The Uganda Journal

THE JOURNAL OF THE UGANDA SOCIETY

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THE LOWER MIOCENE FOSSIL SITE OF BUKWA, SEBEI

By A. WALKER

The Miocene fossil site at Lamitina near Bukwa, Sebei was first found in 1965 by Drs. R. Macdonald and R. A. Old of the Uganda Geological Survey. Macdonald and Old found the hill of sediments that comprises the site when preparing a geological map of the area; they collected invertebrate and plant remains.

In December 1965 a team led by F. P. Henderson and the writer collected *Dinotherium hobleyi* on the south slopes of the hill and that site was designated Bukwa I. In 1966 the main fossil-bearing stratum was discovered by Dr. W. W. Bishop and the writer and the gulleys in which it was exposed called Bukwa II. Surface collection from Bukwa II yielded promising results and in December 1967 a small part of that site was excavated and topographical and local geological mapping was carried out in some detail. In June 1968 a second excavation was made at Bukwa II and at the same time a party of students from the Uganda Geological Survey under the direction of Dr. P. Brock carried out more widespread geological mapping and excavated some critical sections.

The site is situated on the northeast slopes of Mt. Elgon (Masaba), 2¼ miles east-by-south of Bukwa, Sebei, Uganda (lat. 1°17'N., long. 34°47'E). The fossil site of Bukwa II lies at the foot of a small hill (Kwongori Hill), east of the village of Lamitina and that of Bukwa I on the south slopes of the same hill. The base of the main fossiliferous bed is approximately 5,900 feet above sea level.

Geology (*see* map 2 and Fig. 1).

The results of mapping in 1965[1] and of 1968[2] will be available shortly. The following general account is based on that work and on the writer's own observations.

A series of subacrial tuffs and intercalated lava flow are seen to fill a basement depression through which the present rivers Chamangeni and Senendet flow. The oldest sediments to be seen are very coarse boulder beds and are found in the valley of these two rivers. The boulders are, for the most part, rolled blocks of lava. These boulder beds appear to be rapid infillings of former river courses that happen to coincide roughly with the present drainage system. The succeeding beds are a series of tuffs, conglomerates and basaltic lava flows that lie either on the boulder beds, where exposed, or on an irregular, lateritized basement surface. The immediate geology of the fossil site, that is the series of sediments that comprise the small hill, is as follows.

A low basement hill is seen a few yards to the west of site Bukwa II immediately west of the track leading to Kabuchai. This basement rise is covered to the south by a heavily eroded tongue of lava that is seen to extend to the west as far as Lamitina. Banked against the basement rise and this lava flow are a series of alternating tuffs and marls that are exposed to a depth of some 22

feet. Above these sediments, a boulder bed consisting of spheroidally-weathered lava boulders dips eastwards from the lava flow, the boulders decreasing in size but increasing in frequency away from the flow. Succeeding this boulder bed is the main fossiliferous stratum, a bed of pale green clay that varies in thickness from a few inches near the flow to 6 or 7 feet at its most easterly exposure. The top of the green clays is roughly horizontal over all its exposed extent. The green clay passes upwards into flaggy marls that grade into a series of tuffs that makes up most of the sediments of the hill. This main series of tuffs is surmounted by a small cap (14 feet in total thickness) of hard blue lava.

Samples of the capping lava have been radiometrically dated by the Potassium/Argon method through the kindness of Dr. J. A. Miller of Cambridge University and Dr. R. L. Armstrong of Yale University. Their results are as follows:

