RECORDS OF THE GEOLOGICAL SURVEY OF TANGANYIKA

VOLUME IV
1954

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n	Over-burden	Elevation of bedrock sur[face]
	68′	+ 5′
	c. 30′	c. +40′
	26′	+44′
	64′	+ 1′
	53′	c. + 9′
	23′	+32′
	c. 30′	c. +20′
	39′	+ 4′
	17′	+ 6′
	c. 20′	c. − 1′
′	19′	+ 3′
′	c. 25′	c. 0′

II. THE SITING OF WATER-BORINGS AT MLALI, MOROGORO

By A. J. KING, *Geologist-Geophysicist*

ABSTRACT

An account is given of the selection of sites for water bore-holes on a farm near Morogoro. Four possible sites were chosen by inspection of the topography, vegetation, etc., and were then examined in detail by the Electrical Resistivity Method. The presence of aquifers was predicted at three of the sites, which were then drilled. Unfortunately, the borehole at the most promising site caved in at 90 feet after yielding 600 gallons an hour from the predicted aquifer.

In all, supplies sufficient for 20,000 gallons per day were located and the investigation is cited as an example of how geophysical methods can be used to reduce the time spent on geological investigations, although not being entirely independent of them.

In September, 1954, the author was asked to site boreholes for water-supply to a farm which was being reopened at Mlali, 14 miles south-west of Morogoro. The farm belongs to Mr. Nurdin Bandali Lalji and can be reached from Morogoro either by the old road to Mgeta or the new Iringa road. Water was required for domestic purposes and for the irrigation of the eastern part of the farm which is not supplied by the large irrigation scheme carried out in this area by the Water Development Department. It was intended to pump water into storage tanks near the farm-house, which is situated at the top of a sharp, conical hill, and it was estimated that a supply of 10,000 gallons per day would be required.

The drilling was carried out by the Vlok Boring Co., and Mr. Vlok had already chosen a site (No. 1, Plate I) when the author arrived. This, however, was not very satisfactory and three other sites were chosen, from topographic considerations, for geophysical examination which was carried out by means of the Electrical Resistivity Method using a "Geophysical Megger Earth Tester". The results are shown in the corners of the map as graphs of the apparent resistivity (ρ) against the electrode separation (a), the latter being related to the depth of penetration (see Plate I).

Topographically, the farm is dominated by a conical hill rising sharply to about 80 feet above the general ground level. There are no outcrops on this hill but the red earth contains much quartz rubble. The foothills of the Uluguru Mountains lie to the north-east and east and the surface drainage from these slopes divides around the conical hill; that to the north passes through a narrow gap and is somewhat impounded, forming a swampy area of black soil, while that to the south flows westwards in a wider valley, until turned northwards by a marked ridge near the road. South of the farm there is a wide valley which receives water, both ground and surface, from a much larger catchment area in the foothills than that which supplies the farm. This, however, is all native land.

The position of the ground water-table is indicated on the depth-probes by the letter "T" and is clearly seen in three cases. Water is usually obtained from this horizon, but the supply is small, seasonal and often contaminated. Probable aquifers are marked "A" and the generally disturbed nature of the curves below about 200 feet probably indicates the presence of unweathered rock. Sites Nos. 3, 4 and 1 were recommended for drilling in that order, and Site No. 2 was abandoned.

Site No. 3 is on the swampy ground just above what is probably a rock-bar north of the hill. Ground water is probably impounded against this bar and a supply is fairly certain. There is the risk, however, that unless there is a partial fissure through the bar to maintain circulation, the water may be saline. The water-table is too near the surface to be detected in the depth-probe but two aquifers were clearly identified, one at about 50 feet and a very strongly defined one at about 110 feet. Potable water (600 gallons per hour) was struck at about 50 feet, but at 70 feet the hole began to cave in and was abandoned at 90 feet because suitable casing was unobtainable. In view of the fact that the upper water was potable it seems likely that the lower aquifer must carry a large quantity of non-saline water.*

An attempt was made to place Site No. 4 as far into the adjoining broad valley as possible within the boundaries of the farm. The depth-probe showed the water-table at about 20 feet and two aquifers at 115 feet and 155 feet. A small quantity of water was found at the water-table but the main flow (1,500 gallons per hour) came from 120 feet. The hole was completed at 152 feet, before entering the lower aquifer.

