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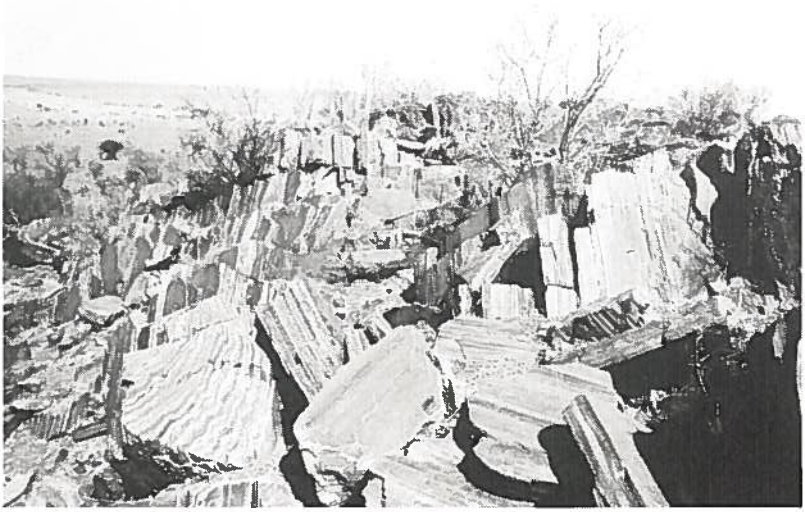

VRYBURG

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Cover: Steeply dipping banded ironstone of the Gold Ridge Formation in the vicinity of Khunwana.

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GEOLOGICAL SURVEY
GEOLOGIESE OPNAME

THE GEOLOGY OF THE VRYBURG AREA

by • deur

N. KEYSER, M.Sc. and C. P. DU PLESSIS, Ph.D.

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Table of Contents

THE GEOLOGY OF THE VRYBURG AREA

by

N. Keyser and C.P. du Plessis

Abstract

The Vryburg 1:250 000 geological map comprises rocks ranging in age from early Swazian to the Quaternary.

The oldest rocks belong to the Basement Complex which is represented by the Kraaipan Group, and Archaean granite and gneiss. The Kraaipan Group is subdivided into the Gold Ridge, Ferndale and Khunwana Formations. These formations occur in three north-trending belts in the Archaean granite and gneiss, and comprise banded ironstone, chert, amphibolite and basaltic lava. The granitic basement consists of migmatite, granite-gneiss, schist and amphibolite. The Mosita Granite, which has been dated at 2 710 Ma, is intrusive into the basement granite and Kraaipan Group.

The Basement Complex is overlain by rocks of the Dominion Group, and Witwatersrand and Ventersdorp Supergroups. The Dominion Group comprises quartzite and lava and is subdivided into the Rhenostersprui, Rhenosterhoek and Syferfontein Formations. The Witwatersrand Supergroup is represented by the Hospital Hill Subgroup which consists of quartzite and shale. It occurs in two synclinal structures south of Ottosdal.

The Ventersdorp Supergroup, comprising amygdaloidal lava, pyroclastic rocks, breccia, conglomerate, greywacke and quartz porphyry, is subdivided into the Klipriviersberg and Platberg Groups and two formations, i.e. the Bothaville and Allanridge.

The Transvaal and Griqualand West Sequences, which are correlates, overlie the Ventersdorp Supergroup unconformably. The Black Reef Formation and Chuniespoort Group represent the Transvaal Sequence while the Griqualand West Sequence is subdivided into the Vryburg Formation, which comprises interbedded quartzite and lava, and the Campbell Group comprising dolomite, chert, flagstone and shale.

The Karoo Sequence is represented by boulder mudstone and shale of the Dwyka Formation.

Diabase and dolerite dykes of different ages intrude all the Proterozoic lithological units, as well as the Dwyka Formation.

The Kalahari Group, calcrete, sand and soil represent the Quaternary deposits in the area.

Salt, gold, iron and diamonds are the most important economic minerals.

Uittreksel

Die Vryburg 1:250 000-geologiese kaart bestaan uit gesteentes wat wissel in ouderdom vanaf vroeg-Swazium tot die Kwartêr.

Die oudste gesteentes behoort tot die Vloerkompleks wat verteenwoordig word deur die Kraaipan Groep, en Argeïese graniet en gneis. Die Kraaipan Groep is onderverdeel in die Gold Ridge, Ferndale en Khunwana Formasies. Hierdie formasies kom voor in drie noordstrekkende stroke in die Argeïese graniet en gneis en bestaan uit gestreepte ystersteen, chert, amfiboliet en basaltiese lawa. Die granitiese vloer bestaan uit migmatiet, granietgneis, skis en amfiboliet. Die Mositagraniet, wat gedateer is op 2 710 m.j., is intrusief in die vloergraniet en Kraaipan Groep.

Die Vloerkompleks word oorlê deur gesteentes van die Dominium Groep en die Witwatersrand en Ventersdorp Supergroepe. Die Dominium Groep bestaan uit kwartsiet en lawa en is onderverdeel in die Rhenosterspruit, Rhenosterhoek en Syferfontein Formasies. Die Witwatersrand Supergroep word verteenwoordig deur die Hospitaalheuwel Subgroep wat bestaan uit kwartsiet en ysterryke skalie. Dit kom voor in twee sinklinale strukture suid van Ottosdal.

Die Ventersdorp Supergroep, bestaande uit amandelhoudende lawa, piroklastiese gesteentes, breksie, konglomeraat, grouwak en kwartsporfier, word onderverdeel in die Klipriviersberg en Platberg Groepe, en die Bothaville en Allanridge Formasies.

Die Transvaal en Griekwaland-Wes Opeenvolgings, wat korrelate is, oorlê die Ventersdorp Supergroep diskordant. Die Swartrif Formasie en die Chuniespoort Groep verteenwoordig die Transvaal Opeenvolging, terwyl die Griekwaland-Wes Opeenvolging onderverdeel word in die Vryburg Formasie, wat bestaan uit tussengelaagde kwartsiet en lawa, en die Campbell Groep, bestaande uit dolomiet, chert, plaveisteen en skalie.

Die Karoo Opeenvolging word verteenwoordig deur rolblokmoddersteen en skalie van die Dwyka Formasie.

Diabaas- en dolerietgange van verskillende ouderdomme is intrusief in al die Proterosoïese litologiese eenhede, insluitende die Dwyka Formasie.

Die Kalahari Groep, kalkreet, sand en grond verteenwoordig die Kwartêre afsettings in die gebied.

Sout, goud, yster en diamante is die belangrikste ekonomiese minerale.

1. INTRODUCTION

The 2624 Vryburg 1:250 000 geological map is bounded by latitudes 26 and 27, and longitudes 24 and 26. Topographically the area is dominated by extensive areas of little relief. The only positive topographic features present are low koppies formed by the resistant geological units such as the banded ironstones of the Kraaipan Group and the quartzite of the Vryburg Siltstone Formation.

Large areas are blanketed by sand of the Kalahari Group, reworked aeolian sand, calcrete and soil. Since much of the area is nearly devoid of any outcrop it was decided to show suboutcrop rather than superficial cover, in order to give some indication of the subsurface geology.

2. BASEMENT COMPLEX

The Basement Complex comprises mainly low-grade metamorphic rocks belonging to the Kraaipan Group, and undifferentiated granite, gneiss, amphibolite and schists.

2.1 KRAAIPAN GROUP

Du Toit (1906) first referred to "...a considerable development of schists, magnetic quartzites and slates, which are closely paralleled by certain rocks at Bloemhof, Pietersburg, Swaziland, and elsewhere." as the Kraaipan Formation. He distinguished an eastern belt at Madibi, a central belt at Kraaipan, and a western belt at Mosita. These belts are flanked by granitic gneiss, granite, and Ventersdorp lavas. Du Toit (1906) also noted that the Kraaipan rocks were extensively folded, sheared and veined. He subdivided the Kraaipan Formation into a lower group, which consisted of magnetite-quartzite, a middle group comprising cherty rocks, and an upper group consisting of magnetic slate, cherty rocks, phyllite and schist.

