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KIMBERLITES NEAR SIKERETI, NORTH-EASTERN SOUTH WEST AFRICA/NAMIBIA

by

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ABSTRACT

During a prospecting program carried out by CDM Prospecting (Pty) Ltd in the north-eastern districts of the Territory, four kimberlite pipes were located in the vicinity of Sikereti in the southern Kavango Area (Fig. 1). Each of these was explored by means of boreholes and an up to 25 m deep prospecting shaft.

The kimberlite, a strongly weathered and carbonised rock, includes abundant xenoliths of Nosib quartzite, Karoo sediments, dolerite and Kalahari deposits. The kimberlite is also overlain by Kalahari beds; it apparently has intruded during an early stage of the Kalahari time, possibly during the older Tertiary.

Log records of several exploration boreholes (percussion drill) are attached.

UITTREKSEL

Gedurende 'n prospekteerprogram wat deur CDM Prospecting (Pty) Ltd in die noordoostelike distrjkte van die Territorium deurgevoer is, is in die omgewing van Sikereti in suidelike Kavango Gebied (Fig. 1) vier kimberlietpype ontdek. Elkeen van hierdie is middels boorgate en 'n tot 25 m diep prospekteerskag ondersoek.

Die kimberliet, 'n sterk verweerde en gekarboniseerde gesteente, sluit talle xenoliete van Nosibkwartsiet, Karoosedimente, doleriet en afsettings van Kalahari tipe in. Die kimberliet word egter ook deur Kalaharilae bedek; dit het blykbaar in 'n vroes stadium van die Kalaharityd ingedring, moontlik in die ouer Tersier. Beskrywings van verskeie eksplorasieboorgate (stampboor) is bygevoeg.

1. HISTORY OF INVESTIGATION

During a comprehensive prospecting program for kimberlite indicator minerals in those regions of South West Africa/Namibia which are covered by Kalahari deposits, CDM Prospecting (Pty) Ltd during 1975 carried out regional mapping and soil sampling in the north-eastern portion of the Territory. In the course of this work a geological reconnaissance map of Area 1920, to a scale of 1:250 000, was compiled, and a stratigraphic subdivision of the Kalahari Group was established (Albat 1978).

Initial soil sampling was undertaken on a 5 x 2 km grid and led to the discovery of several anomalies in the distribution of indicator minerals (garnets, ilmenites and chrome diopsides). During follow-up work the sampling intervals were reduced to 500 m, 200 m and finally to 50 m in smaller areas, and this was supported by ground-magnetometry and drilling. The work resulted 1979 in the identification of four kimberlite pipes which were named K1 to K4 (McGhee 1979; see Fig. 2). The outlines of the pipes and thickness of surface cover were explored with the help of boreholes and up to 6 m deep pits (Balfour 1980, 1981; Medlycott 1980). Subsequently a shaft (21 to 24 m deep, with a cross-section of 3 x 2 m) was sunk into each pipe to explore its internal structure and to supply material for mineralogical investigations. The material, together with that of the manhole pits, was crushed and concentrated locally and then forwarded to the laboratory. All the four kimberlite bodies were found to be devoid of diamonds.

2. SITUATION AND FORM OF THE PIPES

The four diatremes are situated 13 km south-west of Sikereti, 3 km north of the Bushmanland/Kavango border in Area 1920 BA (Figs. 1 and 3); the following are their coordinates:

K1	19°08'15" S	20°37'45" E
K2	19°08'05" S	20°37'40" E
K3	19°08'21" S	20°37'48" E
K4	19°08'23" S	20°37'46" E

They are covered by calcrete and silcrete up to 3 m thick which include some remnants of already eroded kimberlite and are capped by 0,1 to 1,0 m of grey-brown soil. The kimberlite bodies form small mounds rising about one metre above the surrounding plain and on these plant growth may be somewhat denser and higher than elsewhere, but contrasts in soil colour, vegetation and relief are too weak for identification of kimberlites.

