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VEGETATION OF RUSINGA ISLAND

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Rusinga Island is an island in Lake Victoria. It is situated in the South Nyanza district of Kenya. It is only just divided from the mainland by a narrow channel about 100 m across, but this has been sufficient to produce noticeable differences between it and the mainland in vegetation. The island is well populated, the people living for the most part on the flats along the lake shore and on the lower slopes of the hills. There is some evidence that it has been inhabited for a considerable period of time, with far reaching effects on the vegetation. The main interest in examining its present vegetation is to try and deduce from this what the natural, i.e. primary, vegetation succession was before disturbance by man.

TOPOGRAPHY AND GEOLOGY

Rusinga Island consists of a number of hills, the tallest of which, Lugongo Hill, is approximately 300 m above lake level. The lake itself is 1134 m above sea level. The hills are composed of volcanic sediments and agglomerates dating from the Early Miocene. Radiometric dates give a range of ages of deposition from over 20 to 16 million years B.P. (Van Couvering & Miller, 1969). These deposits are part of a large volcano, which is centred at Rangwa Hill on the mainland and from which also came the agglomeratic hills of Gwasi and Gembe and the deposits on the Uyoma peninsula of Central Nyanza (see Fig. 1). The highly alkaline nature of these deposits was very beneficial to fossil preservation during the time of deposition, and must have had a profound effect on local vegetation. At present the only immediately obvious effect of this alkalinity is on the central plug of the volcano itself: Rangwa Hill.

In the Early Miocene, before uplift and rifting of the East African plateau had proceeded very far, the area covered by Lake Victoria at present was a westerly tilted plain with rivers flowing towards the Atlantic. The date of first formation of the lake is not known, but is thought to be 40,000–50,000 years B.P. There are several lake terraces known around the lake. These represent former levels of the lake, but only the 15 m terrace can be seen on Rusinga Island. The terraces were probably formed as a result of irregularities in the rate of downcutting of the Nile, but changes in climate may also have been important. For instance, increased rain and lower temperatures since 1960 have resulted in a 3 m rise in lake level over a period of only two years (Kendall 1969).

CLIMATE

The climate around Lake Victoria is strongly influenced by the lake. A permanent low pressure zone produces heavy rain over the lake and along its shores, particularly