Van Zyl (1972) remapped the Kraaipan area and subdivided the rocks into two groups, occasionally separated by a jaspilite unit. SACS (1980) accepted this subdivision and named three formations, namely the Gold Ridge Formation at the base, followed by the Ferndale Jaspilite Formation in the middle and the Khunwana Chert Formation at the top.

2.1.1 Gold Ridge Formation

The Gold Ridge Formation comprises mainly banded ironstone with subordinate interbedded mica schist, pyrophyllite schist, and quartz-chlorite schist, amphibolite and dolomite. The type area is on Gold Ridge 295, which is situated 10 km northwest of Kraaipan. Here the formation attains a thickness of approximately 400 m.

Banded ironstone forms prominent ridges in all three north–south-trending belts of Kraaipan rocks. It consists of alternating chert- and magnetite-rich bands and laminae, which are in the order of 0,5–10 cm thick (Fig. 1). The thicker bands are usually not homogeneous. The magnetite is often altered to goethite.

The schists are fine grained and deeply weathered, which makes identification of minerals difficult. The mica- and pyrophyllite schists are monomineralic rocks; the latter show some secondary iron enrichment along the foliation planes. Quartz-chlorite schists comprise equal amounts of quartz and chlorite, with some subordinate muscovite.

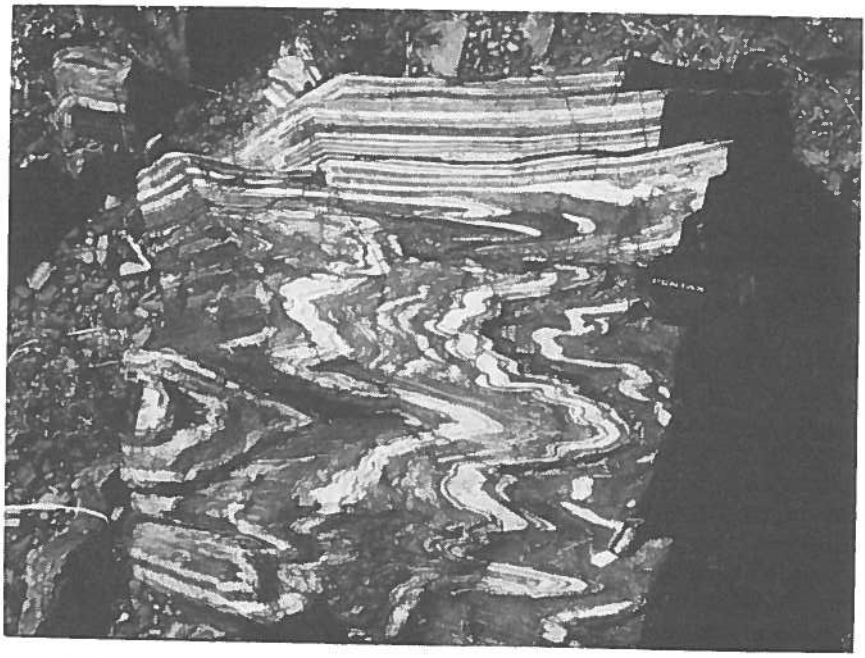

Fig. 1 — Folded chert and magnetite-rich bands of the Gold Ridge Formation southwest of Khunwana.

The dolomite consists mainly of impure siderite which contains magnesium and calcium. Magnetite is a common secondary constituent. In all cases it shows a rhombohedral habit, and is probably pseudomorphous after siderite. Both primary and secondary quartz occur and in places the latter replaces the carbonate minerals (Van Zyl, 1972).

2.1.2 Ferndale Formation

The Ferndale Formation comprises mainly variegated banded jaspilite. The colour of this well-banded rock varies from red to yellow, white, grey, brown and black, depending on the extent and oxidation state of impurities. Microscopically the rock consists of cryptocrystalline quartz with poorly defined magnetite layers (Van Zyl, 1972).

The type area of the Ferndale Formation occurs on the farm Ferndale 286, which is situated 10 km northwest of Kraaipan. The formation also occurs in the western belt to the north of Mosita, on the farm Blink Plaats 215, but is not known to exist in the eastern belt at Madibi. The thickness of this formation has not been recorded.

2.1.3 Khunwana Formation

The Khunwana Formation conformably overlies the Gold Ridge Formation except where the Ferndale Jaspilite is developed. It consists mainly of banded grey recrystallised chert and/or brown jaspilite grading laterally into banded white and grey chert. Amphibolite and lava occur interbedded in the chert. The upper part of the formation contains layers of green chloritic schist up to 10 cm thick. According to SACS (1980) the formation attains a thickness of about 700 m in the type area. The formation also occurs in the western belt towards the north of Mosita, but is not present in the eastern belt at Madibi.

Lava occurs in the Khunwana Formation at 100, 200 and 300 m above the Ferndale Formation, and although poorly exposed, has been shown by Van Zyl's (1972) mapping to be continuous over large areas. The lithology and mineralogy of the three lava units are for all practical purposes identical. The rock comprises hornblende crystals set in a fine matrix of feldspar, epidote, zoisite, calcite and chlorite. The composition of unaltered plagioclase relics (An_{35}–An_{45}) indicates that the rock had an original andesitic affinity. According to Du Toit (1908), the lava occurs throughout the Kraaipan Group. He also described rhyolites and tuffs in the area to the north of Mosita.

2.1.4 Tectonic features of the Kraaipan Group

In broad terms, rocks of the Kraaipan Group were deformed by lateral compressional forces, resulting in isoclinal overfolding and the formation of pseudobedding. A number of discrete episodes of folding, shearing and quartz veining are developed in the western belt. The oldest or F_1-folds occur in the form of small intrafolial folds as well as larger chevron structures. The axial planes of these structures trend approximately north–south. These structures are best developed on a limb of a major chevron-like antiform on Groot Gewaagd 270. At this same locality there is some evidence of pre-F_1 veining. Minor F_2-folds are superimposed on the F_1-folds, their axial trends intersecting at approximately 90°. The intensity of these folds is much less than that of the F_1-folds, and they occur as broad open structures.

Folding was followed by intense localised shearing. This intense or multiple shearing has lead to the development of tectonic breccias, as can be seen on Minden 701 and Vogelstruis Kop 271. Shearing was both preceded and succeeded by quartz veining. These veins are in places deformed and boudinaged, and have locally been deformed into pseudobedding.

Van Zyl (1972) distinguished two types of lineation in the Kraaipan type area:

(i) Magnetite crystals concentrated in the crests and troughs of folds are aligned parallel with the fold axes, thus forming a b-lineation.

(ii) The line of intersection of the folded plane (S_0) with pseudobedding (S_2) gives a lineation parallel with the fold axes of the small folds.

The plane containing these lineations has a dip of 50 to 60° to the east, and the lineations are distributed in a zone angle of 120°.

2.2 UNDIFFERENTIATED BASEMENT GRANITE AND GNEISS

Granite and gneiss cover a substantial part of the map area. It is, however, rarely exposed due to a thick cover of Kalahari sand (Gordonia Formation) in the western and northwestern parts of the map area, and a thick soil cover. The only good outcrops occur in dry river beds at Neverset 283, Mareetsane, Kraaipan, Khunwana, Madibogo and Setlagole.

The basement granite-gneiss comprises migmatite, banded and granitic gneiss, gneiss, granite, amphibolite and schist (Fig. 2). The Archaean gneisses are commonly white, grey or pink, medium to coarse grained in texture, and consist of quartz, orthoclase, microcline, oligoclase, muscovite, and in places, a little biotite (Du Toit, 1906). All the granites are foliated to a greater or lesser degree, and in many places the term gneiss is thus more applicable.