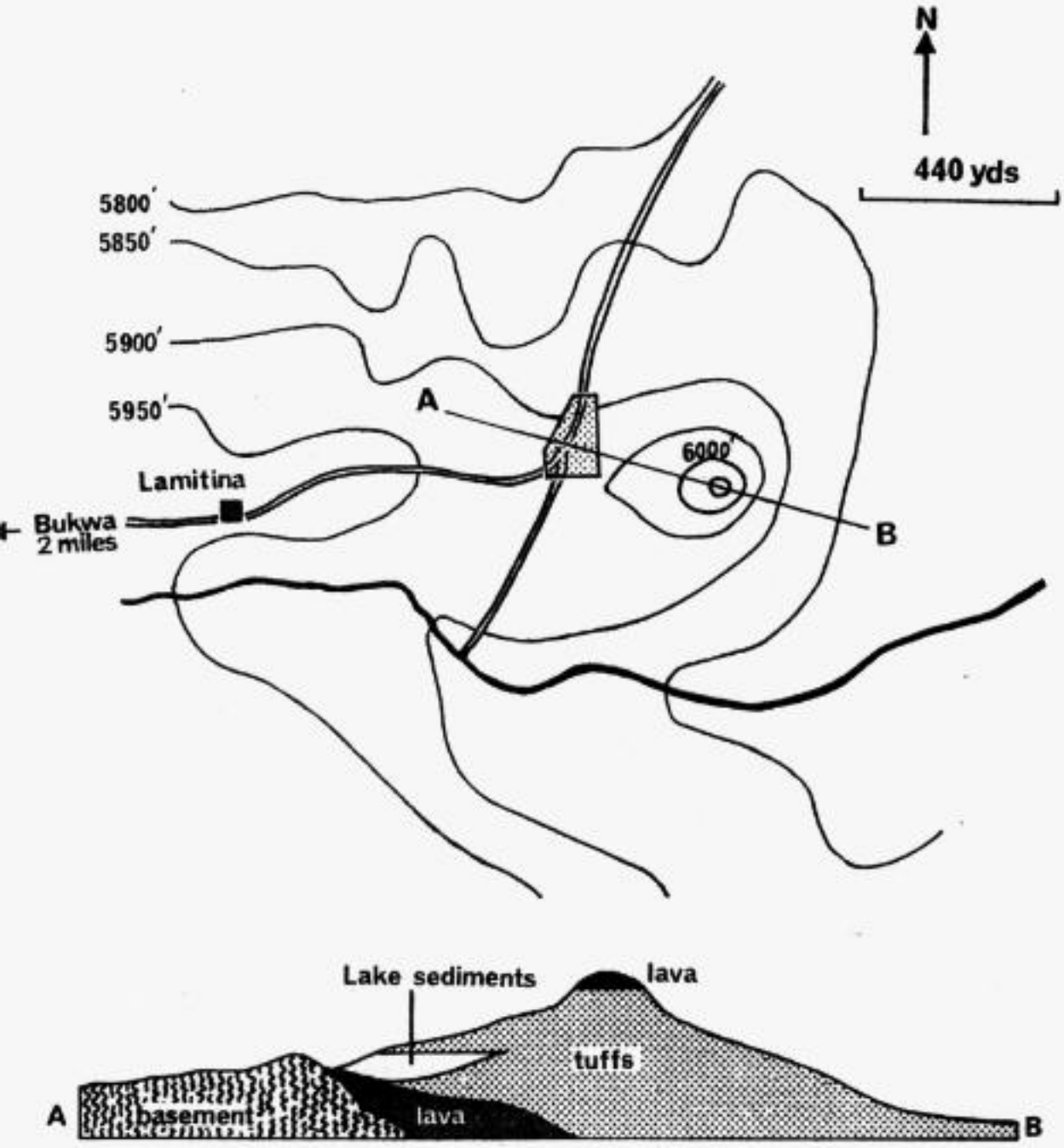
Upper lava	Armstrong	$20.1 \pm 1.3 \times 10^6$ years B.P.
	Miller	$22.0 \pm 0.2 \times 10^6$ years B.P.
		$21.9 \pm 0.2 \times 10^6$ years B.P.