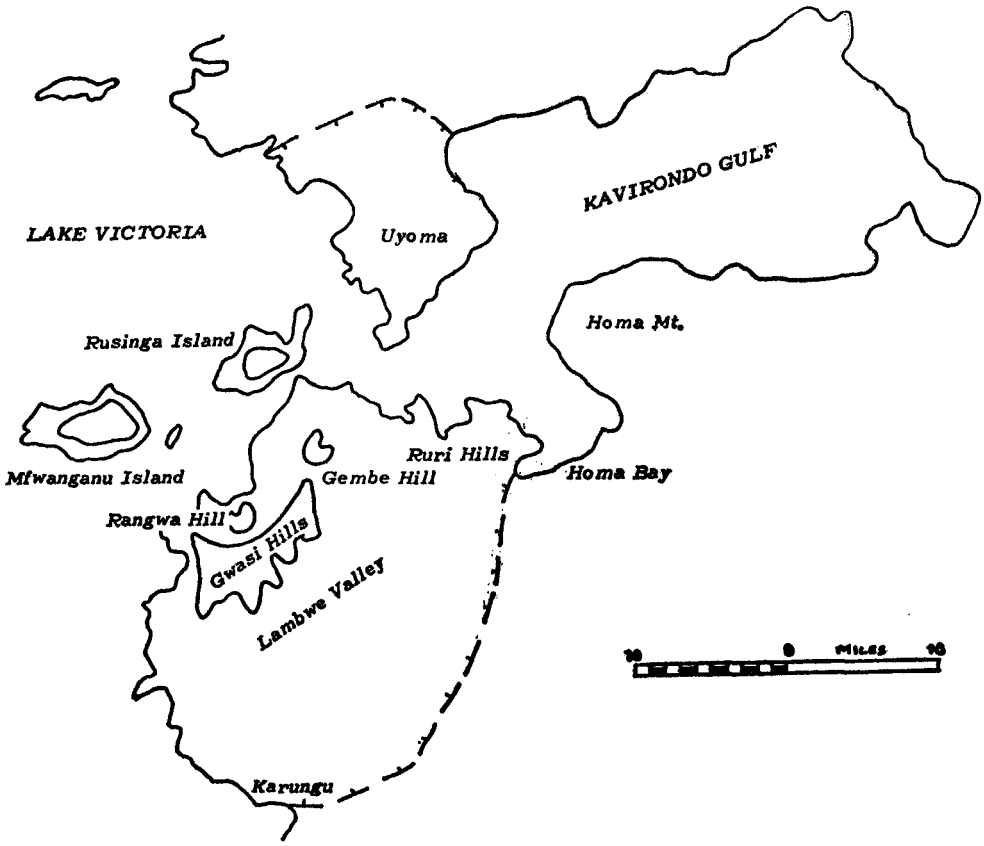

Fig. 1 Locality map showing positions of Rusinga Island and the other places referred to in the text. The broken line shows the extent of the Miocene Volcanic deposits centered around Rangwa Hill.

in the north and west since the predominant winds are from the south and east (Kendal 1969). The rainfall along the Kenya shore of the lake varies from 800 to 1300 mm, increasing north eastwards up the Kavirondo Gulf, and is fairly well spread throughout the year. At Kisumu, the month with the least amount of rain (January) still has an average of 7 days rain (figures published by the East African Meteorological Department). The amount of rain apparently decreases further from the lake if there is no significant rise in altitude, but where altitude does increase there is an increase in rainfall.

Trapnell & Griffiths (1960) have discussed the relation of rainfall and altitude with reference to ecology. They conclude that the low-lying areas around the lake are at the end of an altitudinal and ecological sequence extending from moist montane forest to what they call intermediate semi-evergreen thicket around the lake. This sequence can be seen within the limits of local influence of the lake up the slopes of the Gwasi Hills, which rise from the lake shore to a height of over 2000 m, and have montane evergreen forest at the top. This forest is dominated by *Catha edulis* Forsk., which is the dominant species also in the Chyulu Hills (Faden, pers. comm.), but from local accounts the forest was once much richer and more extensive, and at one time provided large timber for local canoe manufacture.

HISTORY OF VEGETATION CHANGES

There is a little information on prehistorical vegetation in the Lake Victoria region. On Rusinga Island itself an 18 million year old Miocene flora was described by Chesters (1957) on the basis of fossil seeds and endocarps. She described 17 families with 21 genera, from which 12 species, which have closely allied living counterparts, are either climbers (5), large forest trees (3), or smaller forest trees (4). The most characteristic families are Annonaceae, Apocynaceae, Euphorbiaceae, Menispermaceae, Rhamnaceae and Ulmaceae. In addition to these, in the Miocene deposits of the neighbouring island of Mfwanganu there is an abundance of *Entandrophragma* sp. The single species of the Apocynaceae, *Leakeyia vesiculosa* Chesters, had endocarps with air floats, indicating fruit dispersal by water. The abundance of trees and climbers in the flora, and the affinities of the species, was taken to indicate evergreen forest conditions in the Miocene, perhaps gallery forest bordering water (Chesters 1957).

Since the Miocene major geological events have drastically altered the landscape in the Kavirondo area (Baker & Wohlenberg 1971). During the Pleistocene there were changes in climate that must have radically altered ecological conditions (Moreau 1952, Carcasson 1964). Of all this time nothing can be said, but an attempt can be made to assess the human impact in historical times.

The earliest evidence of human occupation of Rusinga Island is the presence of stone tools of the Sangoan culture on the lake terrace mentioned above. In the same deposit are abundant bovid remains which suggests that at the time of deposition of the terrace the vegetation consisted of a fairly open type of woodland, perhaps similar to the present day. From this time (very approximately 30,000–50,000 years B.P.) until only 1000 years B.P. there is another gap, after which there is evidence of iron age occupation in parts of Nyanza, although not for Rusinga Island (Leakey *et al* 1948). These people, having the use of iron and fire, probably had considerable impact on their environment. Within the last few hundred years the shoreline of South Nyanza was settled first by Bantu people and subsequently by Luo (Ogot 1967). The historical traditions of the Bantu are poorly preserved as they were assimilated by the Luo invaders, and the present day inhabitants of Rusinga Island all speak Dholuo and follow Luo customs.

