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THE GEOLOGY OF THE MZIMBA AREA

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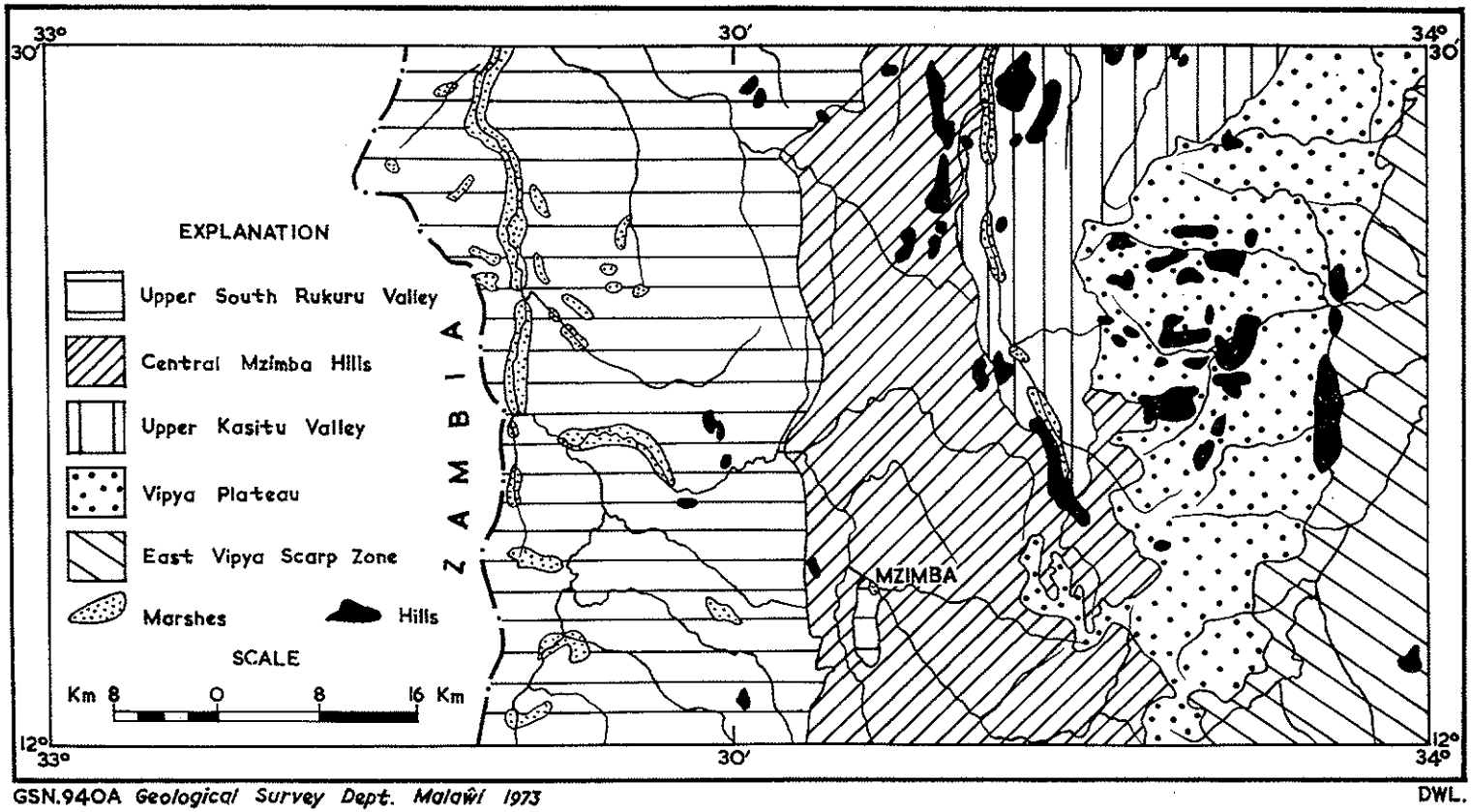

FIG. 2. Topographical units in the Mzimba area (*after Young and Brown* 1962).

