

File ~~77~~44726

**Notes on the Geology, Land Forms and Soils of the
Tanga Province, Tanganyika Territory**

**By
G. Milne**

EAST AFRICAN AGRICULTURAL RESEARCH STATION, ARSHI.

NOTES ON THE GEOLOGY, LAND FORMS AND SOILS
OF THE TANGA PROVINCE, TANGANYIKA TERRITORY

By

G. Milne, Soil Chemist.

GEOLOGY.

(See Provisional Geological Map of Tanganyika, revised edition 1936, publ. Geol. Division, Lands and Mines Dept., Dodoma).

A fringe of raised recent coral limestone runs intermittently down the coast, seen typically at Ras Kazoni.

Inland from this as far as a line running roughly NNE - SSW, and forming a strip about 17 miles wide at Tanga, a little wider at Moa and perhaps 30 miles wide at Saadani, are sedimentary rocks, mostly older than the coral. These include: Jurassic clays and marls some hundreds of feet thick, seen typically in the rolling savannah country between Pongwe and Ngomeni and extending southwards across the Wami River to the Central Railway; a hard pure oolitic limestone, seen typically at Kaweni and at Pongwe; Karroo sandstones and shales between Tanga and Moa, — one form is very like the Millstone Grit of Yorkshire; detrital deposits covering these older rocks and derived by denudation and fluvial deposition from the Basement Complex highlands and plateaux to the west; and deltaic clays and other alluvium principally at the Wami mouth around Saadani.

West of the NNE - SSW line bounding the sedimentary rocks lie the Basement Complex rocks, which occupy the entire remainder of the Tanga Province except for some local alluvia of the Pangani, Mkomazi, Mombo, Luengera and Umba Rivers. The

B.C. rocks are mainly hard gneisses; but there is at least one band of ancient crystalline limestone which crops out across the Kibaya road just west of Handeni, and there may be more such in Uziguha, the Masai Steppe and the Uмба Steppe. I know of no limestones in Usambara or Upare. There are local occurrences of metamorphic rocks of basic character, pegmatites, and graphitic schists. Locally also the gneiss outcrops show much vein-quartz, e.g. just east of Handeni.

There are no volcanic rocks in the Province.

Some extensive black-clay mbugas in the Masai Steppe probably represent old shallow lake sites.

There are gypsum beds at Mkomazi, also salt-impregnated patches on the Usambara pediment-slope in the same region. Lake Manka, a blind "appendix" of the Mkomazi River, is saline. Some well waters in the Usambara foothills and also in the coastal sedimentary belt are brackish with magnesium chloride. Analyses of "sulphur baths" at Amboni are, I believe, extant in the German MS files at Amani. A warm spring was reported at Mnyussi but it did not appear to be a "mineralised" water.

LAND FORMS.

The belt of sedimentary rocks forms a variably undulating plain rising gently westwards from the sea. The Usambara highland (the only East African highland near the sea) is in two blocks. The Eastern block is a plateau 3000 - 4000 ft. high scored by an intricate valley system converging to the Sigi River. It is bounded by steep scarps 1500 - 2500 ft. high rising from a pediment 500 - 1000 ft. above sea-level. Upon the pediment, at the south side mainly, sit a number of low foothills, and there are two major outliers of the highland, — Mlinga, separated to the east from the main block by the north-

going reach of the Sigi River, and Pongwe Mountain south of Muhesa. The Eastern block is severed from the higher Western block by the deep broad N-S Luengera Valley draining to the Pangani and a S-N notch draining to the Uмба. West Usambara has equally steep but higher boundary escarpment and goes to a maximum height of 7000 ft. in the north. It has a few high outliers beyond the Mkomazi River to the west. Its plateau valley systems converge to the Mkussu - Mombo stream tributary to the Mkomazi, to the Luengera which joins the Pangani below the Mkomazi confluence, or to the Uмба, which flows directly eastwards to the sea.

There is a deep gap between north-western West Usambara and southern Pare. Pare (in its southern parts that lie in Tanga Province) is more of a mountain chain than a plateau; its western escarpment is abrupt and steep, its eastern slope breaks down more gradually and has spurs and foothills with valleys draining to the Mkomazi River. The Pare-Usambara gap widens out north-eastwards to the Uмба Steppe, across which there is no further high ground till far beyond the Kenya border.