What effect the early stone age cultures had on the environment it is difficult to say, but it seems likely that those based on a hunting economy had little effect. In his detailed record of changes in vegetation during the last 15,000 years, Kendall (1969, p. 162) found a great increase in grass pollen on the north shore of Lake Victoria about 2000 years ago. He interprets this as being due to the arrival of agricultural—though still stone age—man. Fire was probably their principal weapon against the forest, for stone tools make laborious work of cutting down a tree. Whether Rusinga Island was inhabited at this time is not known, but the probable occupation of the island for at least the last 100 years by iron age cultures before the arrival of the Luos cannot have been without effect on the vegetation.

PRESENT VEGETATION

There are a number of plant communities to be recognized on Rusinga Island. These depend partly on soil and physiographic factors but also in places on cultural factors, and the two may produce a similar end result. Thus the usual lake shore vegetation consists of scattered trees up to 15 m tall of *Balanites aegyptiaca*, *Acacia seyal*, and *Euphorbia candelabrum* (see Table 1 for authorities); but in the "gumbas", which are sacred places in the Luo culture and where people are prohibited from burning, there is an almost luxuriant woodland of figs (*Ficus capensis*), *Albizia coriaria*, and large trees of the species mentioned above. In the lower regions of river valleys, where gullying is not too active, exactly the same association occurs, although never as thick nor as high and not usually with the same luxuriance of ground vegetation because of grazing. Higher up the hillsides the plant associations are rather different, due mainly to shallow

soils and steep slopes. The characteristic species are *Acacia seyal, Sapium ellipticum, Commiphora* sp., and *Rhus natalensis.* Heights are lower than the lake shore trees, ranging from 4–12 m. Areas of land that are lying fallow at present but which were evidently cultivated or cleared up to a few years ago have a dense scrubby association of *Acacia, Tamarindus,* and *Euphorbia.* Conspicuous for its absence on Rusinga Island is any member of the family Combretaceae.

LAKE SHORE COMMUNITIES

The lake shore is extensively cultivated now and offers some of the flattest and most fertile land on the island. In places where it is cut by river courses or where there is a "gumba" the tree growth becomes very dense, but usually there are just scattered trees of the following species: *Acacia brevispica, A. seyal, Albizia coriaria, A. zygia, Balanites aegyptiaca, Canthium schimperanum, Cordia ovalis, Euphorbia candelabrum, E. tirucalli, Ficus capensis, F. sycomorus, Haplocaelum foliolosum, Maytenus senegalensis, Pseudospondias microcarpa, Scutia myrtina, Stereospermum kunthianum* and *Tamarindus indica.* Common grasses are *Hyparrhenia rufa, Sporobolus agrostoides* and *Themeda triandra.*

The same species occur more thickly in the less disturbed areas along the lake shore, and it appears both from their distribution and from local report that neither fire nor wildlife grazing has had any appreciable effect on the area. It has simply been a matter of clearing the natural vegetation by the local inhabitants. However, there appears to be no part of this community that has not been cleared at some time in the not too distant past. Even the "gumbas", which in any case are only 1–2 ha in extent, were probably cleared some time prior to the Luo settlement over 100 years ago. Many of the large isolated trees along the lake shore show signs of having grown in closed forest conditions, i.e. they have a straight bole without any branches for 3–6 m and a fairly constricted crown.

A variation of the lake shore community is that of *Acacia drepanolobium* on black cotton soil. This is uncommon on the island, drainage on the whole being good. It occurs over large parts of Lambwe Valley, the floor of which is exceedingly flat, but in the better drained parts of the valley floor the species comprising the tree thickets have some differences from Rusinga Island, although *Acacia seyal* is dominant in many places. Similar species associations to the Rusinga lake shore are seen in the dry valleys running into Lambwe valley from the Gwasi Hills, and the Kaniamwia Escarpment.

One further variation that must be mentioned is the swampland along the lake shore. This occurs patchily along the shore and is nowhere extensive. It is dominated by *Cyperus papyrus* L.