A sample of the lower lava that abuts against the basement, was also dated by Dr. Armstrong and gave the following result:

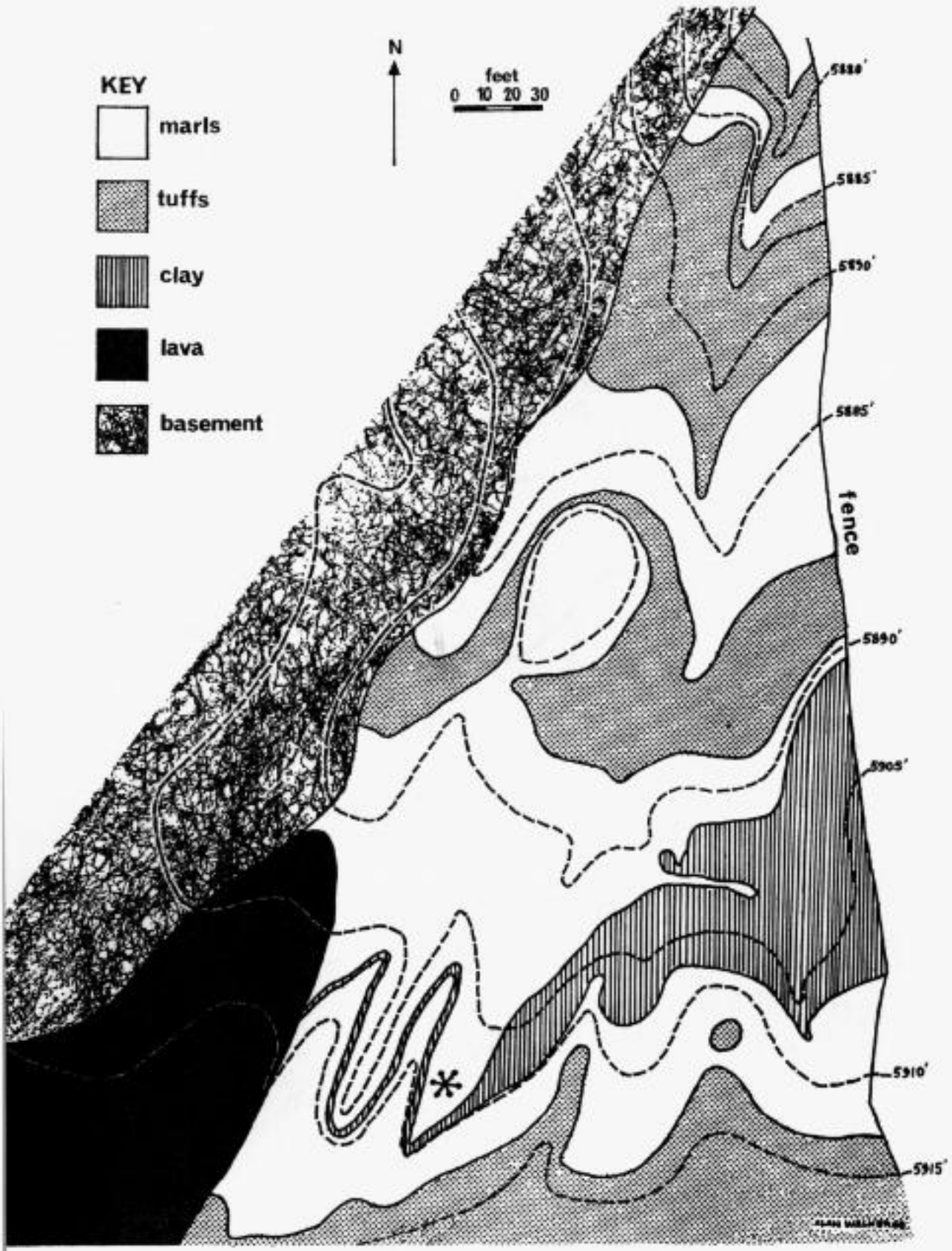
Lower lava	Armstrong	$17.4 \pm 0.3 \times 10^6$ years B.P.

In view of the fact that the two different laboratories both gave closely similar ages for the capping lava and that there is no evidence for inversion of the sediments, the date for the lower lava must be regarded as erroneous. A re-examination of the sample supplied to Dr. Armstrong indicates that there was a high possibility of Argon leakage and a further sample of a closely associated but less weathered flow is being sent for further analysis. It is hoped that with the new sample two dates will be available on the upper and the lower lavas and hence the age of the enclosed sediments accurately determined. The upper age limit for the sediments of about 22 million years leaves no doubt that they and their enclosed fauna and flora are correctly assigned to the Lower Miocene.