Near the surface the bodies have a roundish to oval shape with axes between 40 and 80 m in length and are aligned approximately in a NNW-SSE direction over a

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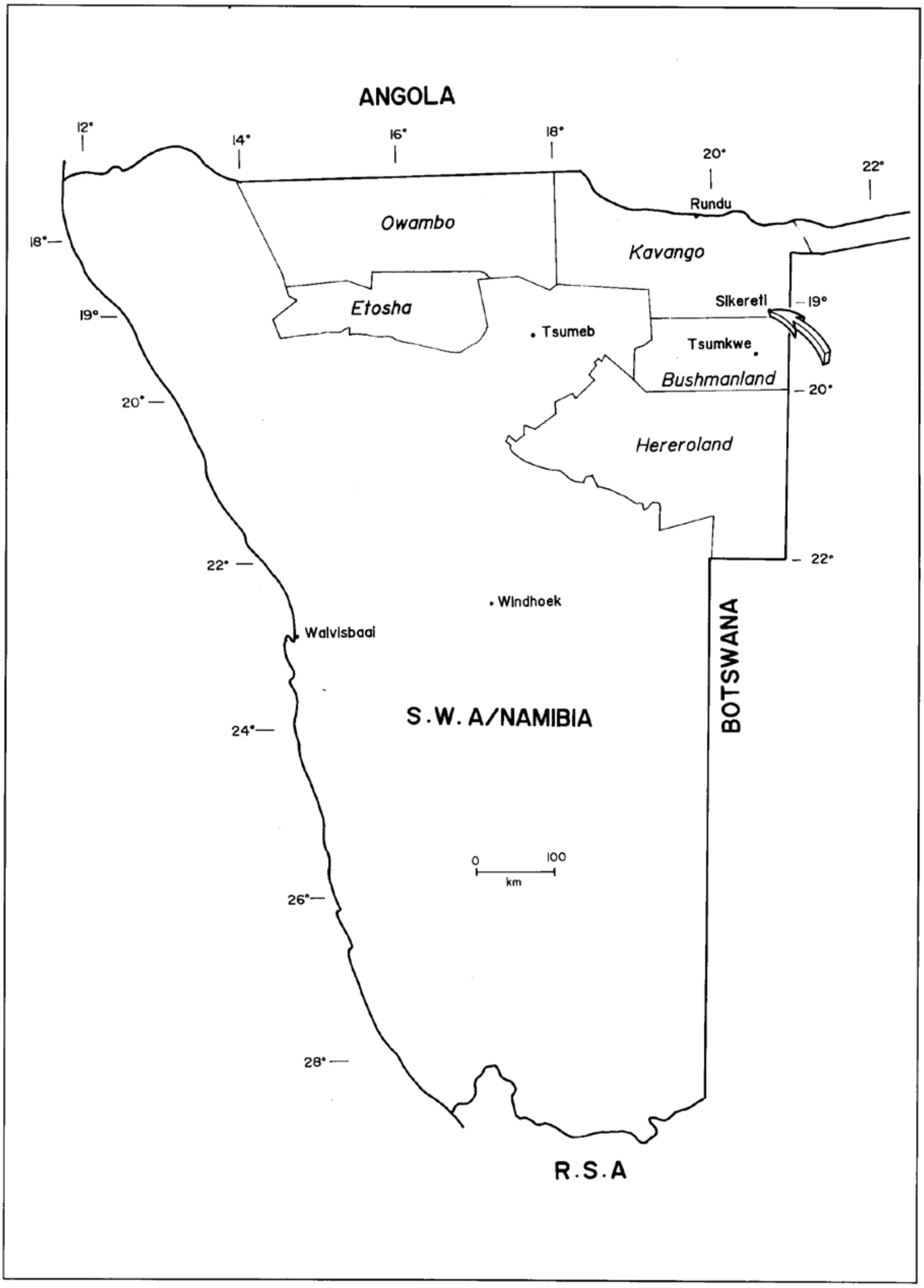

Fig. 1: Location of Sikereti in north-eastern South West Africa/Namibia.