II. PHYSIOGRAPHY

(a) Topography

The area falls naturally into the five topographical units (Young and Brown 1962) depicted in Figure 2, the chief characteristics of which are the following:–

(i) *The upper South Rukuru Valley*

This zone extends from the Zambian border to about longitude 33° 30'E. Its mean elevation is around 1220 m (4000 ft) and its monotonously flat topography is interrupted only by a few inselberg features such as Sorora Hill.

(ii) *The Central Mzimba Hills*

This term is used to describe a belt of hilly ground along and to the west of the watershed between the South Rukuru and Kasitu basins, generally at elevations of 1370 m to 1590 m (4500 ft to 5200 ft). The area is dissected by the tributaries of the South Rukuru River, and features several prominent inselbergs such as Mt. Hora and Mazozo Hill.

(iii) *The upper Kasitu Valley*

The Kasitu River rises on the Vipya escarpment in the Mtanga Tanga Forest Reserve and traverses the area in a northerly direction. The river itself flows in a marsh belt 100 m to 200 m wide, its course being determined by a major fault which marks the western edge of the Vipya Plateau. The valley itself is generally less than 6 km wide, its eastern side being the steep rise of the plateau edge and its western side the ridge of the Central Mzimba Hills.

(iv) *The Vipya Plateau*

As described above, the western side of this plateau is defined by the escarpment overlooking the Kasitu Valley, a feature which becomes less prominent towards the headwaters of the river. The plateau surface is an undulating peneplain with an average elevation of about 1680 m (5500 ft) drained by wide, shallow, frequently marshy valleys separated by gently convex interfluves. It is surmounted by several prominent inselbergs exceeding 1820 m (6000 ft) in height such as Mpamphala and Nkalapya Hills. Towards the east the surface is dropped about 300 m (1000 ft) by the Chikangawa Fault (Plate II) forming a broad shelf which merges eastwards into the scarp zone described below.

(v) *The East Vipya Scarp zone*

This zone which, east of the area presently described, descends to the level of Lake Malawi, is deeply dissected and features several deep steep-sided gorges formed by the various tributaries of the Luweya River system.

(b) Drainage

The area has three distinct drainage basins – the South Rukuru, the Kasitu and the Luweya.

The South Rukuru River (which rises on the western face of the Vipya Mountains south of the Mzimba area) meanders northwards through extensive *dambo** near the Zambian border which follows the watershed with the Luangwa River drainage in Zambia. All the major tributaries of the South Rukuru flow westwards

* Chichewa: broad, grass-covered, swampy valley(s).

from the Vipya Plateau and Central Mzimba Hills, many having a perennial flow. The chief tributaries from south to north are the Njoka, Mirara, Ngoli, Mzimba, Luwanjazi, Luwankasi and Luwewya Rivers.

The Kasitu River drains the northern part of the west Vipya scarp, flowing northwards in its fault-controlled valley. North of the Mzimba area it is joined by the Kafurufuru, another fault-controlled river, and is eventually confluent with the South Rukuru.

The Luweya system drains the eastern flanks of the Vipya Plateau, its main tributaries being the Kalungulu, Chikangawa, Muzitu, Lichelemu and Luwafwa Rivers. The north-easterly course of the Luweya itself is fault-controlled, the river flowing in a straight deep gorge for about 28 km. Since much of its catchment area receives 1370 mm to 2000 mm of rainfall per annum, it has one of the highest average discharges in the country.

(c) Erosion surfaces

The undulating planation on top of the Vipya Plateau has been ascribed (Lister 1967) to the post-Gondwana erosion cycle of early to middle Cretaceous times (Fig. 3).

The valleys which dissect the plateau, more deeply in the southern part of the area, are considered to be the headwaters of the African erosion cycle which was operative between late Cretaceous and early Miocene times.