The pre-volcanic basement topography was strikingly irregular and in the Bukwa region had a general slope to the northeast. This slope was dissected by rivers and steams running to the northeast. Deep weathering surfaces are found where the basement is not scoured clean. The first evidence of signs of volcanic activity is the presence of coarse lava boulder beds that are seen to fill the old pre-volcanic drainage system. Subsequent to this a whole series of ashes and lavas covered most of the Bukwa area. In some cases there is a great thickness of ash and in other places the tuffs are seen to abut horizontally against basement slopes or partly eroded lava flows. In the immediate region of site II a small western basement rise, together with a slightly more southerly eroded lava flow, provided the western limits of a small lake. This lake seems to have been nothing more that a shallow depression in the tuffs, but the presence of a good aquatic fauna and the fact that a thickness of at least 6 feet of true clays were laid down indicate that a considerable expanse of water was present. The base of the fossil bed (i.e. the lake bed) is seen to dip northeastwards and is covered by rounded pebbles. The basin eventually filled with clays and as the lake became shallower so the upper marls were laid down. The rest of the sedimentary sequence seen at Kwongori Hill is a series of subaerial tuffs mostly horizontally bedded and containing land invertebrates, such as gastropods and millipedes, as well as several fossil plant horizons including sedge, grass, flower and leaf beds. There is some evidence to suggest that at certain times the ash surface was under a shallow sheet of water and that plant debris was washed in, but the grass and sedge beds have the plants in their positions of



Sketch-map showing location of fossil site Bukwa II with cross section of simplified geology along the line A–B.



Geological sketch-map of the immediate area of the Bukwa II site. The asterisk marks the site of the main fossiliferous gulley

growth, often with the tops of the plants bent and broken by the next ash fall. It seems most likely that the small capping lava flow, of which only 14 feet remains on the hill, was not a widespread flow but a narrow tongue. Post-volcanic erosion has removed nearly all the sedimen, been preserved. The many of the lava flows in this area. Only by virtue of the protection afforded by the capping lava have the soft fossil-bearing sediments been preserved. The present-day drainage system conforms closely to that of the pre-volcanic times. This could perhaps be accounted for by supposing a rejuvenation of stable rivers that were outside the control of the more southerly volcanic lavas and sediments, the pre-volcanic basement mostly being harder than the lavas or pyroclastics.

Fauna and Flora.

An extensive fauna and flora has been collected from the Bukwa site and all specimens are housed in the Uganda Museum. A preliminary account of the flora is given by Hamilton.[3]

The faunal list is as follows:

MAMMALIA	
Primates:	*Limnopithecus legetet* Hopwood
Insectivora:	*Myohyrax oswaldi* Andrews
	others as yet unidentified
Hyracoidea:	*Megalohyrax championi* Arambourg
	Meroehyrax bataeae Whitworth
Proboscidea:	*Dinotherium hobleyi* Andrews
	indeterminate mastodonts
Perissodactyla:	
Rhinocerotidae:	*Chilotherium* sp. nov.
	Diceroryhinus sp.
Artiodactyla:	
Anthracotheriidae:	*Brachyodus aequatorialis* MacInnes
	?*Hyoboops africanus* Andrews
Suidae:	*Diamantohyus africanus* Stromer
	?*Lystriodon jeanneli* Arambourg
Tragulidae:	*Dorcatherum parvum* Whitworth
	Dorcatherum pigotti Whitworth
	large tragulid (not *Dorcatherium chappuisi*)
Palaeomerycidae:	*Palaeomeryx* sp. (the large species of Whitworth)[4]
Rodentia:	*Megapedetes pentadactylus* MacInnes
	others as yet unidentified
Carnivora:	small and medium sized, indeterminate carnivores.
AVES	wading birds
REPTILIA	*Crocodylia* sp.
	trionychid and pelomedusid water tortoises
PISCES	medium sized and tiny fresh-water fish

Invertebrate fossils include millipedes, potamid crabs, ostracods (species of *Heterocypris*) fresh-water and land gastropods.