The migmatite, banded gneiss, amphibolite and schist probably represent supra-crustal rocks which were subjected to high-grade metamorphism and deformation.

At a number of localities the granitic rocks contain xenoliths of older formations. These inclusions range in size from a few centimetres to hundreds of square metres and

Fig. 2 — Amphibolite (dark grey) and gneiss (light grey), Tlhakajeng Spruit.

comprise mainly schist, amphibolite and banded ironstone. The xenoliths seem to occur more often in the gneissic and migmatitic rocks than in the common granites.

Pegmatite and quartz veins are abundant in the granite. The pegmatite veins seldom exceed a width of 20 cm while the quartz veins can be up to 15 m wide. The veins are randomly oriented but the majority seem to be parallel to the foliation of the granite, i.e. northeast–southwest.

Du Toit (1906) also reported the presence of aplite and granite veins. He stated that the aplite veins are locally common, but usually only occur penetrating the patches of schist included in granite. Four kilometres south of Madibogo Station a single granite vein cuts vertically through granite and schists.

In the vicinity of Kraaipan outcrop of a pinkish fine- to medium-grained granite, which differs markedly from the surrounding granite-gneiss, is found. The granite appears to be much younger than the granite-gneiss because of its homogeneous nature; it contained no xenoliths, pegmatite or quartz veins. Unfortunately no intrusive relationship with the Kraaipan Group could be established and since no dating has been done on it, it is provisionably considered to be part of the basement.

A few kilometres northeast of Khunwana near the Tlhakajeng Spruit, shear zones up to 5 m wide and 3 km long occur in the Basement granite and gneiss. The shear zones strike north-northeast–south-southwest and comprise granitic breccia which have been silicified to form quartz ridges (Fig. 3). The breccia texture can still be seen in fresh material.

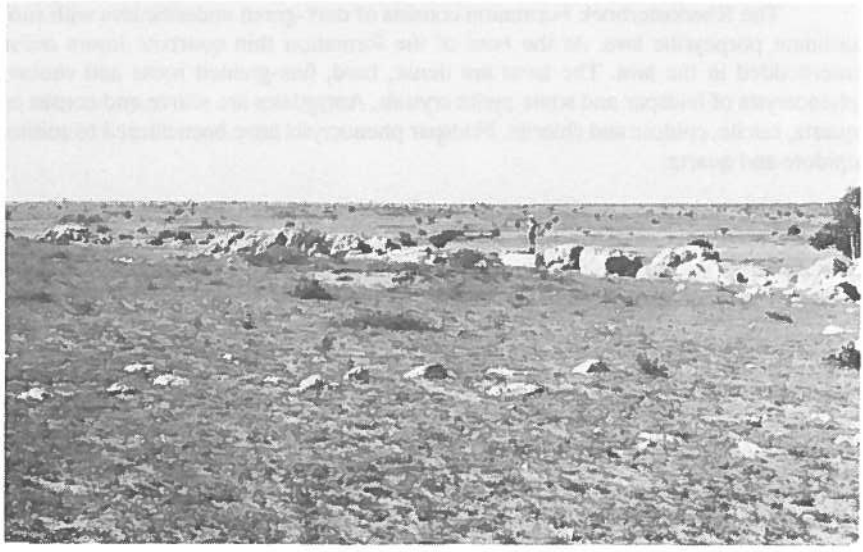

Fig. 3 — Quartz ridge near Tlhakajeng.

3. DOMINION GROUP

The Dominion Group overlies the Archaean granite and gneiss, and forms prominent outcrops in the vicinity of Ottosdal. The type area of the group is situated about 35 km east of Ottosdal in the vicinity of the Dominion Reefs Mine. SACS (1980) subdivided the group into three formations, namely the Rhenosterspruit Quartzite Formation, the Rhenosterhoek Andesite Formation and the Syferfontein Porphyry Formation. This subdivision corresponds to that of Von Backström (1962) for the Ottosdal area.

3.1 RHENOSTERSPRUIT FORMATION

The Rhenosterspruit Formation consists of grey quartzite, yellow sericitic quartzite and conglomerate, and ranges in thickness between 90 and 120 m. An andesitic lava layer, up to 30 m thick, occurs interbedded with the sediments. The conglomerates are auriferous and contain well-rounded and well-sorted pebbles of quartz which do not exceed 5 cm in diameter.

Outcrop of the Rhenosterspruit Formation is limited to Goedgedacht 323 IO and Gestoptefontein 349 IO north of Ottosdal where it strikes north-northwest–south-southeast and dips between 20 and 45° towards the west. Normal and reverse faults have offset the strata at various localities.

3.2 RHENOSTERHOEK FORMATION

The Rhenosterhoek Formation consists of dark-green andesitic lava with subordinate porphyritic lava. At the base of the formation thin quartzite layers occur interbedded in the lava. The lavas are dense, hard, fine-grained rocks and contain phenocrysts of feldspar and some pyrite crystals. Amygdales are scarce and consist of quartz, calcite, epidote and chlorite. Feldspar phenocrysts have been altered to zoisite, epidote and quartz.

The thickness of the Rhenosterhoek Formation has not been determined in the Ottosdal area. On Goedgedacht 323 IO, which is situated north of Ottosdal, it appears to be very thin and pinches out northwards. South of Ottosdal on Strydpoort 403 IO, it seems to be much thicker and could be up to 300 m thick.

3.3 SYFERFONTEIN FORMATION

The Syferfontein Formation comprises mainly quartz-feldspar porphyry with interbedded andesitic lava, tuff and tuffaceous sediments. The porphyry is made up of corroded phenocrysts of tabular feldspar and rounded quartz set in a microcrystalline matrix. Feldspar predominates over quartz and consists of acid oligoclase, rimmed by albite, and orthoclase which is developed interstitially (Von Backström, 1952).

Tuff and tuffaceous sediments occur throughout the formation as lenses or discontinuous layers. Two types can be distinguished, i.e. a pink tuff consisting of quartz,

altered feldspar, chlorite and epidote, and a blue-grey tuff, known as wonderstone, which consists mainly of pyrophyllite and a little chloritoid. The wonderstone layers range between 15 and 90 m in thickness, while the tuffaceous sediments consist of shale and greywacke and occur interbedded with the tuffs.

Van Niekerk and Burger (1969) dated the Dominion lava at between 2 800 ± 60 and 2 830 ± 110 Ma (U–Pb method). The samples were taken from the Dominion Reef Mine. According to them the most probable age was approximately 2 800 Ma.

4. WITWATERSRAND SUPERGROUP

The Witwatersrand Supergroup overlies the Dominion Group and outcrops in the area between Ottosdal and Wolmaransstad. According to Von Backström (1952) no certain unconformable relationship could be established between these two successions. The Witwatersrand Supergroup is represented by rocks of the Hospital Hill Subgroup of the West Rand Group, and occurs in two synclinal structures, one of which lies to the north of the Doornkuil–Klipfontein fault and strikes southwest–northeast, the other lies to the south of the fault and strikes north-northwest–south-southeast.

4.1 HOSPITAL HILL SUBGROUP

The Hospital Hill Subgroup in the Ottosdal area consists of a quartzite at the base overlain by ferruginous shales. The quartzite ranges from fine to coarse grained with layers of grit and according to Von Backström (1952) it can be correlated with what was previously known as the Hospital Hill Quartzite. The Orange Grove Quartzite, which forms the base of the Witwatersrand Supergroup in the Central Rand and Klerksdorp areas, pinched out westwards of Klerksdorp in the Dominion Reefs area and is thus not present here. The shales correspond to the Parktown Formation; they are thinly bedded or laminated and range from yellow to red in colour, depending on the iron content. Secondary iron enrichment of the shale near the surface resulted in the formation of haematite and limonite layers. Magnetite also occurs in places.