The Pangani River, carrying the Killimanjaro, Meru and North Pare drainages, passes to the west and south of all the above-mentioned highlands and their outliers; it receives the Mkomazi, Mkussu-Mombo and Luengera Rivers, but almost none of the East Usambara drainage, which goes to the sea independently via the Sigi and the Mkulamuzi Rivers.

West of the Pangani trough, beyond a low escarpment, lies the Nasai Steppe, a broad arid plateau carrying a few scattered isolated residual hills but with well-defined

drainages only at its outermost margins.

Between the Pangani in its reaches between Korogwe and the Falls, and the margins of the Wami Plain to the south, is the broken-down peneplain of Uziguha, a low plateau shallowly dissected and draining mainly by the Msangasi River and other minor channels of intermittent flow to the sea or to the Wami. To the west of Uziguha lie the Nguru Mts., projecting northwards from Ukaguru and Usagara and dying out in the Masai Steppe in a series of isolated hills. Kanga Mountain is an easterly outlier of the Nguru chain.

SOILS.

(A short account of the Soils of the Tanga Province was written and published as an appendix to Mr. E.C. Baker's report on the Social and Economic Conditions of the province, Government Printer, Dar es Salaam 1934. For soils of the E. Usambara highland, see Essays in Applied Pedology, I, E. Afr. Agric. Journal 1937. For soils of the northern part of West Usambara highland and adjacent low country, see a typescript report on a Soil Reconnaissance in the neighbourhood of Kitivo etc., 1937, copies available at Amani on request. See also the relevant part of the Provisional Soil Map of East Africa, 1936, and its accompanying Memoir.)

A list of the chief soil types is given below. For some of them, names are given,^x which are provisional and are intended to cover a fair range of variation around the central type.

Ras Kazoni loams. Chocolate loams to clay loams over the coral rock of the coastal fringe. Are shallow and pockety, but fertile when sufficiently deep. Have high lime status but no free carbonate. They pass locally into.

Mkonduchi calcareous mould (a type better represented in the Wanda country of Zanzibar). A brownish black primitive soil, of loose friable consistence, containing large amounts of vegetable debris and free calcium carbonate, occurring discontinuously amongst outcrops of coral rock.

^xThe naming of a soil after a locality merely provides a convenient label for it for easy reference. It does not imply that the soil is found only in that particular place nor that it is the only or necessarily the most important soil there.

Amboni sandy loams. Brown to grey-brown or red-brown sandy loams over orange-brown to red-brown deep sandy-loam subsoils, developed on transported Basement Complex detritus in the coastal sedimentary belt. Of moderate acidity, low lime status and low organic matter content; well drained. The chief sisal soil of the coast estates.

Pongwe sands. Grey sands to loamy sands of good depth over clayey-sand to sandy-clay subsoils mottled at depth in yellow and grey with red blotches. Neutral to slightly acid, locally liable to waterlogging and generally of high water table. Typically around Tanga outskirts and Pongwe village, where they carry good maize, sweet potatoes, cassava, coconuts and locally rice.

Kasela sandy clays. Grey-brown, grey to nearly black sandy clays over impervious rusty-mottled yellowish brown clay subsoils on the Jurassic clays and marls. Mostly in grassland with scattered trees including xerophytic species and palms. Infertile and usually avoided for crops except some cassava. Alternately waterlogged and droughty.

Mlingano and Muhesa ^{over} loams and clay-loams. Chocolate to bright red-brown top soils/red subsoils, on the ridges, slopes and minor hills of the Usambara pediment, on Basement Complex rocks. There are two recognisable subdivisions of these red loams: Mlingano, on broad low ridges well away from the hills; bright colour, friable consistence, great depth, acid, poor in nutrients, but productive after resting periods under bush; and Muhesa, on narrower ridges and steeper slopes in the foothill region; browner colour, heavier consistence, better crumb-structure, shallower to parent rock, neutral reaction, good nutrient status, supports dense population in all food crops and also citrus fruits. One or other of these two main red-earth types occupies also much of Uziguha (in well drained situations) as far west as Kwediboma.