The best development in the area of the very mature African surface however is the peneplain extending over the South Rukuru basin and the Central Mzimba Hills. Rift faulting and slight upwarping to the east, dating from late Miocene times, promoted the post-African (late Miocene and Pliocene) erosion cycle which resulted in broad shallow valleys and gentle slopes merging gradually with the African surface to give the present composite topography. The lower Kasitu valley is also a post-African feature.

The deep dissection of the East Vipya Scarp is also the effect of post-African erosion of an African surface, with Quaternary incision affecting the Luweya and other fault-controlled valleys.

(d) Climate and Vegetation

West of the Vipya Plateau the Mzimba – South Rukuru plains have a warm, fairly dry climate with mean annual temperatures of 18,3°C to 21,1°C. Rainfall varies from 635 mm in the west to 1370 mm at the Plateau edge.

On the Plateau itself the climate can be described as cool and fairly wet with mean temperatures in the range 12,8°C to 15,6°C. Annual rainfall is about 1370 mm, most of which falls in the months December to April.

The East Vipya Scarp zone is warm to hot and wet with a mean temperature range of 18,3°C to 23,9°C and rainfall generally between 1370 mm and 2000 mm per annum.

The natural vegetation of the South Rukuru Valley is open grassy woodland in which the dominant tree varieties are species of *Brachystegia* and *Julbernardia*. On the Central Mzimba Hills *Brachystegia cryptosepalum* is the characteristic tree in similar woodland. The vegetation of the Vipya Plateau is montane grassland with scattered shrubs and small trees. Patches of montane evergreen forest in the valleys suggest that these may be the relicts of a once more extensive cover of this type. The Vipya Plateau already carries extensive plantations of coniferous trees and planting continues with the objective of covering most of the plateau surface. The timber is destined to support a pulpwood industry. The East Vipya Scarp zone supports a moist *Brachystegia* woodland which is denser than the open woodland of the western plains and may have a closed canopy and sparse grass or other undergrowth.