5. VENTERSDORP SUPERGROUP

The Ventersdorp Supergroup is subdivided into the basal Klipriviersberg Group, the Platberg Group in the middle, and the Bothaville and Allanridge Formations at the top (SACS 1980).

In the Central Rand the Witwatersrand Supergroup is conformably overlain by the Klipriviersberg Group, but on the West Rand and in Western Transvaal the Klipriviersberg oversteps the Witwatersrand and Dominion rocks to overlie the basement granite. To the west of Migdol and Delareyville, and in the vicinity of Thaba-Sione, the Platberg Group and the Bothaville and Allanridge Formations in turn overstep the Klipriviersberg.

5.1 KLIPRIVIERSBERG GROUP

The Klipriviersberg Group outcrops in an extensive area in the eastern part of the Vryburg 1:250 000 geological map. It occurs in the southeastern part in the area between Ottosdal and Migdol, extends northwards to the Sannieshof–Biesiesvlei area and further north to an area just south of Itsoseng where it is overlain by the Transvaal Sequence.

SACS (1980) subdivided the Klipriviersberg Group into the Westonaria, Alberton, Orkney, Jeanette, Loraine and Edenville Formations. Although these formations have certain distinctive characteristics in their type areas, these characteristics appear to be absent in this area and the formations could not be mapped. Spherulitic structures which are characteristic of the Loraine Formation were however found on the farms Gestoptefontein 349 IO and Kleinplaats 324 IO.

The Klipriviersberg comprises mainly green-grey aphanitic, basaltic lava which is usually well jointed and free of amygdales. Porphyritic and amygdaloidal flows occur occasionally. The best outcrops occur along the Klein Harts River.

5.2 PLATBERG GROUP

A major unconformity separates the Klipriviersberg and Platberg Groups. After the deposition of the Klipriviersberg, block faulting resulted in the formation of grabens and troughs in which the Platberg Group was deposited. Contemporaneous volcanism and sedimentation in these troughs resulted in interfingering and an interlayered succession of sediments, basaltic lava, quartz porphyry and pyroclastic rocks. These different lithological units now constitute the formations making up the Platberg Group, which is subdivided by SACS (1980) into the Kameeldoorns, Makwassie and Rietgat Formations. The Goedgenoeg Formation has lately been added to this group, but has not yet been approved by SACS.

Recent mapping of the Ventersdorp Supergroup in the vicinity of Vryburg has again brought the possible correlation of the Zoetlief Group with the Platberg Group to the fore. In the past the Zoetlief was correlated with the Ventersdorp Supergroup (Du Toit, 1906) or with the Dominion Group (De Wet, 1942). Early age determinations for the two groups differed and so also contributed to the correlation problem. Using the U–Pb method, Van Niekerk *et al.* (1964) determined an age of 2 300 Ma for the Makwassie at Klerksdorp and later U–Pb dating on zircons by Van Niekerk *et al.* (1968) yielded a substantially older age of 2 638 ± 105 Ma for the Kareefontein Formation of the Zoetlief Group. Recent U–Pb zircon dating of the Makwassie Quartz Porphyry Formation at Klerksdorp yielded even older ages of 2 643 ± 80 Ma (Van Niekerk *et al.*, 1978) and 2 699 ± 16 Ma (Armstrong *et al.*, 1986) which are more in line with that of the Zoetlief and indicate that the Kareefontein Porphyry at Zoetlief and Makwassie are coeval.

Field evidence is also overwhelmingly in favour of a correlation between the Platberg and Zoetlief Groups. There is a direct correlation between the lithologies and

the stratigraphy of the formations of the two groups which is not the case with the Dominion and Zoetlief Groups. Where the Dominion porphyry (Syferfontein Formation) is overlain by a sedimentary or volcanic succession, these can always be allocated to a known formation of the Witwatersrand or Ventersdorp Supergroups. The Zoetlief Group is therefore regarded as part of the Ventersdorp Supergroup, and more specifically the Platberg Group.

5.2.1 Kameeldoorns Formation

The Kameeldoorns Formation comprises detritus which accumulated alongside fault scarps to form clastic wedges which thin away from the scarps. The coarse material, which in places includes huge blocks, was deposited as breccia and conglomerate near the fault scarps and is therefore largely representative of the lithology of the adjacent horst. The finer material, i.e. sand and mud, was deposited further away as greywacke, flagstone and shale. At times lacustrine conditions prevailed in the grabens, allowing the deposition of cherts and dolomites to take place.

Not all the material making up this formation originated from the horsts. Volcanism also contributed ash and pyroclastic material which were reworked and/or transported and deposited by water. These tuffaceous sediments cannot be distinguished from the clastic sediments of the Kameeldoorns Formation on a mapping scale because they are very similar in appearance and occur interbedded with the latter (Fig. 4).

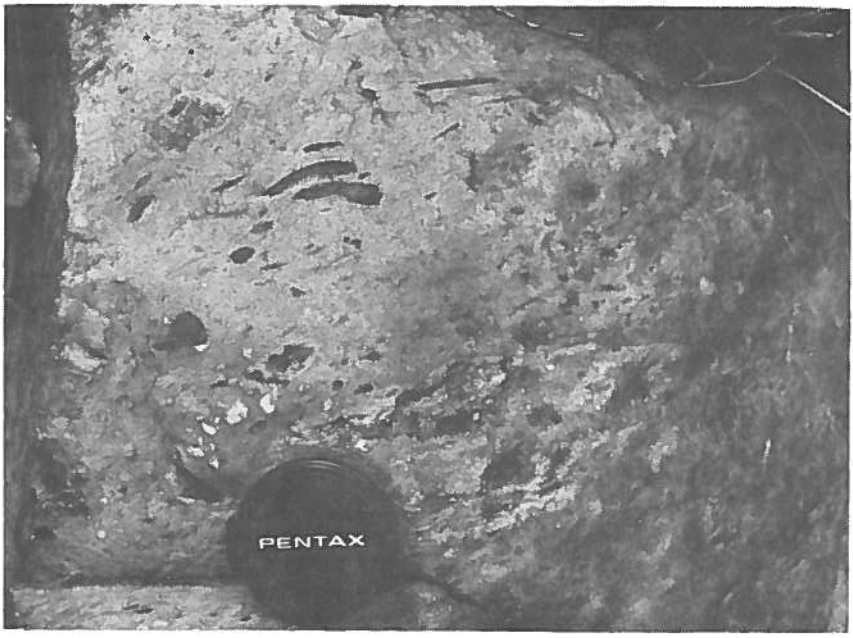

Fig. 4 – Flattened pumice clasts in a lapilli tuff, Zoetlief 451.

Kameeldoorns sediments outcrop in the vicinity of Leeuwbosch 456 and Wildebeest Pan 533 where they were formerly known as the Oasis Formation of the Zoetlief Group, to the east of Mosita on Bosch Kop 306, Mooi Plaats 307 and Massouw 272 where they constituted the Bosch Kop Formation; outcrops are also present at Zand Bult 352, Borneo 185 IO and Albert 110 IO.

5.2.2 Goedgenoeg Formation

The Goedgenoeg Formation has not yet been approved by SACS, but the name is used by the mining companies for a pophyritic and amygdaloidal lava unit which underlies the Makwassie Formation in the vicinity of Klerksdorp. Although it is extensively developed in the Platberg and Klerksdorp areas only one small outcrop occurs in the Vryburg map area, namely to the south of Ottosdal on Klipfontein 311 IP.

The Goedgenoeg Formation consists of green-grey porphyritic and amygdaloidal lava which is identical in appearance and geochemistry to that of the Rietgat Formation (Bowen, 1984). Where the Makwassie Formation, which separates the Goedgenoeg and Rietgat Formations, is absent, it becomes impossible to distinguish between the Goedgenoeg and Rietgat Formations.

