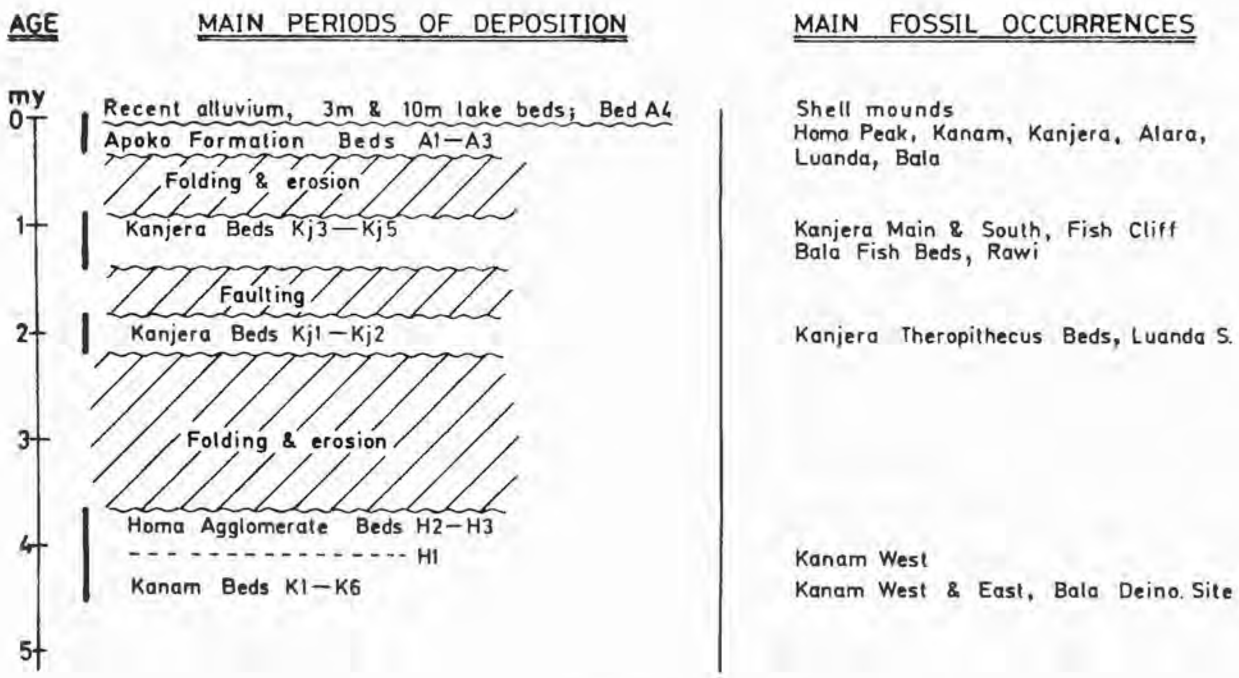

Fig. XI–3

Homa Peninsula: Main Periods of Deposition

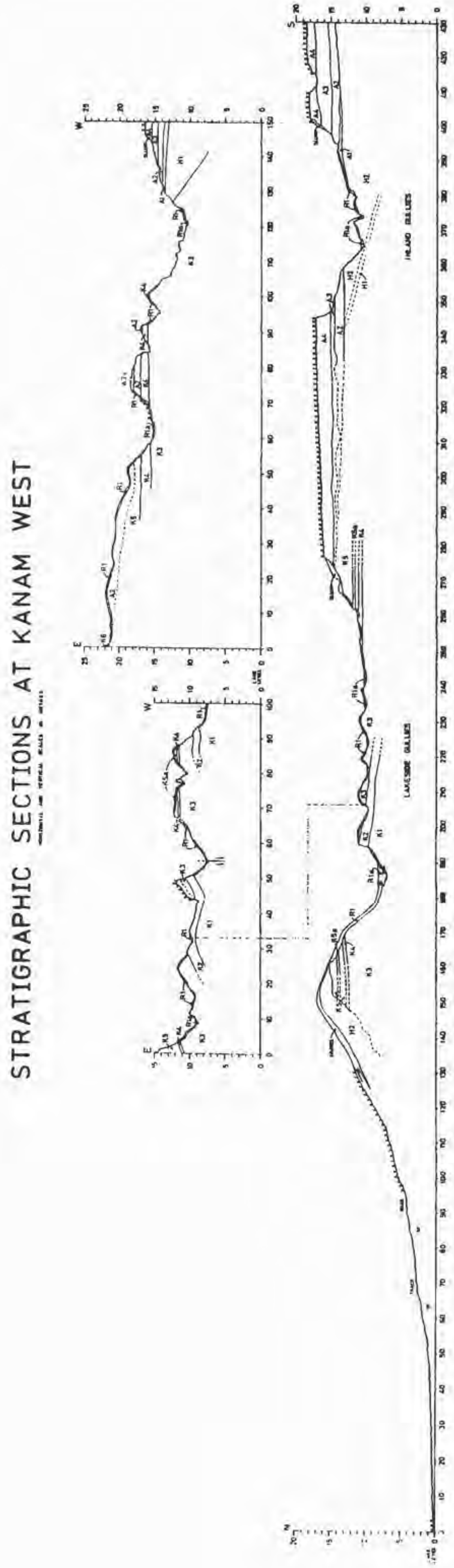

Fig. XI–4

Stratigraphic Sections at Kanam West