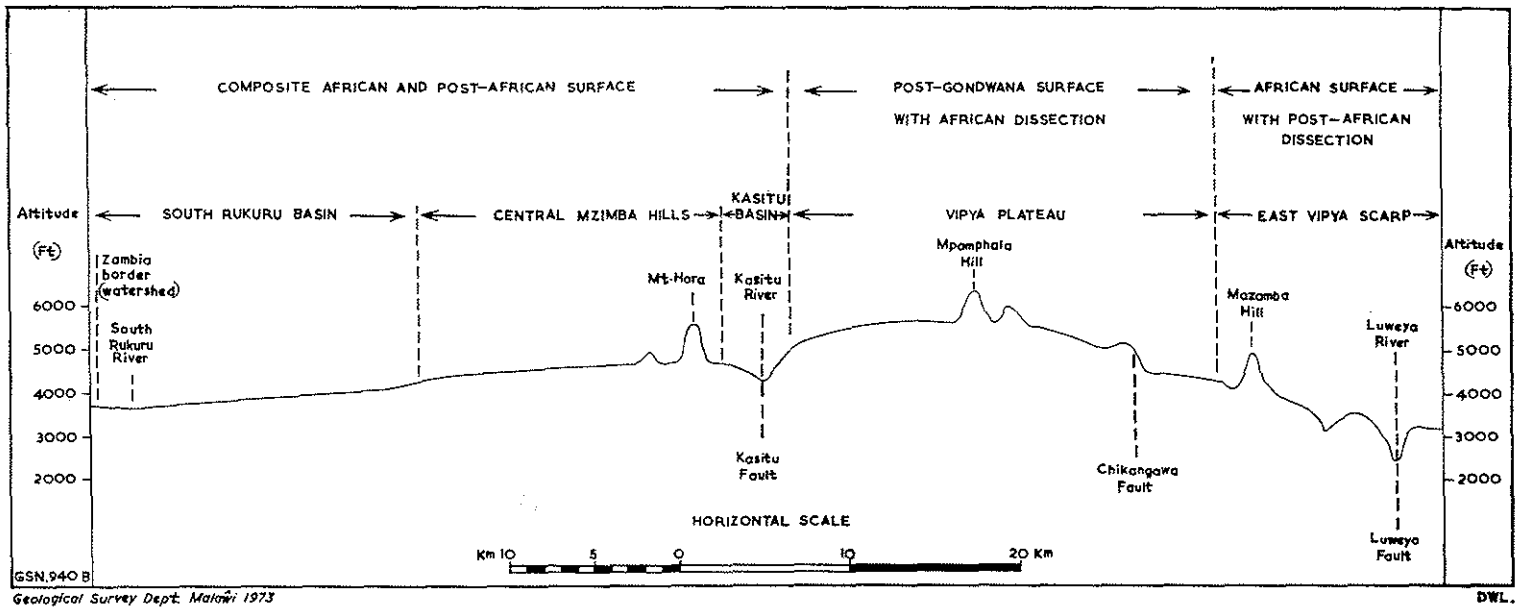

FIG. 3. Diagrammatic section across the Mzimba area showing the relationship between topographical units and erosion surfaces.