Dark-coloured clays, of valley bottoms amongst the foothills and broad flats on the plains. (These soils await further classification and no names are yet available except the general terms "black clays of the bondes and mbucas".) Surface soil colour varies from dark grey-brown through grey-black to inky black, subsoils are rusty-mottled in a yellow-brown to light grey ground colour or sometimes black to several feet depth. In the more humid country there is no free carbonate except at great depth, and the subsoils are acid and strongly mottled. In the drier country free carbonate occurs in the middle subsoil or right to the surface, and rusty mottling is absent. All soils of this group are sticky and plastic when wet, hard and cracked when dry, and are limited by these difficult physical properties and by their liability to excesses of drought or of flood, but their chemical reserves of plant nutrients are high. In humid or irrigable situations they carry rice and have sweet potatoes or sugar cane at their margins. In dry country they are uncultivated.

Soils, not yet named, intermediate in character between the red earths and the black clays, in situations of transitional character as regards topography, slope and drainage. Surface soil colours are dull brown to grey, subsoils

range from orange-brown to drab, sometimes with mottling, and in one special case associated with the Mlingano soils, with a horizon of massed ironstone concretions. All the foothill country contains narrow zones of one or more of these soils along the contours transitional from ridge-flank to bottom-land, and they occur extensively in the country between Korogwe and Handeni. A particular case falling in this group is the apron-slope soil that occurs as a strip between the foot of the high escarpment of West Usambara and the adjacent plain, e.g., between Mombo and Mkumbala, similarly between the East Usambara escarpment-foot at Magunga and the Luengera flood-plain. Most of the soils in this group are productive except in low-rainfall country, where they tend to develop a hard sheet-washed surface.

The soils of the highlands. In the highlands of Usambara, Pare and Nguru it is necessary to distinguish between several interlocking sets of conditions. There are the older soils of the elevated plateau surfaces and the younger soils of the escarpments and rocky slopes. Further, the wetter parts of the highlands have soils which are highly leached and exhaustively weathered, the drier parts have soils less leached and less senile. The higher highlands are cooler than the lower, with resulting differences in organic matter accumulation and associated secondary effects. Finally there has been some degree of control by parent rock, the Basement Complex gneisses being not everywhere uniform petrologically. The following list of highland soils is representative but not exhaustive :

Maramba, Mshituni, Sangerawe, Ulaya and other variants. 3000-3500 ft. plateau (East Usambara), rainfall 75-90 inches. Pinkish-brown orange-brown to yellow-brown soils, acid and exhaustively weathered, poor in all nutrients, texture sandy loam to clay loam, friable consistence, mealy structure, subsoil often gravelly, always permeable and well drained. On steep slopes and narrow ridges, no level land. Carries heavy rain forest but is mostly of poor fertility under agricultural crops.

Sakarre and related soils. 4500-5000 ft. plateau (West Usambara), rainfall 65 to 100 inches. As the foregoing, but darker in the top 6 to 9 inches owing to accumulation of dark-coloured humus. At still higher altitudes this effect becomes more marked and culminates in the Sungwe soil at 7000 ft., in which podsollic characters appear.

Gare, Kwemhalalo and related soils. 4500-5000 ft. plateau, rainfall 35 to 50 inches. Chocolate to reddish brown loams over red-brown to bright red deep subsoils, texture coarse sandy loam to stiff clay loam, reaction neutral to moderately acid, not exhaustively weathered, fertile but erodible and often found in truncated form, i.e., with top soil lost.

On steep declivities, juvenile soils occur varying from rudimentary black loams in direct contact with fresh rock to shallow and immature forms of the soils already listed. In general these young soils are more fertile than the maturer soils in regard to content of plant nutrients, but are limited by shallowness, discontinuity and liability to loss by physical displacement. There is scope for stone terracing on some of these slopes.

7.

Alluvial soils occur very locally in parts of the valley systems of the highland plateaux; they are referred to in paragraphs 31 and 48 of the Kitivo Report quoted above. Paragraphs 12 to 19 of the same report discusses the alluvial soils occurring at the foot of the Usambara escarpment where the Uмба River descends from the plateau to the plain. The alluvial soils of the Luengera and Mkomazi Rivers have not yet been studied.

G. MILNE
April, 1939.