5.2.3 Makwassie Formation

The Makwassie Formation lies mainly on Kameeldoorns sediments or Archaean granite. The formation consists exclusively of quartz porphyry and feldspar porphyry. The quartz porphyry comprises phenocrysts of K-feldspar, oligoclase and quartz set in a crypto- to microcrystalline groundmass. The only difference between the quartz porphyry and feldspar porphyry is the amount of quartz phenocrysts which is much less in the case of the feldspar porphyry. The groundmass varies in colour from white to green, grey, red, brown and black. Variations in the size and amount of phenocrysts and flow thickness occur from flow to flow (Fig. 5). Xenoliths of a dark fine-grained rock occur locally.

The Makwassie Formation outcrops in the Zoetlief area, from Zoetlief 451 in the north to Morgenzon 607 in the south, east of the Zoetlief area on Verdwaalvlakte 540, east of Vryburg on O'Reilly's Fontein 686, Leeuwrand 715 and Schatkist 716. It also occurs west of Delareyville on Excelsior 186, Borneo 185 and further south on Leeuwkop 192, Corsica 209 and Doornhoek 215. In the latter area outcrop is very poor and the extent of the Makwassie was interpreted from aerial photographs.

5.2.4 Rietgat Formation

The Rietgat Formation in the Vryburg map area comprises amygdaloidal and non-amygdaloidal lava and agglomerate which occur interbedded with quartzite and tuffaceous sedimentary rocks. It outcrops in the Zoetlief area north of Vryburg on Zoetlief 451 and Gemsbokfontein 453; towards the east of Vryburg on Schatkist 716; in Soutpan at Stella; towards the west of Sannieshof near the Bossies Siding and

Fig. 5 — Disturbed layers on the Makwassie Quartz Porphyry, Karee Fontein 454.

Leeuwpan 279 IO; and southeast of Delareyville on Doornbult 365 IO and Rietgat 387 IO.

In the Zoetlief area the Rietgat lava comprises green to green-grey phaneritic rocks with an intersertal or diabasic texture. The lava, which is medium-grained and nearly devoid of amygdales, occurs interbedded with sedimentary and pyroclastic rocks. Because of poor outcrop the thicknesses of the lavas could not be determined.

The original mineralogy of the lava consisted of lath-like feldspar and pyroxene (augite) set in a glassy groundmass, but this composition has been fundamentally changed to a mineralogy comparable to that of a greenschist. The feldspars have been partly or completely saussuritised. The pyroxene, which probably consisted of augite (short stubby laths), has been uralitised and the glassy groundmass has been devitrified. Thus, the rocks now consist chiefly of secondary minerals, i.e. chlorite, epidote, clinozoisite, calcite, sericite and uralite (tremolite–actinolite). The composition of the feldspars could not be determined.

The sedimentary rocks of the Rietgat Formation in the Zoetlief area consist of a mixture of tuffaceous and clastic sediments which dip at 6–25° to the south. At the base of this sequence tuffs and tuffaceous sediments prevail while the top half consists mainly of tuffaceous sedimentary rocks and quartzites. Ripple marks on the bedding

planes of some of the tuffaceous units indicate that reworking and deposition of the tuffaceous material by fluvial processes, have taken place.

The Rietgat Formation at Stella consists of greenish or dark-grey arkosic quartzite, micaceous flagstone, siltstone, shale and amygdaloidal lava. The sedimentary rocks dip at a low angle to the south. The quartzite and flagstone consist of subangular to rounded grains of quartz, orthoclase, microcline and lithic fragments and flakes of biotite. The orthoclase, microcline and biotite in the quartzite and flagstone indicate a granitic origin for the sediments. Lithic grains, which comprise mostly lava particles, indicate that some of the material was derived from the Ventersdorp itself. Channels, scoured in lava and pyroclastic breccia, and filled in with sediment, occur at the top of a volcanic succession on the western side of Saltpan at Stella (Fig. 6). This area is regarded as the source of some of the volcanic material.

The Rietgat Formation at Rietgat 387 IO, Doornbult 365 IO and Bossies Siding consists of green-grey to dark-green amygdaloidal and tuffaceous lava and agglomerate. Outcrop in this area is very poor and the relationship with other formations as well as the thickness of the beds, could not be determined. The lava is fine grained in texture and has been altered to secondary chlorite, epidote, sericite, calcite and uralite.

5.3 BOTHAVILLE FORMATION

The Bothaville Formation unconformably overlies the Platberg Group and was deposited in shallow basins on a gently undulating surface. Where the Platberg Group is not developed this formation overlies the Archaean granite, as can be seen west of Delareyville on Bospan 197 IO, Leeuwpan 195 IO, Rapoeli 191 IO and Rapoeli 206 IO and at Thaba-Sione. Other outcrops occur east of the Harts River on Rosalie 391 IO, Brodricks Vally 386 IO, Goedgevonden 366 IO, Roodewal 364 IO, Doornbult 365 IO and Diamant Aar 359 IO. North of Vryburg smaller outcrops occur in the Zoetlief area on Gemsbokfontein 453 and Zoetlief 451, and further west of that on Verdwaal Vlakte 540.

The Bothaville Formation comprises quartzite, greywacke and conglomerate which vary in colour from white to red-brown. The conglomerate consists of quartz, chert, tuff, lava and quartz-porphyry pebbles set in a quartzitic matrix (Fig. 7). Microscopically the quartzite and greywacke comprise quartz, feldspar and mica in varying quantities with subordinate magnetite, garnet and titanite.

The thickness of the Bothaville Formation varies according to the pre-Bothaville topography and can attain 100 m in places outside the Vryburg area. However, no information could be obtained on the thickness of the formation in the Vryburg map area.

5.4 ALLANRIDGE FORMATION

The Allanridge Formation underlies an extensive area of the Vryburg 1:250 000 geological map. It occurs in a more or less continuous belt from Lotlhakane in the north

Fig. 6 — Flagstone channel scoured in Rietgat lava, Stella.

Fig. 7 — Pebbles in Bothaville Quartzite, Roodewal 364.

to Migdol in the south, and in the area between Broedersput, Vryburg, Zoetlief and Stella.

The Allanridge Formation overlies the Bothaville Formation conformably but where the latter pinches out the Allanridge oversteps onto diverse older lithologies.

The formation consists mainly of two types of lava, i.e. a dark-green amygdaloidal lava (Fig. 8) and a light green-grey porphyritic lava. The latter occurs in a small area on the southern boundary of the map on Losasa 258 IO, Eenzaamheid 717, Kareeput 257, Karee Put 714, and also Bernau 674. According to De Wet (1943), the porphyritic lava overlies the dark-green lava and is in turn overlain by agglomerate and tuff.

The dark-green lava, which is by far the most prominent unit in the Allanridge Formation, also constitutes the greater part of the Ventersdorp Supergroup in the area. The lava is fine to medium grained in texture and the plagioclase and augite in it have been replaced by secondary minerals, such as chlorite, epidote, calcite sericite and uralite. The amygdales in the lava consist of quartz, chalcedony, calcite, chlorite or epidote, or any combination of these minerals. Where more than one mineral makes up an amygdale, the minerals commonly form concentric zones.

Tuff, agglomerate and volcanic breccia occur interbedded with the lava towards the top of the formation (Fig. 9). These rocks can be traced from Dorenpoort 612 in the west to Schatkist 716 in the east and outcrops in Bokkraal se Kop, Pretoriuskop, Massouskop and on Bernau 674, Welgelegen 677 and Vaarwel 683, where they underlie the Vryburg Formation. The same horison was also found at the trigonometric beacon on Gemsbok Hoek 541, just south of Zoetlief 451.