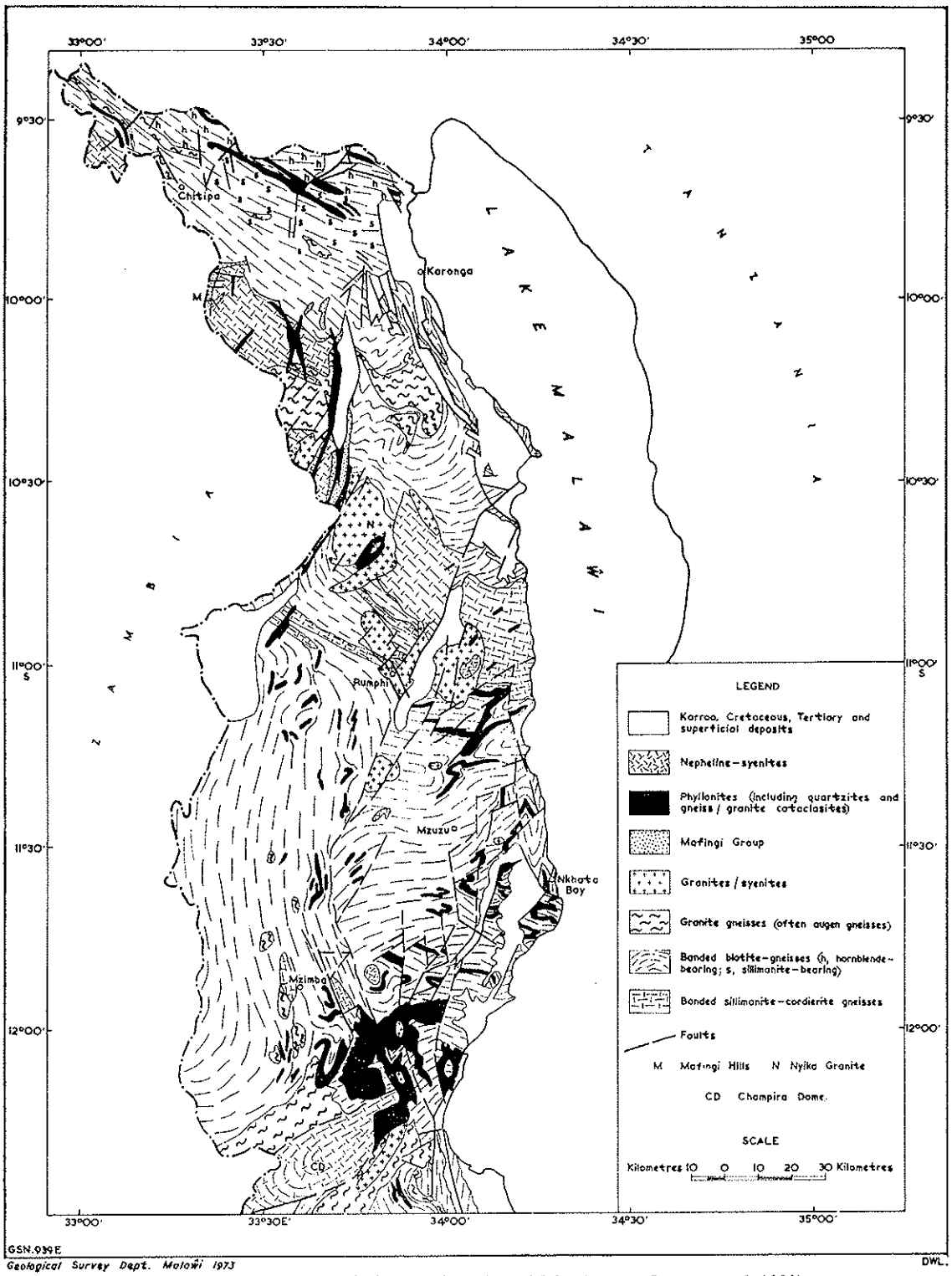

FIG. 1. Generalized geological map of northern Malawi (*after Cannon et al.* 1969).

The samples were analysed spectrographically for the seven elements copper, chromium, lead, molybdenum, nickel, silver and tin. A selected number were analysed for arsenic by a modified Gutzeit method, and for zinc and copper by atomic absorption spectrophotometry using the perchloric acid method of extraction. Niobium was determined chromatographically.

The results (Carter 1968–69, unpublished reports EMR 10, 35 and 39; Dawson 1968, unpublished report EMR 20; Gaskell 1968, unpublished report EMR 27; Carter *et al.* 1973) showed no groupings of anomalously high values which justified follow-up programmes. The following features of regional geological interest emerged however.

Slight rises in niobium values are associated with granite-gneiss masses to the north of Mzimba, particularly the one forming Kabondwe Hill, recalling similar associations in the granites of the Rumphi area to the north (Hopkins 1973).

Small increases over background values for nickel and chromium in the Mombera area are associated with pyroxene gneisses, thus supporting the view that these may have originated as enderbitic igneous rocks.

Relatively high niobium, lead, zinc and molybdenum indications are associated with the Chikangawa nepheline syenite but no absolute values high enough to warrant investigation were obtained.

Of particular interest is the occurrence of a pervasive high background for lead in streams associated with mica pegmatites. While stream sediments on paragneisses elsewhere in the country have lead values of the order of 10 to 20 ppm, those in the pegmatite areas gave a mean value of 50 ppm. The pegmatites themselves gave rock values of only 50 to 100 ppm which are not high enough to account for the elevated background level. This must be due to a correspondingly high level of lead acquired by the country rocks at the time of pegmatite emplacement.

(c) Water supply

Of the total of 55 boreholes drilled for water supply in the area, all but a few are located in the peneplain of the upper South Rukuru basin. Only one hole failed to provide water. The average depth of the holes was 40 m (131 ft) and the average yield 655 g.p.h. This figure corresponds fairly closely to a typical yield from weathered gneiss aquifers. These are characteristic of this basin (Pascall 1973, unpublished report DP/10) due to the deep weathering prevalent below the mid-Tertiary land surface which has undergone only shallow erosion to produce the present-day topography.

Details of location, depth and yield of the boreholes are given in Table II and sites are marked on the accompanying geological map.