HILLSIDE COMMUNITIES

The vegetation on the hillsides is surprisingly independent of either degree of slope or geological horizon. The Pleistocene terrace has the same vegetation association as the higher Miocene volcanics of Lugongo Hill, but the vegetation of the latter is strikingly different from that of Gembe Hill on the neighbouring mainland, even though they are part of the same geological horizon. The explanation of this would seem to be that Gembe Hill is regularly burnt over as an aid to hunting and to improve grazing, so that trees are scattered on the exposed slopes and consist largely of *Combretum, Acacia* and *Commiphora* species. In a few sheltered gullies on the west slopes of Gembe Hill the vegetation is much thicker and more like that of Rusinga Island. On Rangwa Hill and on the other two carbonatite hills in South Nyanza, Ruri Hills and Homa Mountain, the dominant tree species is *Terminalia brownii* Fres. associated with *Combretum molle* G. Don. The latter is widespread in South Nyanza, but the former occurs only on these three hills in the whole of the western part of this district.

Typical species represented on the slopes of Rusinga Island are as follows: *Acacia brevispica, A. hockii, A. seyal, Annona senegalensis, Carissa edulis, Commiphora* sp., *Euphorbia* spp., *Ficus* spp., *Grewia mollis, Kigelia africana, Lannea stuhlmannii, Maytenus senegalensis, Pseudospondias microcarpa, Rhus natalensis, Sapium ellipticum, Stereospermum kunthianum, Ximenia americana* and *Ziziphus mucronata.* In addition, *Markhamia platycalyx* is present in several places, but according to the local people it has been introduced artificially there.

There are great variations in the density of tree species on the hillsides of Rusinga Island. The north and west slopes of Lugongo Hill appear to have deeper soil and to have been cultivated more in the past, and here the tree cover is more sparse; whereas in places on the south and east slopes, where the soil is very thin, dense thickets are common, interspersed with grass glades where the soil is almost non-existent. Gullying occurs all round the slopes of the hills on the island, cutting down deeply into the Miocene sediments, and while some of these are now overgrown with trees others are completely barren, especially those in areas of intensive agricultural activity at present.

DISCUSSION

The vegetation type present in an area today is not usually a reliable indication of what would be there in the absence of human interference. Glover (1968) considers that "fire, shifting cultivation and grazing are the major factors responsible for the formation and maintenance of savanna country". Nonhuman factors may be concentration of elephant or hippopotamus populations and naturally occurring fire. Savanna communities are therefore deflected sub-climax associations dependent on these factors for their maintenance and the implication is that in the absence of these factors they would revert in whole or in part to woodland communities. Similarly, Pratt, Greenway & Gwynne (1966) state unequivocally that "most East African vegetation types are the product of human activity". They go on to suggest a system of classifying vegetation types based on the density and height of tree or bush canopy cover, and their system is used in this paper.

The existence of large expanses of open grassland in East Africa at the present time has led to the belief that it is a natural climax. The same is true of the even larger expanses of so-called savanna. The classification of Pratt, Greenway & Gwynne (1966) accepts this implicitly, merely changing the vague term savanna to more precise terms such as wooded grassland etc. In his analysis of tropical African grasslands, Michelmore (1939) came to the conclusion that grassland is very limited under natural conditions and that:

(1) grass is favoured by strong seasonality of rainfall.
(2) within the equatorial zone, which as a whole does not have a long dry season, grass is limited to areas where either the soil is extremely thin, e.g. glades within an area of evergreen forest, or the soil is waterlogged for part of the year, e.g. flood plains, valley bottoms, and on black cotton soils.

There are two exceptions to this generalization: montane grassland that develops above the tree line, and desert grasslands where absolute rainfall is extremely limited. Apart from these, however, grassland as a natural climax is rare in equatorial Africa, and where it is present as a result of human activity it is in general less luxuriant than further north and south away from the equator (Michelmore 1939).

The present vegetation on Rusinga Island varies from grassland to woodland. It has been shown to have been inhabited by people for a considerable period of time, and the most important factors that would appear to have modified the vegetation are probably shifting cultivation and grazing. Goats, sheep and cows are grazed all over the island. There are permanent farms on the lower slopes of the hills and along the lake shore, but shifting cultivation is still practised on the upper slopes, cultivated land there only retaining the soil for a few seasons. Deep gullies at present stabilized with tree thickets are evidence of former clearing of land now under woodland vegetation.

In addition to these human factors, hippos exert a local influence along the lake shore.

