RECORDS OF THE GEOLOGICAL SURVEY OF TANGANYIKA

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THE HOT SPRINGS AT IBADAKULE, SHINYANGA DISTRICT

By J. R. F. Handley, *Geologist*

Abstract

A further analysis of water from the hot springs is recorded, and comparison made with analyses of a sample taken previously, and of waters from boreholes in the Wembere Steppe.

Several hot springs issue in a tributary of the Mhumbo River, two and a half miles north of Ibadakule. These were briefly described by Teale (1931), and a water sample was collected and analysed.

During February 1952, the writer visited these springs, and a further sample of water was collected. The analysis of this sample, together with the older analysis for comparison, appears below:

	Sample A	Sample B
Total Solids (Dried at 105°C)	3·657%	3·69%
NaCl	0·842	1·24
Na_2SO_4	0·609	0·49
Na_2CO_3	1·961	1·69
$CaCo_3$	0·012	Trace
$MgCO_3$	0·015	ND*
R_2O_3	0·007	ND*
SiO_2	0·058	ND*
Organic	0·059	ND*
Loss, etc.	Nil	0·27

Sample A: Collected February, 1952. Analysis by R. A. Sutton. Reference X/2962, Geological Survey, Dodoma.

Sample B: Collected by E. O. Teale. Analysis by F. Oates.

*ND = Not determined.

The springs are near to a kimberlite pipe, and also to a contact between granite and schist. Either of these features may provide fissures up which the heated waters could rise. The temperature of the water at surface is between 50°C and 55°C.

The figures show similarities to analyses made in the Department of waters from boreholes in the Wembere Steppe. Although the total solids are far higher in the water from the boreholes, the relative proportions of the soluble constituents are comparable.

References

Teale, E. O. 1931. Shinyanga Diamond Fields. *Short Pap. geol. Surv. Tanganyika*, 9.

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THE GEOLOGICAL CONDITIONS GOVERNING THE ZANZIBAR TOWN WATER SUPPLIES SUMMARIZED FROM A REPORT

By G. M. Stockley*

Abstract

Results of an investigation to determine how best to augment the present water supplies of Zanzibar Town are given. The geology of the area is briefly described. Two aquifers are believed to exist, one feeding the Chem Chem and Bububu Springs from which present water supplies are obtained and the other near the base of the Mazingini Ridge to the south-east of the town. The upper aquifer is the obvious source of additional supplies. Should this prove unsatisfactory the alternative would be to tap the lower by drilling at a point remote from existing springs, best chosen after geophysical survey.

Introduction

The Water Supply of Zanzibar Town is almost world famous; records referring to the Chem Chem Springs, dating from before the Christian era are said to exist. It is understandable that the Government of Zanzibar is desirous that the unique water supply should retain its high reputation. The investigation now described was instituted to obtain information as to the possibility of tapping fresh sources of pure water, to a quantity of about 300,000 gallons per day, in the vicinity of the present supplies (i.e. the Chem Chem and Bububu Springs to the west of the Mazingini Ridge behind Zanzibar Town) without interfering with the present artesian springs.

Sources of water other than those now in use, are known in the area, such as the Walezo and Dunduki Springs. Bacteriological examination has shown water from the Walezo stream to be contaminated, but there seems little reason to suppose that it should not be pure at the point of issue from the aquifer near the base of the Mazingini Ridge.

To the east of the catchment area is the rather flat-topped Mazingini Ridge, largely covered by clove plantations, and bounded by steep cuttings fifty to eighty feet deep forming the headwaters of the general drainage to the west. Between the cuttings are narrow interfluves descending first steeply by two or three well-defined platforms, then widening and gently sloping to the coast.

The west of the catchment area is covered for the most part by coconut plantations, but there is an intervening strip of almost uncultivated country.

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The average annual rainfall figure for the area taken from the records at the Victoria Gardens and Kizimbani is 66·26 inches.

The total area of the Bububu and Chem Chem Springs catchment is estimated to be at least five square miles, and the average rainfall in this area, assuming that at least fifty per cent of the precipitation goes to replenish groundwater supplies, is adequate to account for the total volume of water in the springs and rivers issuing from the area.