Site No. 1 had been chosen by the driller on the inside of a bend in the main stream traversing the farm. This is a broad valley and the portion of ground-water flowing south of the hill is probably widely distributed laterally. A borehole anywhere in this valley would probably strike water but the yield would not be very great and the depth-probe seemed to confirm this. The water-table can be identified and an aquifer recognized at about 115 feet. There is also a poorly defined aquifer at about 55 to 60 feet. Muddy water was struck just above this level, at 50 feet, and was sealed off. The main supply of 675 gallons per hour was obtained from about 105 feet, again above the indication on the depth-probe.

The remaining site, No. 2, had been chosen on vegetational rather than topographical evidence. It is just above a line of rushes and other water-loving plants which indicate a strong surface supply at least. This was confirmed in the depth-probe where the water-table is very well-defined. Below the water-table, however, and down to the unweathered rock, the curve is featureless, suggesting homogeneous and probably dry rock.

This investigation, while being wholly successful in locating a more than adequate water supply, illustrates besides, the value of the Electrical Resistivity Method in supplementing geological evidence and assessing the validity of the conclusions drawn from such evidence. In this case, where concrete geological evidence is almost non-existent, it has been possible to place the sites in order of preference and to indicate the depths to which the holes should be drilled. These are conclusions which could otherwise be reached only by long and detailed geological mapping.

*Resistivity decreases with increasing water content and/or increasing soluble salt content. The same resistivity minimum could, therefore, be due either to a large amount of potable water or a small quantity of saline water.

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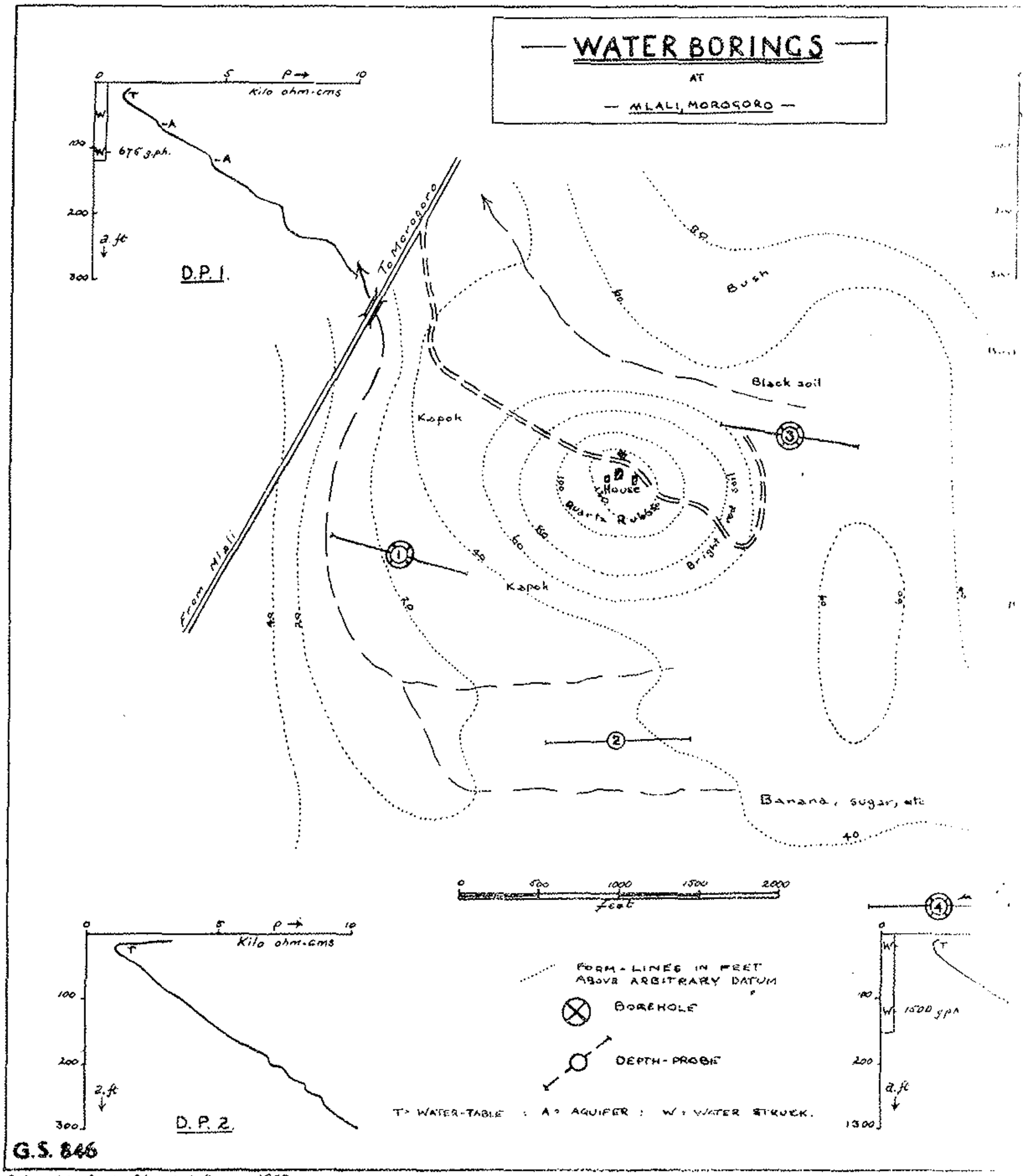

