GEOLOGY

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Sources of information

Geological maps (scales 1: 250 000 & 1: 50 000) with accompanying explanations, topographical maps, geophysical maps, aerial photos, satellite images, journal papers etc. can either be purchased or accessed at the Council for Geoscience in POLOKWANE, 30A Schoeman Street; Tel.: 015-295 3471; Fax 015-291 5568; e-mail: gbrandl@geoscience.org.za.

General information is also available on the Council website: www.geoscience.org.za or at the Council library in PRETORIA: 280 Pretoria Street, Silverton; Tel.: 012-841 1001; e-mail: lniebuhr@geoscience.org.za.

Our data base has been compiled over a period of about 60 years, with the first detailed geological mapping of Soutpansberg having started in the early nineteen forties. To my knowledge our data base is complete.

Summary statistics

Geological history

About 1 800 million years ago the Soutpansberg depositional basin was formed as an east-west trending asymmetrical rift or half-graben along the Palala Shear Belt. This belt formed between two major crustal blocks, e.g. the Kaapvaal craton in the south and the Limpopo Belt in the north. Deposition started with basaltic lavas and was followed by sedimentary rocks (syn-rift sequence). After an erosional period, pink massive quartzite was deposited (post-rift sequence) which covered a much larger area then the original rift. Until the deposition of the Karoo rocks the Soutpansberg rocks formed a flat featureless landscape. Only after sedimentation had ceased (about 150 millions years ago) was the area strongly block-faulted and then uniformly tilted to the north. During the last ± 60 million years erosion formed the landscape as we see it today. The pink resistant quartzite was instrumental in shaping the present morphology. The Soutpansberg rocks which developed in a half-graben subsided along a main border fault situated most probably some 10–20 km south of the present Soutpansberg mountainous area.

Stratigraphy

Although featuring so prominently in the landscape of the Limpopo Province, the Soutpansberg Group rocks did not attract much scientific attention in the past, since they are almost devoid of any economic mineralization. The rocks give rise to a mountainous, wedge-shaped terrain, which extends from the Kruger National Park in the east, where it is 40 km wide, to Blouberg in the west. Here it wedges out against the prominent Melinda and Senotwane Faults. Outliers occur west of Blouberg, on the banks of the Limpopo River, and in Zimbabwe. A correlate of the Soutpansberg rocks is the Palapye Group in Botswana.

The Soutpansberg rocks rest unconformably on gneisses of the Limpopo Belt and Bandelierkop Complex. Along the eastern and most of the northern margin the Soutpansberg outcrops are unconformably overlain by, or tectonically juxtaposed against, rocks of the Karoo Supergroup. The contact relationship between the Soutpansberg and Waterberg Group rocks is a tectonic one, though the latter rocks are believed to be younger. The Group is best developed in the eastern part of Soutpansberg, where the maximum preserved thickness is about 5 000 m.

The Soutpansberg Group represents a volcano-sedimentary succession which is subdivided into seven formations (Brandl, 1999). The basal discontinuous *Tshifhefhe Formation* is only a few metres thick, and made up of strongly epidotised clastic sediments, including shale, greywacke and conglomerate. The following *Sibasa Formation* is dominantly a volcanic succession with rare discontinuous intercalations of clastic sediments, having a maximum thickness of about 3 000 m. The volcanics comprise basalts, which were subaerially extruded, and minor pyroclastic rocks. The basalts are amygdaloidal, massive and generally epidotised. The clastic sediments which include quartzite, shale and minor conglomerate, can reach locally a maximum thickness of 400 m. The overlying *Fundudzi Formation* is developed only in the eastern Soutpansberg, and wedges out towards the west. It is up to 1 900 m thick, and consists mainly of arenaceous and argillaceous sediments with a few thin pyroclastic horizons. Near the top of the succession up to four, about 50 m thick layers of epidotised basaltic lava are intercalated with the sediments. It is followed by the *Wyllie's Poort Formation*, which is an almost entirely clastic succession, reaching a maximum thickness of 1 500 m. Since the formation overlies, from east to west, progressively older units, its lower contact is interpreted to form a regional unconformity. Resistant pink quartzite and sandstone with minor pebble washes dominate the succession, with a prominent agate conglomerate developed at the base. The uppermost unit is represented by the *Nzhelele Formation*, which consists of a 400 m thick volcanic assemblage (Musekwa Member) at the base, followed by red argillaceous and then by arenaceous sediments. Maximum preserved thickness is of the order of 1 000 m. The volcanics consist of basaltic lava and several thin, though fairly consistent horizons of pyroclastic rocks of which one is copper-bearing.

North of the main Soutpansberg outcrop two additional units, the *Stayt* and *Mabiligwe Formations*, are recognized. The former succession which is preserved between two prominent faults has a maximum thickness of

1 800 m. Basaltic lava is developed at the base, followed by argillaceous sediments with thin interbeds of pyroclastic rocks. Agate conglomerate and pink quartzite are capping the top. Copper mineralization is known to occur in strongly fractured portions of the succession. The Mabiligwe Formation is confined to a small area along both banks of the Limpopo River, having a thickness of at least 50 m. It is entirely a clastic succession, with no volcanics developed except for a thin tuffaceous horizon (Barker, 1979; Brandl, 1981, 1986, 1987 & 2002).

Structural geology

The Soutpansberg strata which are tilted gently towards the north are truncated by numerous extensional faults. Two fault systems are recognized, the dominant one trending ENE (parallel to the regional strike) and the other one NW to WNW. These structures generally delineate discrete elongated blocks. The majority of the faults are believed to have been initiated in pre-Karoo or even during Soutpansberg times, with most of the structures having been reactivated in post-Karoo times. The Soutpansberg rocks are unfoliated, but are in places strongly fractured.

Intrusive rocks

Dykes and sills of diabase are plentiful in the Soutpansberg rocks. The former intruded often along fault planes, whereas the sills were mainly emplaced along the interface of shale and competent quartzite. Some of the diabase intrusions are probably synchronous with the Soutpansberg volcanism.

Economic geology

The Soutpansberg rocks are not well endowed with economic minerals, and only copper mineralization, considered to be subeconomic, is reported from its eastern part. Salt is produced at the "Soutpan" from brines pumped up from deep wells. A number of thermal springs occur, and they are invariably associated with recently re-activated post-Karoo faults. The mountains, which receive exceptional high rainfall, play a unique role in recharging the regional groundwater, in particular in the area north of Soutpansberg.

The age of the Soutpansberg rocks is only poorly constrained. Rb-Sr whole rock ages obtained so far from the volcanic rocks which are, however, hydrothermally altered suggest that the Soutpansberg Group, or at least its lower part, was deposited sometime between 1 974 and 1 800 million years (Barton, 1979; Cheney *et al.*, 1990).

Major studies and publications

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GEOLOGICAL SURVEY, 1956. 1:125 000 Geological Series: Sheet 42-Soutpansberg.

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Recommendations for priority studies required to fill any gaps identified

At the moment there is an urgent need a) for a Council publication summarizing all the relevant aspects of the Soutpansberg area with regard to geology, geohydrology and economic geology, and b) for absolute age determinations of the Soutpansberg rocks. The latter could range in age between 1 000–2 000 million years, and their stratigraphic relationship to the Waterberg Group rocks further south is therefore equivocal. The Council for Geoscience is aware of these shortcomings, and during the last few months has started to address some of these issues.

"Hot spots" of particular importance

Preservation of a number of unique natural geological sites, e.g. where delicate sedimentary or volcanic structures are exposed, should be attempted. These sites are part of our national heritage resources, and are of invaluable importance for students of earth sciences.

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