Figures for the flow of water from the various known springs and rivers within the catchment area have been calculated as follows:—

	Gallons per day
Artesian Springs:	
Chem Chem Springs (average)	1,222,300
Bububu Main Spring (average)	1,502,000
Bububu Lower Spring	197,000
Surface Streams:	
Walezo	325,490
Mto Upepo } Dunduki }	1,000,000
	4,246,790

Some of these figures are only estimated, but it appears that 4,500,000 gallons per day cannot be an over-estimate of the total volume of water issuing from the catchment area.

The daily flow of the artesian springs fluctuates with the seasons.

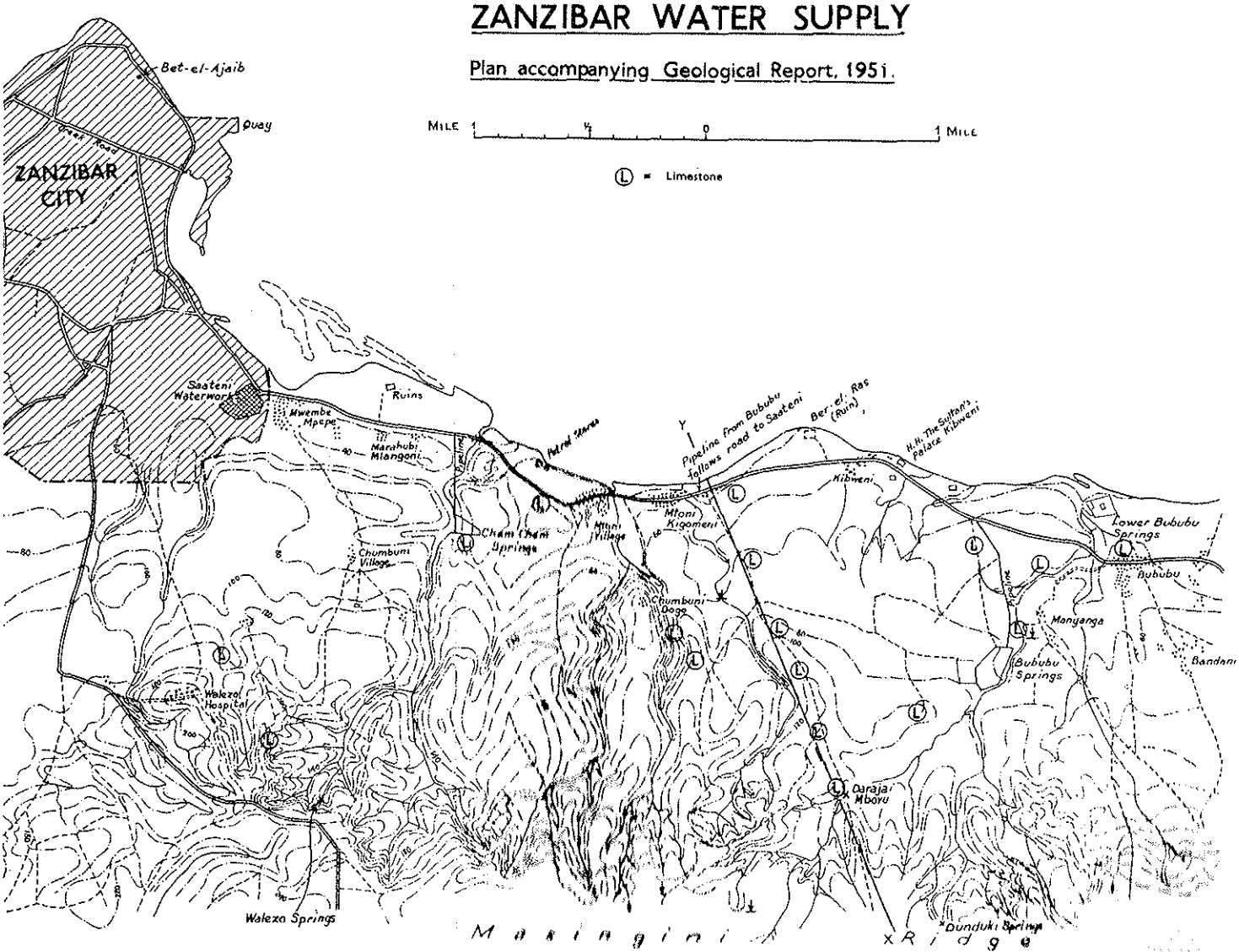
The accompanying sketch-map shows that two lines of springs exist, the higher near the base of the main Mazingini Ridge at the Walezo—Dunduki elevation of 180—200 ft., and the lower at the elevation of the Bububu and Chem Chem springs, about 13 to 60 feet.