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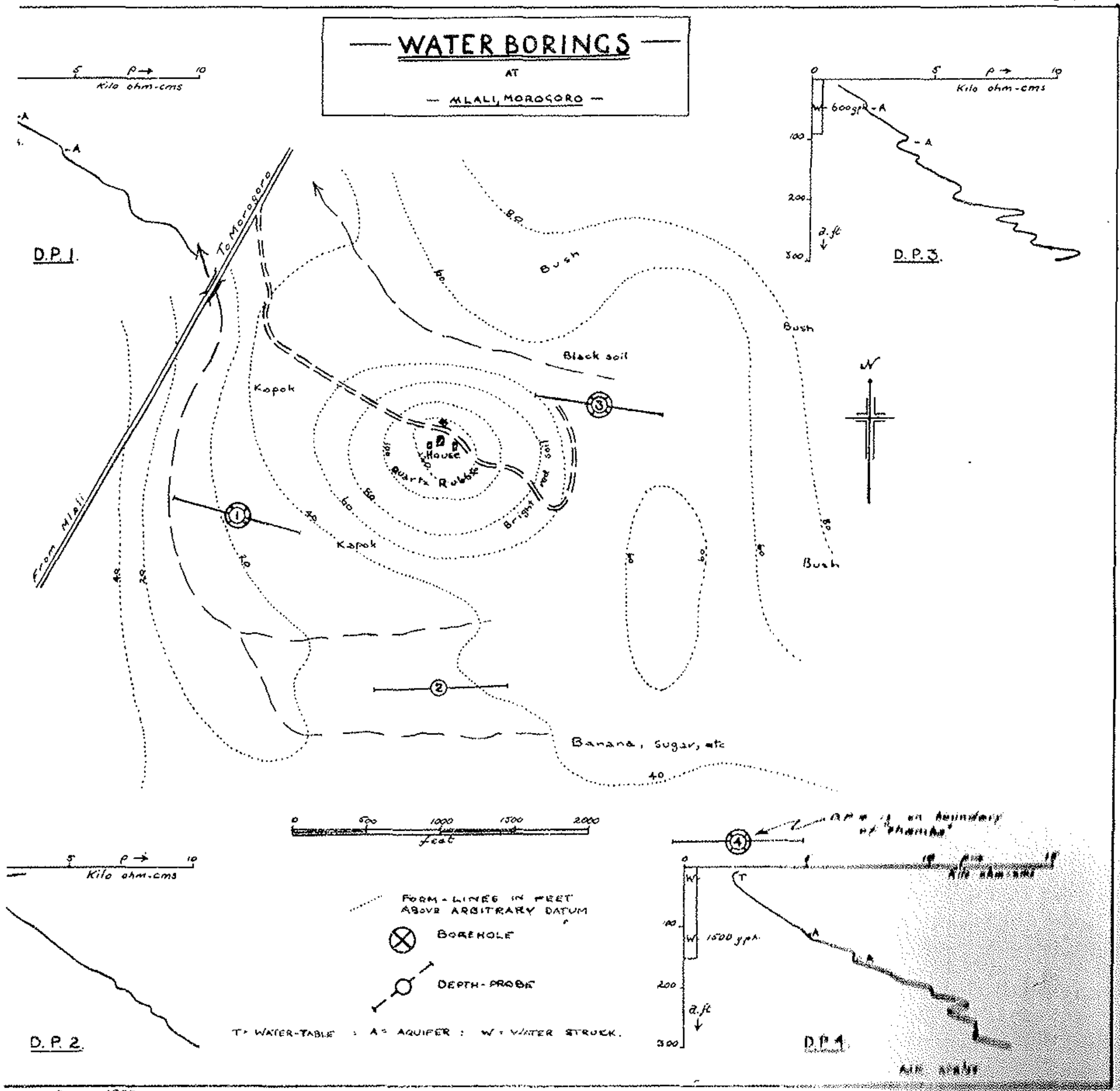
Plate I



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