6. GRIQUALAND WEST SEQUENCE

The Griqualand West Sequence is represented by the volcanosedimentary Vryburg Formation, and the predominantly dolomitic Schmidtsdrif Formation, which forms part of the Campbell Group. The two formations form two arcuate outcrops. The first stretches from Dorenpoort 612 on the southern boundary through Bokkraal se Kop, Pretoriuskop, Massouskop and round to Vryburg and the second lies to the east of Vryburg between Rosendal 673 and Hartklip 722. A big outlier of the Vryburg Formation also occurs to the northwest of Stella on Zoete Inval 342.

6.1 VRYBURG FORMATION

The Vryburg Formation unconformably overlies the Ventersdorp Supergroup on a regional scale, although this contact seems to be conformable in places, e.g. at Pretoriuskop and Massouskop. The formation dips at about 5° in a southerly direction and can be subdivided into four units, i.e. a lower sedimentary unit, a lower lava unit, an upper sedimentary unit and an upper lava unit.

Conglomerate forms the basal part of the lower sedimentary unit, and grades upwards into grit and quartzite. Shale and flagstone (thin-bedded, micaceous, fine-

Fig. 8 — Quartz amygdales in the Allanridge lava, Bernau 674.

Fig. 9 — Agglomerate in the Allanridge Formation, Bernau 674.

grained sandstone) are absent in this unit. Pebbles in the conglomerate are well rounded and average 1,5 cm in diameter, and comprise quartz, chalcedony, jaspilite, lava and agate. The jaspilite pebbles were derived from the Kraaipan Group and the lava pebbles from the Ventersdorp Supergroup. The quartzite of this lower unit is well exposed in the Vryburg area while the conglomerate is mostly covered by Quaternary sediments.

The lower lava unit is lenticular but can attain a thickness of up to 10 m. On Hartklip 722 it is 12 m thick and in the vicinity of Vryburg it pinches out so that no distinction can be made between the lower and upper sedimentary units. The lava is compact at the base, becoming amygdaloidal towards the top.

The upper sedimentary unit is made up of conglomerate, grit, quartzite, flagstone and shale. The quartzite is white in colour and is usually fine grained and massive. It consists mainly of well-rounded quartz grains, with lesser amounts of orthoclase, microcline, magnetite and calcite.

Three flagstone beds occur in this unit. The flagstones are thinly bedded quartzites which are locally micaceous and often finely ripple marked. It can be removed in slabs, and is used for building purposes. The flagstones pass upwards into green fissile sandstones or shales.

The shales weather to a deep-red colour along joints and bedding planes. The fresh rock, however, is pitch black with fine calcite crystals visible in the sunlight. Microscopic flakes of chlorite and biotite, and some quartz are present.

The upper lava unit is well exposed on Zand Vlakte 582, on the main road from Vryburg to Ganyesa. From here it seems to thin and pinch out towards the west. The most easterly outcrop of this unit occurs on Hartebeest Poort 723.

The lava comprises plagioclase, pyroxene, titanite and rutile. Some ilmenite, altered to leucoxene, is also present. Towards the top of the formation the lava becomes highly amygdaloidal and the amygdales are elongated in a north–south direction. It is directly overlain by the Schmidtsdrif Formation.

6.2 SCHMIDTSDRIF FORMATION

6.2.1 Boomplaas Member

The Boomplaas Member represents a transition between the Vryburg Formation and the Cambell Group and consists of dolomite with interbedded shale, flagstone and chert. The base is normally taken at the lowermost dolomite layer. The formation seems to be horizontal in this area.

The dolomite forms a rather homogeneous succession; the only variation being provided by ooliths and stromatolites. According to Du Toit (1905) the ooliths occur frequently, and have been reported on Lima 667 by De Wet (1942) where they are composed of calcite and quartz. The stromatolites vary in size from 0,05 to 2,0 m across.

Some of the larger stromatolites are elongated, generally in a north–south direction, and clay-drapes occur on some of them.

6.2.2 Clearwater Member

The shale beds which occur interbedded throughout the Schmidtsdrif Formation are thin near the base and thicken towards the middle of the formation where the predominance of shale over dolomite defines the Clearwater Member. The fresh shale is pitch black with occasional small pyrite grains, and weathers to a red-brown colour. Ripple-marks are commonly developed on bedding planes.

The flagstone layers are generally thin but can attain a thickness up to 4,5 m. Because they are more resistant than shale and dolomite, they form cappings on the dolomite, and constitute the higher ground.

6.2.3 Monteville Member

The Monteville Member, which forms the top of the Schmidtsdrif Formation, consists of dolomite with interbedded shale, siltstone and quartzite. The Monteville occurs towards the southwest of Vryburg on Lochnagar 661.

7. TRANSVAAL SEQUENCE

The Transvaal Sequence occurs in the northeastern corner of the Vryburg 1:250 000 geological map. Only the Black Reef Formation and the Chuniespoort Group are present in this area and they are mostly covered by thick sand, gravel, calcrete and soil.

7.1 BLACK REEF FORMATION

A major unconformity separates the Black Reef Formation from the underlying Ventersdorp Supergroup. The formation consists of one or two quartzite beds, separated by a layer of soft, grey shale. Shale also occurs at the top of the formation in the transition zone between the Black Reef and the overlying dolomite.

The Black Reef quartzite is medium to very coarse grained, dark coloured, and shows cross-bedding in places. Conglomerate commonly occurs at the base of the formation but is not confined to this horizon.

7.2 CHUNIESPOORT GROUP

The Chuniespoort Group consists mainly of dolomite, limestone and chert. SACS (1980) subdivided the group into five formations of which only two, i.e. the Oaktree and Monte Christo, which belong to the Malmani Subgroup, are present in the area.

7.2.1 Oaktree Formation

The Oaktree Formation consists of dark chert-free dolomite, with interbedded shale near the base. Outcrops of this formation were found on Makouspan 64 IO and Mooimeisjesfontein 118 JO.

7.2.2 Monte Christo Formation

The Monte Christo Formation comprises chert-rich dolomite and can be subdivided into three members, i.e. an oolitic chert-rich dolomite at the base, a banded chert and dolomite zone in the middle and an upper chert-rich dolomite zone.

The oolitic chert zone consists of oolitic and ripple marked chert and light-coloured dolomite. Recrystallisation of the dolomite has in places destroyed any primary structures that may have existed.

The banded chert and dolomite zone contains at its base a dark chert-free dolomite which shows well-developed columnar stromatolites. Upwards this zone becomes progressively richer in chert and the dolomite becomes lighter in colour.

Extensive chert rubble on the landscape surface marks the upper chert-rich dolomite zone. It consists of light-coloured, highly recrystallised dolomite with numerous bands of chert. The dolomite becomes darker in colour towards the top of the formation.

8. KAROO SEQUENCE

The Dwyka Formation is the only formation of the Karoo Sequence present in the Vryburg 1:250 000 map area.

8.1 DWYKA FORMATION

The Dwyka Formation occurs in the vicinity of Vryburg, but is seldom exposed in outcrop. Large erratic boulders, which lie strewn all over the country-side, are the only indication of the presence of the Dwyka Formation in the area. It can, however, be seen in road quarries along the main road between Vryburg and O'Reilly's Pan and it also outcrops in the area surrounding O'Reilly's Pan.

The Dwyka was deposited on a very uneven floor. Glacial striations on the Ventersdorp rocks on Bernau 674, indicate that the Dwyka glaciers probably scoured out valleys and depressions in the pre-Karoo rocks, in which the Dwyka Formation was then deposited.

The Dwyka consists mostly of boulder mudstone and shale. The boulders were derived from pre-Karoo rocks and consist of lava, quartz porphyry, chert, dolomite, granite, gneiss, quartzite and banded ironstone. These boulders are often 1,8 to 2,4 m

in diameter, are finely striated, and show polished surfaces. Most of these erratics were probably derived from areas quite close to their present site of deposition.