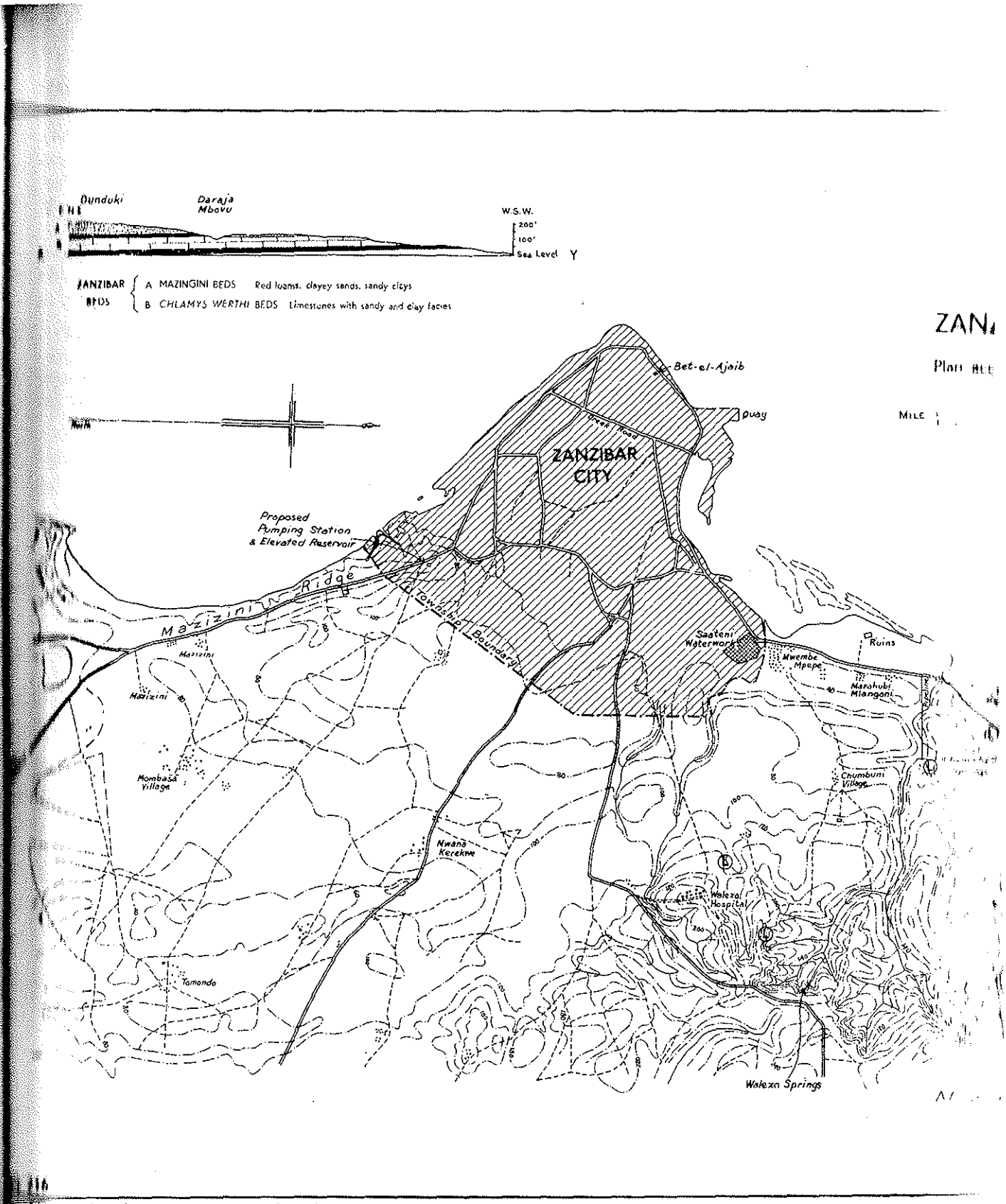
Geology and Hydrology of the Catchment Area