Table 1

Species	Bukwa	Rusinga	Karungu	Songhor	Koru	Mwafanganu	Ombo	Napak	Moroto	Congo Miocene
Limnopithecus legetet	X	X	—	X	X	—	—	X	—	—
Myohyrax oswaldi	X	X	X	?	—	—	—	—	—	—
Megalohyrax championi	X	X	X	X	—	—	—	X	—	—
Mercohyrax bataeae	X	X	—	—	—	—	—	—	—	—
Dinotherium hobleyi	X	?	X	—	—	?	?	—	?	X
Chilotherium sp.nov.	X	?	—	—	—	—	—	—	—	—
Diceratherium sp.	X	X	—	—	—	—	?	X	—	—
Brachyodus aequatorialis	X	X	?	—	—	X	—	X	X	X
Hyoboops africanus	?	X	X	—	—	—	X	—	—	—
Diamantohyus africanus	X	—	—	—	—	—	—	—	—	—
Lystriodon jeanneli	?	—	—	—	—	—	—	—	—	X
Megapedetes pentadactylus	X	X	—	X	—	—	—	X	—	—
Dorcatherium parvum	X	X	X	—	—	—	—	—	—	?
Dorcatherium pigotti	X	X	X	—	—	X	X	—	—	?
Palaeomeryx sp. (large sp.)	X	X	—	—	—	—	—	—	—	—

Table I gives a summary of the main elements of the Bukwa fauna compared with those of other East African Miocene sites. Almost all the mammals found at Bukwa have also been found on Rusinga Island, but as the Rusinga sites have been pooled in the most up to date lists[5] it is possible that comparison with any one Rusinga site would be unfavourable. Nearly all the Rusinga sites have now been placed in the Hiwegi series and dated at between 17.5 to 18 $\times$ 10^6 years B.P. Site 113 is probably the only one of equivalent age to the Bukwa deposit[6] The early Miocene site of Karungu compares well with Bukwa and has been dated at about the same age (22 $\times$ 10^6 years B.P.)[7].

Of especial interest in the Bukwa fauna is the presence of a pig, *Diamantohyus africanus*, previously known only from South West Africa and Baluchistan. The ceratocerhine rhinoceros *Chilotherium* is known from Africa by an upper third molar from Loporot, Kenya and by two fragmentary teeth from Rusinga[8] Plate I is a reconstruction of the left upper premolar/molar series that have been recovered from Bukwa. The enormous size of the molars, the great height of the crowns of all the teeth, the presence of a first upper premolar as indicated by a facet on the mesial border of the second premolar all serve to place the species in the genus *Chilotherium*. The Bukwa teeth and limb bones will certainly enable a diagnosis to be made.

After excavation with the trowel the fossiliferous green clay was broken down in water and passed through fine sieves in order to recover the smaller specimens. Only clay and ostracods passed through the sieve and small teeth and bones remained. Some of the rodent and insectivore teeth are of such small size that it is doubtful whether the species from which they come have been recorded previously from the East African Miocene.

The value of the Bukwa fauna lies in the fact that it is from one of the earliest Miocene sites in Africa, and that the nature of the sediments allows a representative sample of the fauna from the largest to the smallest mammals to be collected. It is apparent that each of the East African Miocene volcanoes had a forest fauna that, by analogy with present conditions, should be in some ways unique to each mountain mass. This, the first mammalian fossil site on Mt. Elgon, should enable more easy comparison with the faunas of the separated mountain masses of Napak and Moroto in Uganda and the Kavirondo mountain (Rangwa) of Kenya, for it is situated midway between the two areas. It is hoped that future excavation will lead to a greater knowledge of the fauna and flora. Meanwhile the better specimens are being made available to the relevant experts for study.

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