9. INTRUSIVE ROCKS

9.1 MOSITA GRANITE*

The Mosita Granite, dated at 2 710 ± 65 m.y. (Burger *et al.*, 1979), differs considerably from the older granite-gneiss in appearance and outcrop pattern. The Mosita Granite forms typical domal outcrops (Fig. 10) which is in sharp contrast with the poor outcrops of the older granite-gneiss found in river beds. The Mosita Granite is intrusive into the Archaean granite-gneiss and the Kraaipan Group. This can be clearly seen on Mosita 251 wherea large xenolith of Kraaipan rock is included in the granite.

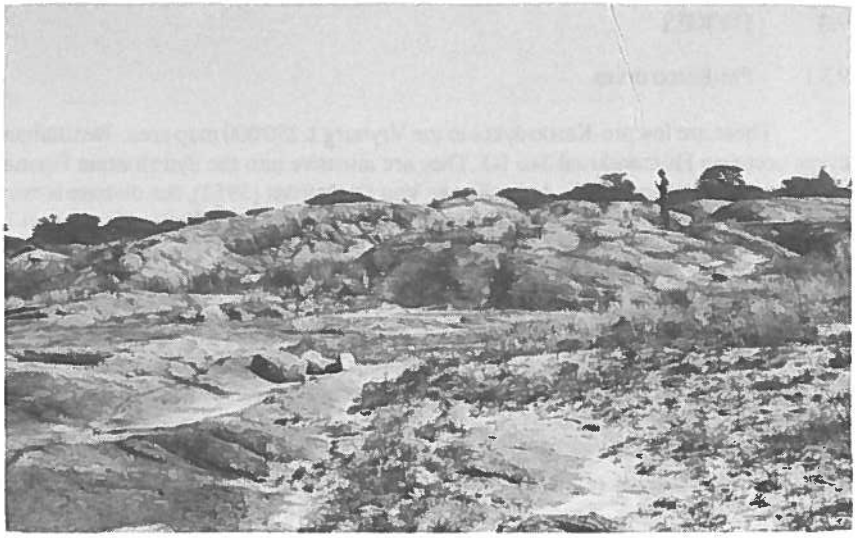

Fig. 10 — Domal outcrop of Mosita Granite, Blaau Krans 256.

The Mosita Granite is a homogeneous, coarse-grained, porphyritic rock and is red-pink in colour. It is mainly composed of microcline phenocrysts, which show polysynthetic twinning and average 10 mm across, and plagioclase (albite, oligoclase) and quartz which occur interstitially. Small amounts of biotite, muscovite and apatite

* Not yet approved by SACS.

and secondary minerals, sericite and chlorite are present. Perthitic intergrowth of K-feldspar and albite is common.

9.2 GABBRO (Mg in legend)

North of Ottosdal, on Gestoptefontein 349 IO and Humanskraal 346 IO, gabbro occurs intrusive into rocks of the Syferfontein Formation of the Dominion Group. According to Von Backström (1962), quartzite and lava xenoliths, derived from the Rhenosterhoek and Rhenosterspruit Formations respectively, are found in the gabbro. The xenoliths range between 2,5 and 15 cm in diameter.

The gabbro consists of two types, viz. a coarse-grained, light-coloured type and a fine-grained, dark-coloured type. The texture is decussate. Labradorite (An_{50-60}), hypersthene, augite, and small amounts of mica and iron ore make up the gabbro (Von Backström, 1962).

9.3 DYKES

9.3.1 Pre-Karoo dykes

There are few pre-Karoo dykes in the Vryburg 1:250 000 map area. Two diabase dykes occur on Humanskraal 346 IO. They are intrusive into the Syferfontein Formation of the Dominion Group. According to Von Backström (1952), the diabase is even grained and microcrystalline and contains a few feldspar phenocrysts up to 3 mm in diameter, in an altered groundmass of chlorite, zoisite and secondary quartz.

9.3.2 Post-Karoo dykes

Numerous dolerite dykes traverse the map area. They are mostly covered with sand, but can be traced out on aerial photographs because of the vegetation they support. In general two groups of dykes can be distinguished. One group strikes east–west and includes the greater portion of the dykes; the other strikes about north–south and mostly occurs in the area to the west of Vryburg and to the south of Ganyesa.

The dolerite is dark in colour, ranges from fine to coarse grained in texture and according to De Wet (1942) consists of labradorite, hypersthene and olivine (Fa_{36}). The pyroxene has been changed to secondary hornblende. Biotite, chlorite, magnetite and apatite are accessory minerals.

10. CALCRETE

Calcrete covers large areas, especially in the dolomitic terrain and to a lesser degree in areas underlain by Ventersdorp lava. The calcrete which overlies dolomite of the Transvaal and Griqualand West Sequences probably formed by the evaporation of water charged with carbonates derived from the underlying rock.

Carbonate-charged streams, issuing from the dolomite, were also responsible for the deposition of calcrete in the vicinity of Deelpan, Leeuwpan and Barberspan.

In the Ventersdorp lava area the calcrete occurs along dry river beds which indicates that the drainage systems were involved in the transportation of the carbonate. Wind played a major role in the deposition of calcrete in the vicinity of pans. The calcrete always occurs along the southeastern edges of pans. This is on the down-wind side because the prevailing winds are from the northwest. Rain or seepage water which accumulates in the pans is normally very shallow and is driven by the wind to the southeastern side of the pan where it evaporates and calcrete is deposited (Fig. 11).

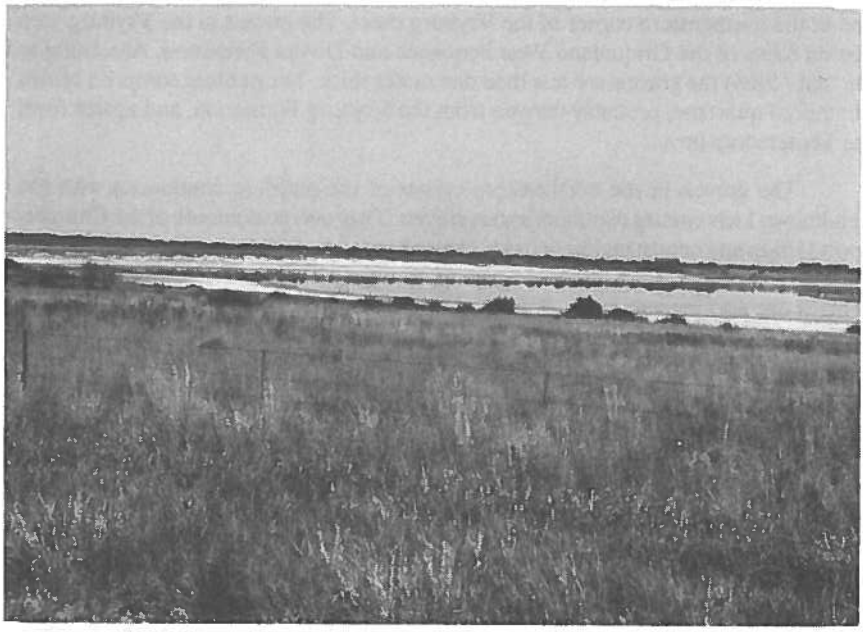

Fig. 11 — Calcrete on the southeastern edge of Bulpan, Geysdorp district.

According to Netterberg (1969) the calcretes in southern Africa fall into five groups which range in age from Tertiary to Quaternary. The calcretes in the Vryburg map area have not yet been classified into age groups and are thus shown as a single lithological unit.

11. SILCRETE

An extensive deposit of silcrete covered by a relatively thick overburden of sand, occurs west of Ottosdal in the vicinity of Swarts Rust 379 IO, Mooiplaats 370 IO,

Doornpan 371 IO and Brakpan 380 IO. Generally the silcrete ranges from 0 to 20 m in thickness but can attain thicknesses up to 50 m on Swarts Rust 379 (Von Backström, 1962).