It can be concluded that the vegetation of Rusinga Island has been much disturbed by human settlement, both past and present; and in this it is no exception to the general conclusion mentioned earlier that human interference has greatly altered tropical African vegetation communities. An attempt will now be made to say what the vegetation type of Rusinga Island would be if it were undisturbed.

To begin with there is the guide afforded by the protected "gumba" communities on Rusinga Island itself. These are composed of the same species found elsewhere on the island, but the trees are much taller, the canopy is much denser (in places being closed), and the ground vegetation is much thicker. They are present at random points along the shore, being the places where the incoming Luos happened to come to land, and as such they can be taken to be typical of what the lake shore vegetation would be were it undisturbed by man. It should be classified on this basis as woodland.

On the higher slopes of Rusinga Island there is no such guide to the natural vegetation. There are, however, areas where the vegetation is less disturbed and where probably it has not been cleared for the last 30 years at least. Here, dense thickets of trees (over 6 m high) are interspersed with glass grades on thin soil and isolated groups of trees. This can probably be taken to indicate that thickets form a part of the natural vegetation of the island, the rest consisting of either bushland or woodland. This agrees with the broad classification of the area as "intermediate semi-evergreen thicket" (Trapnell & Griffiths 1960).

These two lines of evidence are supported by some other considerations. The rainfall over the area is relatively high, 800–1000 mm, and is distributed throughout the year, there being no well defined dry season. This is quite a high rainfall for this altitude, and should be sufficient to support dense stands of trees. Another consideration is the comparison of the Rusinga area with the detailed vegetation survey of Uganda (Langdale-Brown, Osmaston & Wilson 1964). From this the vegetation of Rusinga Island compares closely with the "undifferentiated moist semideciduous thicket" (G1 in their classification) which occurs along the Uganda shore of Lake Victoria up to the border of Kenya, and which passes into "moist *Combretum* savanna" (K) and "*Combretum-Hyparrhenia* savanna" according to their classification. Both the latter types are said to be fire climax, and having a mean annual rainfall of 800–1500 mm, would probably succeed to semi-deciduous thicket; this in turn is suggested as a successional stage leading to a forest climax (Langdale-Brown, Osmaston & Wilson 1964, pp. 53, 57 and 60). The similarity of this sequence with that of the area around Rusinga Island is striking; firstly the correspondence in species and tree density at the shore; and secondly the similarity of inland vegetation types between Lambwe Valley and the area around Bunwale.

It is concluded, therefore, that the natural vegetation of Rusinga Island, free from the influence of man, would consist of two zones of woodland: along the lake a moist form of semideciduous woodland with closed canopy in places and grass glades due to either hippo grazing or to waterlogged soil; and on the slopes of the hills a (semi) deciduous woodland with thickets, with grass glades where the soil is thin. The typical tree species would probably be *Albizia* spp., *Acacia* spp., *Sapium ellipticum*, *Grewia mollis* and *Lannea stuhlmannii*.