TABLE II

BOREHOLES DRILLED FOR WATER SUPPLY IN THE MZIMBA AREA UP TO JUNE 1973

Ref. No.	Locality	Grid Reference	Depth (m)	Depth (ft)	Yield (gph)	Year drilled
E 98	Eswazini Sub Court	WC 720039	24	79	310	1957
E 99	Jandalala	WC 684181	20	65	410	1957
E 100	Bulala School	WC 489092	36	118	325	1957
E 101	Mzalangwe	WC 615169	37	121	410	1957
E 97	Manyamula	WB 479808	37	121	780	1958
E 189	Njingi	WB 389802	32	104	900	1958
W 81	Viyuku Makomo	WB 503889	37	120	440	1960
W 82	Kapopo	WB 487822	49	161	500	1960
W 212	Nelson Nkata	WB 514802	44	143	440	1960
W 217	Kandodo Chisi	WB 582814	43	140	264	1960
W 300	Hora Farm Institute	WC 680142	61	200	330	1961
A 77	Mombera Mission	WC 750053	48	156	400	1962
E 138	Yakuwata	WB 652844	28	91	561	1962
W 84	Chisasa	WC 514006	34	111	720	1962
W 291	Timothy Mpaka	WC 423029	12	38	*	1962
H 12	Mpanga Visoti	WB 497739	47	154	720	1965
H 13	Aaron Hara	WB 463742	36	117	514	1965
H 14	Bichi Mumba	WB 487739	35	116	500	1965
H 15	Thomas Nyirenda	WB 444820	59	195	514	1965
H 16	Mtora Bota	WB 449829	57	188	660	1965
H 17	Mteyo Ngoma	WB 488791	44	144	720	1965
H 18	Daniel Tembo	WB 475911	47	155	500	1965
H 19	Gomani Kandaviri	WB 498855	16	53	*	1965
H 20	Dickson Sagara	WB 479913	52	170	610	1965
H 21	Jonas Lowore	WB 476833	43	140	440	1965
H 23	Kasoti Phiri	WB 566892	?	?	NIL	1965
H 24	Damasek Phiri	WB 543872	31	103	440	1965
H 25	Chingati Chirwa	WB 521816	43	140	1060	1965
H 26	Daniel Ngoma	WB 391887	30	100	1400	1965
H 27	Ngalaweni	WB 396841	21	70	*	1965
H 28	Mjinge	WB 383806	35	115	1200	1965
H 29	Kamteteka	WB 388967	18	60	1200	1965
H 30	Wajingo	WB 388932	22	72	*	1965
H 31	Emoneni	WB 351891	32	105	1400	1965
H 32	Chuya	WB 358807	29	95	1200	1965
H 33	Kabuku	WB 369789	34	110	1200	1965
H 34	Likoti	WB 365761	17	55	*	1965
H 35	Paulosi Ntara	WB 344741	41	136	1400	1965
Q 137	Basopo	WB 470997	32	105	480	1968
Q 146	Bongowongo	WB 533993	43	141	300	1968
Q 147	Chikosera	WB 551992	37	123	576	1968
Q 148	Daniel Muwowo	WB 393969	37	122	800	1968
Q 149	Chisengese	WC 395003	37	122	720	1968
R 176	Manyamula Rural Training Centre	WB 486814	40	132	600	1970
R 180	Kholwani Lungu	WB 362922	55	180	900	1970
R 181	Kamangadazi	WB 443938	40	133	550	1970
R 186	Kamwanjiwa Young Pioneer Base	WC 444093	30	97	720	1970
R 187	Mungoni Wamavi	WB 413938	41	135	800	1970
DP 48	Mzalangwe Dip Tank	WC 621153	51	167	175	1971
FC 75	Kamanjiwa Young Pioneer Base	WC 448092	43	140	650	1971
RB 80	Bapani Project	WC 647056	45	146	250	1972
RB 85	Chinyera	WC 735230	44	143	340	1972
GK 34	Kamcoco Road Camp	WC 444106	46	150	1345	1973
GK 35	St. Paul's Parish	WB 662858	47	153	570	1973
GK 40	Chindi	WC 451266	46	150	515	1973

Depth in metres calculated to nearest whole metre.

* Not measured: drilled by hand rig.