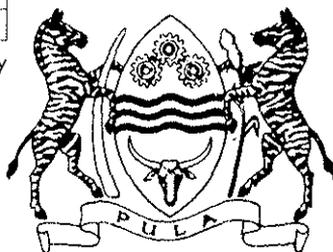


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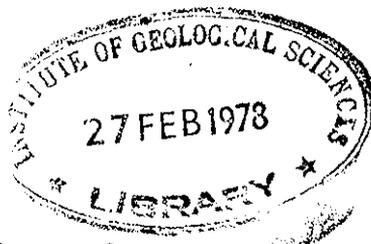
*District Memoir 3*

# THE GEOLOGY OF THE AREA AROUND FRANCISTOWN AND PHIKWE, NORTHEAST AND CENTRAL DISTRICTS, BOTSWANA

BY

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## 15 WATER RESOURCES

### 15.1 INTRODUCTION

The urban community, livestock, and the mine complex at Phikwe are the main consumers of water in the map-area. There is no surface water for most of the year except in rare reservoirs along the Shashe and Tati Rivers. The water requirements of the map-area are generally supplied by groundwater excluding the mine complex at Phikwe. The latter is supplied with most of its water by pipeline from the Shashe Reservoir which is situated about 15 kilometres to the west of the map-area near Tonota. The water resources for each part of the map-area are described below.

### 15.2 FRANCISTOWN

Three boreholes supply most of the water to the urban community, although private boreholes and wells along, and in, the Tati River supplement the boreholes. Two main aquifers are exploited – the sand-filled water courses and the weathered rock zone together with its fracture systems. Where the rivers flow over the gneissic terrain they have high water storage capacities in their sandy beds. However where they flow over the schistose material of the Tati schist relic their storage capacity is reduced because of the high infiltration capacity of the schistose rocks. Therefore most of the wells in the watercourses are located over the gneissic terrain. The weathered rock zone varies from 15 to 60 metres below surface.

The Francistown boreholes are located in the Penhalonga formation of the Tati schist relic. Recharge of the aquifer is partly by direct infiltration through the overlying soil cover, but mainly through the watercourses particularly where the rivers flow over schistose rocks in the schist relic. The Tati River which supplies water to this aquifer, has a catchment area of 2 000 square kilometres where the annual rainfall is about 550 millimetres. This compares with a mean annual rainfall of 419 millimetres over the last ten years for Francistown. The aquifer has a high leakage due to the number of fracture zones cutting it.

Yields from boreholes vary between 15 904 and 136 320 litres per hour. The three boreholes supplying Francistown are reported to give 820 000 litres a day. The total dissolved solids in the water are about 400 parts per million with locally high copper values due to the presence of this element in fracture zones in the underlying rock.

A survey by Colquhoun, O'Donnell, and Partners with Australian Groundwater Consultants recommended that a well-field should be set up near the confluence of the Tati and Ntshe Rivers to supply the future water requirements of Francistown. The aquifer, the weathered zone of the Tati schist relic, is unconfined with a high leakage content. It has a good storage capacity with low transmissivities. The consultants recommended that a large number of closely spaced boreholes should be utilized rather than a few widely spaced boreholes. The recharge potential is good, although the number of dams upstream in the Tati and Ntshe Rivers should be monitored in the future.

### 15.3 THE RURAL AREAS

The major sources of water are wells and boreholes mainly situated along, or in, the larger rivers. During the rainy season the rivers contain stagnant pools of surface water. On the upper reaches of the Motloutse and in the shadier parts of the Shashe and Tati Rivers the pools last throughout the dry season and are an important source of water for livestock. One concrete dam on the Tati, just south of Francistown, provides a small but constant supply of water. In the North-East District several earth dams were noted on the tributaries of the Tati which also provide a permanent source of water. The old mineshafts in the Tati schist relic generally contain water at about 20 to 40 metres below the surface and are occasionally pumped e.g. at Golden Eagle and Blue Jacket. Well points along the pipeline from the Shashe dam to Phikwe provide

water for the cattle posts along this route. Away from the watercourses in the Central District several wells were found in the porphyroblastic granite. The rock is well jointed and water probably concentrates in the joint zones.

The watershed between the Shashe and Motloutse Rivers is the area with the gravest water problem. Wells are scarce which means that water has to be carried from wells in the main rivers. One well at Sedimo is in an amphibolite dyke cutting the gneissic terrain which indicates that wells sited on the quite common amphibolite dykes along the watershed could help reduce the water shortage in this area.

#### 15.4 PHIKWE MINE AND TOWNSHIP

The water requirements of this urban area are met by a complex of boreholes along the Motloutse and Letlhakane Rivers; by pipeline from the Shashe reservoir; by boreholes concentrated along the Letlhakane Fault and by isolated boreholes in the urban area itself. The reservoir at Shashe holds enough water to supply all the requirements of the mine and town at Phikwe. The complex of boreholes along the Motloutse drain the sandy bed of the river and are connected to a central pump house about 8 kilometres north of Phikwe mine.

The nature of the aquifer which the boreholes tap along the Letlhakane Fault is still uncertain. Geophysical surveys across the fault are hampered by the adjacent Tuli-Sabi Straightening Zone which is geophysically similar to the Fault. In fact it is quite possible that the Straightening Zone rather than the Fault is the actual aquifer. Robins (1973) estimated that the aquifer contained about two million cubic metres of water and that about 1 090 560 litres a day could safely be extracted from it. He inferred that the aquifer is confined over most of its length by an upper clay layer but is locally unconfined where the Motloutse River follows the Letlhakane Fault and was recharged there. The water is quite saline with about 1 600 parts per million of total dissolved solids. Robins (1973) noted that the salinity decreased with time and tritium isotope studies of the water also indicated that it becomes younger with continued extraction.