The colour of the silcrete varies from white to grey with red staining in places and the grain-size ranges from cryptocrystalline through fine and coarse-grained types to silcrete-conglomerate. According to Von Backström (1962) at least two periods of silicification exist. Older fragments and boulders of a dark silcrete are included in a lighter-coloured, younger silcrete. In places calcrete occurs mixed with silcrete.

12. GRAVEL

River-terrace gravels, diamondiferous in places, occur in the vicinity of Vryburg and in the northeastern corner of the Vryburg sheet. The gravels in the Vryburg area rest on rocks of the Griqualand West Sequence and Dwyka Formation. According to Du Toit (1906) the gravels are less than one meter thick. The pebbles comprise brown weathered quartzite, probably derived from the Vryburg Formation, and agates from the Ventersdorp lava.

The gravels in the northeastern corner of the map are continuous with the well-known Lichtenburg diamondiferous gravels. They overlie dolomite of the Chuniespoort Group and consist mainly of chert, chalcedony and quartzite pebbles derived from the Transvaal Supergroup. Bushveld granite, Rooiberg felsite and Waterberg quartzite pebbles are also present in small amounts (Von Backström, 1952). The pebbles are usually well-rounded, but angular chert rubble from the underlying dolomite has also been incorporated in the gravels.

13. KALAHARI GROUP

SACS (1980) subdivided the Kalahari Group into four formations, i.e. the Wessels Gravel Formation at the base, overlain by the Budin Clay Formation and the Eden Sandstone Formation, with the Gordonia Sand Formation at the top. Of these only the Gordonia Formation occurs in the area, but the others are known to exist in boreholes. It is possible that gravel, sand and clay of the underlying formations may outcrop along the dry river beds towards the north of the area because the Kalahari Group has not yet been mapped in detail.

13.1 GORDONIA FORMATION

It is practically impossible to define the eastern limit of the Gordonia Formation in the Vryburg area. The formation thins towards the east and there appears to be a transition from it to the other Quaternary deposits (sand and soil). The boundary shown on the Vryburg sheet is thus largely arbitrary.

The Gordonia Formation comprises red and yellow fine-grained sand. Although the formation is an aeolian deposit no dunes are present in the area. Any dunes that might have been present must have become destroyed during reworking of the sand.

14. AEOLIAN SAND

The area to the east of the Gordonia Formation, in the vicinity of Mareetsane, Kraaipan and Geysdorp is underlain by aeolian sand. This may have been part of the Gordonia Formation in the past, but because of fluvial reworking and mixing with the in situ weathering products of the underlying granite it has lost its character, and is therefore shown as undifferentiated aeolian sand.

15. SOIL COVER

The areas on the Vryburg sheet which are shown as suboutcrop are in fact covered by soil. It was decided, however, to show suboutcrop rather than soil cover wherever sufficient data on the underlying geology was available. In the northeastern corner of the Vryburg sheet some soil cover is shown, because insufficient information was available to allow a meaningful interpretation of the geology.

16. ALLUVIUM

Alluvium occurs on the flood plains along the Great Harts River and its tributaries. It consists mostly of a black soil containing pebbles of calcrete. In places lenses of gravel occur interbedded with the soil. South of Barberspan it covers a track of land about 6 km wide.

17. ECONOMIC GEOLOGY

17.1 DIAMONDS

Some occurrences of diamonds in the old river terraces have been reported on the western section of Kunana Location No. 4 (Schanzlin, 1928), and in the Vryburg district (Du Toit, 1906). The occurrences on Kunana are related to the Lichtenburg diamond field.

17.2 GOLD

Du Toit (1906) first reported the occurrence of gold at Madibi (presently known as Madiba) where it occurs in weathered brecciated Kraaipan schist cut by lenticular quartz veins. The schist is reported to be well banded with a width of approximately 1 to 2 m, and stands almost vertically. He deduced that the gold was deposited from solution along with some secondary quartz and pyrite along lines of fracturing. He concluded that the bodies would probably be found to be lens-like in shape.

Du Toit's 1906 report also mentioned the occurrence of gold at Kraaipan, Woodhouse 294, Gemsbok Pan 309 and Kunana Location, where the values were said to be low. The exception was thought to be Madibi where the values apparently increase with depth.

Schanzlin (1928) investigated the occurrences on Kunana Location, where the gold was also found in a body of schist following the edge of the banded ironstone. The reef was subsequently worked at Muir's Mine where the gold content was 17 g/t (Coetzee, 1976). A similar occurrence has been described west of Geysdorp on Lynplaats 8 IO. The lode, 0,75 m wide, has been traced for over 2,5 km. It follows the northwest-striking contact of the banded ironstone and schist, and a gold content of 20 g/t was reported (Schanzlin, 1928).

17.3 BRICK CLAY

At Stella building bricks are manufactured from clay derived from the Kraaipan rocks. The bricks are for exclusive use by the local community.

17.4 IRON

The only comparatively important iron occurrences are in the banded ironstones of the Kraaipan Group, and in the magnetic shales of the Parktown Formation of the Hospital Hill Subgroup, and are found where secondary enrichment of these rocks has taken place.

17.4.1 Kraaipan ore

AMCOR investigated the siliceous iron formation near Kraaipan Station in Bophuthatswana and on Lynplaats 8 IO. The reserves of ore containing 37–42% iron and 35–42% SiO_2 were estimated at about 200 million tons. Some 44 000 tons of detrital ore were produced during 1969 and 1970 for the Newcastle Steelworks (Coetzee, 1976).

17.4.2 Hospital Hill ore

The small outcrop of Witwatersrand Supergroup in the southeastern corner of the Vryburg map area, contains ferruginous shale that has excited some interest in the past (Bleloch *et al.*, 1938; Boardman, 1938, 1939; Haughton, 1939). The deposits consist of lenticular bodies of haematite with some magnetite, bounded by limonitic shale and interbedded with soft shale (Coetzee, 1976). These occurrences, which occur mainly on Strydpoort 403 IO, Waagkraal 374 IO and Kliprif 376 IO, have been prospected on several occasions. Drilling has shown that the secondary enriched zones extend only to a depth of 10 to 15 meters. The haematite ore contains 50–60% iron and the soft limonite ore 40–54% iron.

17.5 WONDERSTONE

Wonderstone is a term applied to a massive soft rock composed predominantly of pyrophyllite which occurs interbedded with the porphyritic lava of the Syferfontein Formation of the Dominion Group on Gestoptefontein 349 IO to the north of Ottosdal.

One important use of wonderstone both locally and abroad is in the synthesis of industrial diamonds by the ultra-high pressure–high-temperature method in which the wonderstone is used as a gasket material and a pressure-transmitting medium. Pyrophyllite has the advantage that its melting point increases with increasing pressure.

17.6 LIMESTONE

Limestone, in the form of calcrete, was quarried on Dudfield 35 IP and Springbokpan 61 IO. The limestone was used in the manufacture of cement.

17.7 SALT

Salt occurs in nearly all the pans on the Vryburg map area. Only two pans are in production at present, namely Koppiespan near Delareyville and Soutpan at Stella. The latter pan also yields gypsum as a by-product.

In South Africa most salt pans occur in areas underlain by the Dwyka Formation or the lower Ecca. In the Vryburg area though, with the exception of O'Reilly's Pan which is underlain by Dwyka tillite and the pans on Bulpan 183 IO and Zoutpan 518 which are underlain by Archaean granite-gneiss, most of the salt pans occur on Ventersdorp lava.

17.8 BUILDING SAND

At Setlagole the local community uses the sand occurring in the river bed of the Setlagole River for the manufacture of cement bricks.

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