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TABLE 1

VEGETATION LIST FOR RUSINGA ISLAND

Family	*Name and Authority*	*Dholuo Name*
Gramineae	*Sporobolus agrostoides* Chiov.	Abinywe
	Hyparrhenia rufa (Nees) Stapf.	Ogare
	Themeda triandra Forsk.	Akwar
Anacardiaceae	*Lannea stuhlmanii* (Engl.) Engl.	Kuogo
	Pseudospondias microcarpa (A. Rich.) Engl.	Ochol
	Rhus natalensis Krauss	Sangla
Annonaceae	*Annona senegalensis* Pers.	Obolo
Apocynaceae	*Carissa edulis* (Forsk.) Vahl	Ochuoga
Balanitaceae	*Balanites aegyptiaca* (L.) Del.	Odho
Bignoniaceae	*Markhamia platycalyx* (Bak.) Sprague	Siala
	Kigelia africana (Lam.) Benth.	Yago
	Stereospermum kunthianum Cham.	Pololok
Boraginaceae	*Cordia ovalis* DC.	Oseno
Burseraceae	*Commiphora* sp.	Arupien
Caesalpiniaceae	*Tamarindus indica* L.	Chwa
Capparidaceae	*Maerua angolensis* DC.	Amoyo
Celastraceae	*Maytenus senegalensis* (Lam.) Exell	Achuodo
Compositae	*Vernonia amygdalina* Del.	Melosia
Euphorbiaceae	*Bridelia micrantha* (Hochst.) Baill.	Athuno
	Croton dichogamus Pax	Ang'we
	Sapium ellipticum (Krauss) Pax	Ochak
	Neoboutonia melleri (Muell. Arg.) Prain	Opok
	Euphorbia candelabrum Kotschy	Bondo
	E. tirucalii L.	Ojuok
Mimosaceae	*Albizia coriaria* Oliv.	Ober
	A. zygia (DC.) Macbr.	Oturbam
	Acacia seyal Del.	Ale
	A. senegal (L.) Willd.	Kiluor
	A. sieberana DC.	—
	A. brevispica Harms	Osiri
	A. drepanolobium Sjoestedt	Dunga
	A. hockii De Wild.	Arumbe
Moraceae	*Ficus capensis* Thunb.	Ngou
	F. sycomorus L.	Bongo
Myrtaceae	*Syzygium guineense* (Willd.) DC.	—
Olacaceae	*Ximenia americana* L.	Olemo
Papilionaceae	*Erythrina abyssinica* DC.	Orembe
Rhamnaceae	*Scutia myrtina* (Burn. f.) Kurz	Migodha
	Zizyphus mucronata Willd.	Lango
Rubiaceae	*Canthium schimperanum* A. Rich.	Kango
Sapindaceae	*Haplocoelum foliolosum* (Hiern) Bullock	Ahundwi
Simaroubaceae	*Harrisonia abssinica* Oliv.	Pedo
Tiliaceae	*Grewia mollis* A. Juss.	Aroyo

REFERENCES

BAKER, B. H. & WOHLENBERG, J., 1971, Structure and Evolution of the Kenya Rift Valley, *Nature* **229**: 538–541.

CARCASSON, R. H., 1964, A Preliminary Survey of the Zoogeography of African Butterflies, *E. Afr. Wildl. J* **2**: 126–157.

CHESTERS, K. I. M., 1957, The Miocene Flora of Rusinga Island, *Palaeontographica* **101**: 30–71.

East Africa Meteorological Department, *Climatological Statistics for East Africa Part 1, Kenya and Seychelles*, 1971.

FADEN, R. B., Personal Communication, November 1971.

GLOVER, P. E., 1968, The role of fire and other influences on the savannah habitat, *E. Afr. Wildl. J* **6**: 131–137.

KENDALL, R. L., 1969, An Ecological History of the Lake Victoria Basin, *Ecol. Monog.* **39**: 121–176.

LANGDALE-BROWN, I., OSMASTON, H. A. & WILSON, J. G., 1964, *The Vegetation of Uganda, and its Bearing on Land Use*, Government of Uganda, Entebbe, 159 p.

LEAKEY, M. D. & OWEN, W. E., 1945, A Contribution to the Study of the Tumbian Culture in East Africa, *Coryndon Mus. Occ. Pap. No. 1.*

LEAKEY, M. D., OWEN, W. E., & LEAKEY, L. S. B., 1948, Dimple Based Pottery from Central Kavirondo, *Coryndon Mus. Occ. Pap. No. 2.*
MICHELMORE, A. P. G., 1939, Observations on Tropical African Grasslands, *J Ecol.* **27**: 282–312.
MOREAU, R. E., 1952, Africa since the Mesozoic, *Proc. Zool. Soc. Lond.* **121**: 869–913.
OGOT, B. A., 1967, *History of the Southern Luo*, East Africa Publishing House, Nairobi.
PRATT, D. J., GREENWAY, P. J. & GWYNNE, M. D., 1966, East Africa Range Classification, *J appl. Ecol.* **3**: 369–382.
TRAPNELL, C. G. & GRIFFITHS, J. F., 1960, The Rainfall-Altitude Relation and its Ecological Significance in Kenya, *E. A. Agric. J* **25**: 207–213.
VAN COUVERING, J. A. & MILLER, J. A., 1969, Miocene Stratigraphy and Age Determinations, Rusinga Island, Kenya, *Nature* **221**: 628–632.
VERDCOURT, B., 1967, The Miocene non-marine Mollusca of Rusinga Island, *Palaeontographica* **121**: 1–37.

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