Much of the country is covered by thick sandy deposits so that a description of the detailed geology must necessarily be somewhat conjectural.

The general geological sequence in Zanzibar has been described by Stockley (1927). The catchment area of the Chem Chem and Bububu Springs, as delineated in the sketch-map, is occupied by the Zanzibar Series. This series includes the Mazingini Beds of red loams, pebbly sands, pebbly clayey sands, underlain by the *Chlamys werthi* Beds of yellowish limestones, clays and sands.

In all parts of the series, there is lateral and vertical gradation between the various strata and no continuous section exists for study. Evidence for the existence of a clay bed underlying the *Chlamys werthi* limestone, as shown in the section, was obtained from old records of borings, as well as from surface observations, but for that below the


ZANZIBAR WATER SUPPLY
Plan accompanying Geological Report, 1951.
MILE 1 ½ 0 1 MILE
L = Limestone
ZANZIBAR CITY
Bet-el-Ajaib
Quay
Saateni Waterworks
Mwembe Mpepe
Marahubi Mlangoni
Ruins
Pipeline from Bububu follows road to Saateni
Ber-el-Ras (Ruin)
H.H. The Sultan's Palace Kibweni
Kibweni
Mtoni Kigomeni
Mtoni Village
Chumbuni Village
Chumbuni Boogo
Lower Bububu Springs
Bububu
Manyanga
Bububu Springs
Bandani
Waleza Hospital
Waleza Springs
Ojaja Mboru
Dunduki Springs
Maringini Ridge



Dept. of Lands & Surveys D.S.M. 1953 (Z 1451).

Mazingini Beds the evidence is largely circumstantial, and the bed may not be continuous. The sediments dip very slightly to the east. Throughout, the beds contain small quartz and felspar pebbles, usually oval and well rounded. The Mazingini Beds appear to contain pebbly material coarser than that in the underlying *Chlamys werthi* Beds. Moreover east of the Bububu Springs, the gravelly material is much coarser than that found in the same beds further to the east exposed in the deep cuttings of the Mazingini Ridge. This is evidence confirming and supporting the belief that the sediments were derived from the west as previously argued (Stockley, 1927).

The two lines of springs mentioned above are separated by a vertical interval of about 150 feet, and can probably be identified with two separate aquifers—the upper one in the Mazingini Beds and the other in the underlying *Chlamys werthi* Beds—separated by beds of sandy clay.

Chemical analyses of water from the lower springs show that they have a considerable lime content, without doubt derived from the limestones of the *Chlamys werthi* Beds.

Conclusions

The obvious source of the additional water required to augment the Zanzibar Town supply is the upper aquifer.

Drainage of the swamps and examination of the water at its point of issue from the aquifer at Walezo and at Dunduki, is required to determine if its purity is comparable with the present supply. From either of these springs, water could be piped under gravity into the existing distribution mains. It is possible that the average flow of the Walezo and Dunduki streams (which is known to be in excess of the required 300,000 gallons per day) is controlled by the damming effect of the headwater swamps of the streams, allowing for accumulation during the rainy season and subsequent drainage to give a flow greater than the the season yield of the springs themselves. If not only the swamp water, but either of the springs is itself contaminated, or the combined dry season yield is insufficient, the only alternative would be to tap the lower aquifer by drilling.

A site for such a borehole could best be chosen after geophysical (resistivity) survey of the area, and must be sufficiently remote from the present artesian supplies to avoid any interference by the withdrawal of water.

References

Stockley, G. M., 1927. Report on the Geology of the Zanzibar Protectorate. Zanzibar.