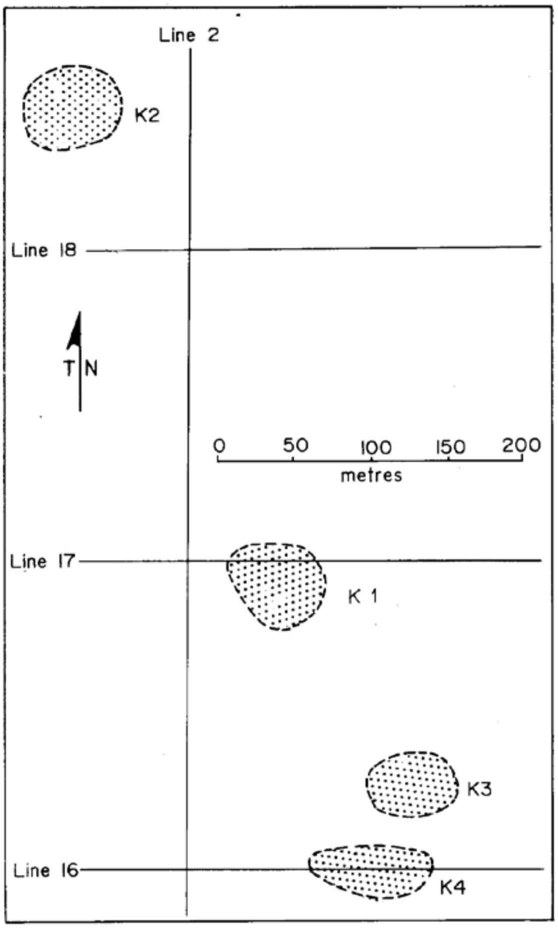

Fig. 2: Outlines of the four kimberlite diatremes within the sampling grid near Sikereti (after McGhee 1979, and Wilson 1980).

distance of 600 m (Fig. 2), three of them within 250 m of each other. The extent of the pipes is small, together they cover just under 1 ha (K1 - 0,25 ha, K2 - 0,28 ha, K3 - 0,20 ha, K4 - 0,21 ha).

K1, the most thoroughly investigated body, apparently has a nearly circular cross-section, slightly elongated in a NW-SE direction (Fig. 3). Its outlines are known to a depth of about 70 m. While the uppermost portion has a steep conical form (its E-W diameter decreasing from 62 m at the surface to about 40 m at 60 m depth), the diameter seems to narrow further to less than 15 m below a depth of 60 m.

This can either mean a sudden narrowing of the diatreme, perhaps caused by change of the bedrocks at about 60 m (see Fig. 3), or that the pipe passes into a dyke. In the last case the explosion point would be very shallow below surface, even if one considers erosion of the uppermost portion of the pipe; this, together with their linear alignment, could indicate that the four diatremes originated from a NNW-SSE striking dyke. On the other hand, boreholes 23, 29 and 32 (Fig. 3) could have entered a large xenolith without having intersected it and the pipe might still be broader than is presently assumed.

3. LITHOLOGIC DESCRIPTION

3.1 The Groundmass

The uppermost 25 m of the vents have been investigated by means of shafts and were found to be filled with tuffaceous, strongly altered kimberlite (tuffisitic kimberlite breccia TKB) with abundant xenoliths that make up between 14,5 and 45,5 per cent of the total filling in K1 (Wilson 1980).

No layering or grading of the rocks was noticeable, the xenoliths are scattered at random within the matrix. The kimberlite is an aphanitic rock with irregular porphyritic patches; its primary texture is obliterated by carbonatisation and clay mineralisation. Today the kimberlitic matrix is porous to dense and of greenish, grey and pink colour, consisting mainly of calcareous material. Two samples of the weathered kimberlite have been treated with HC1; 53 percent of greenish kimberlite out of K1 and 80 per cent of medium grey kimberlite of K3 were dissolved. It is extensively fractured, allowing easy circulation of groundwater; the fracture zones are filled by quartz, silcrete, calcite, clay and silt. The root zone reaches down to 3 m below surface, but small rootlets have been observed even at 24 m (Wilson 1980).

Green to yellow-green kimberlite forms most of the material intersected in K1. Its colour is caused by serpentinised olivines. Serpentine occurs as thin crusts with fibrous texture or nodules; the latter are pseudomorphs after olivine and measure up to 8 mm across. Other minerals contained in the pseudomorphs are calcite and black, brownish and pink iron oxide and hydroxide.

The colour of the pinkish kimberlite is supposedly derived from intense mixture with red mudstone and/or limonite. Serpentinised olivine is present here, too; once its content increases, the pink variety passes into the greenish one. Pink kimberlite is abundant in the middle section of K3; its lower portion intersects medium grey rock, the colour of which is caused by tiny flakes of a black, opaque mineral; serpentinised olivines are absent there. The matrix consists mainly of carbonate. In the upper portion of K3, the kimberlite is calcretised and has turned a light grey. The various colourations are of secondary origin and do not indicate different types of kimberlite.

Within the altered matrix, phenocrysts of the following minerals could be identified as relicts of the kimberlite:

Ilmenite, the most abundant, forms euhedral to rounded grains up to 5 mm across, of which many are rimmed by tiny spinels. At the surface, weathering and degradation of the kimberlite produced an enrichment of ilmenite in the soil; this anomaly extends over some 3000 ha, with the four bodies asymmetrically situated near the margin.

The composition of garnets from borehole samples of K1, analysed by Wyatt (1979), puts them into the brack-

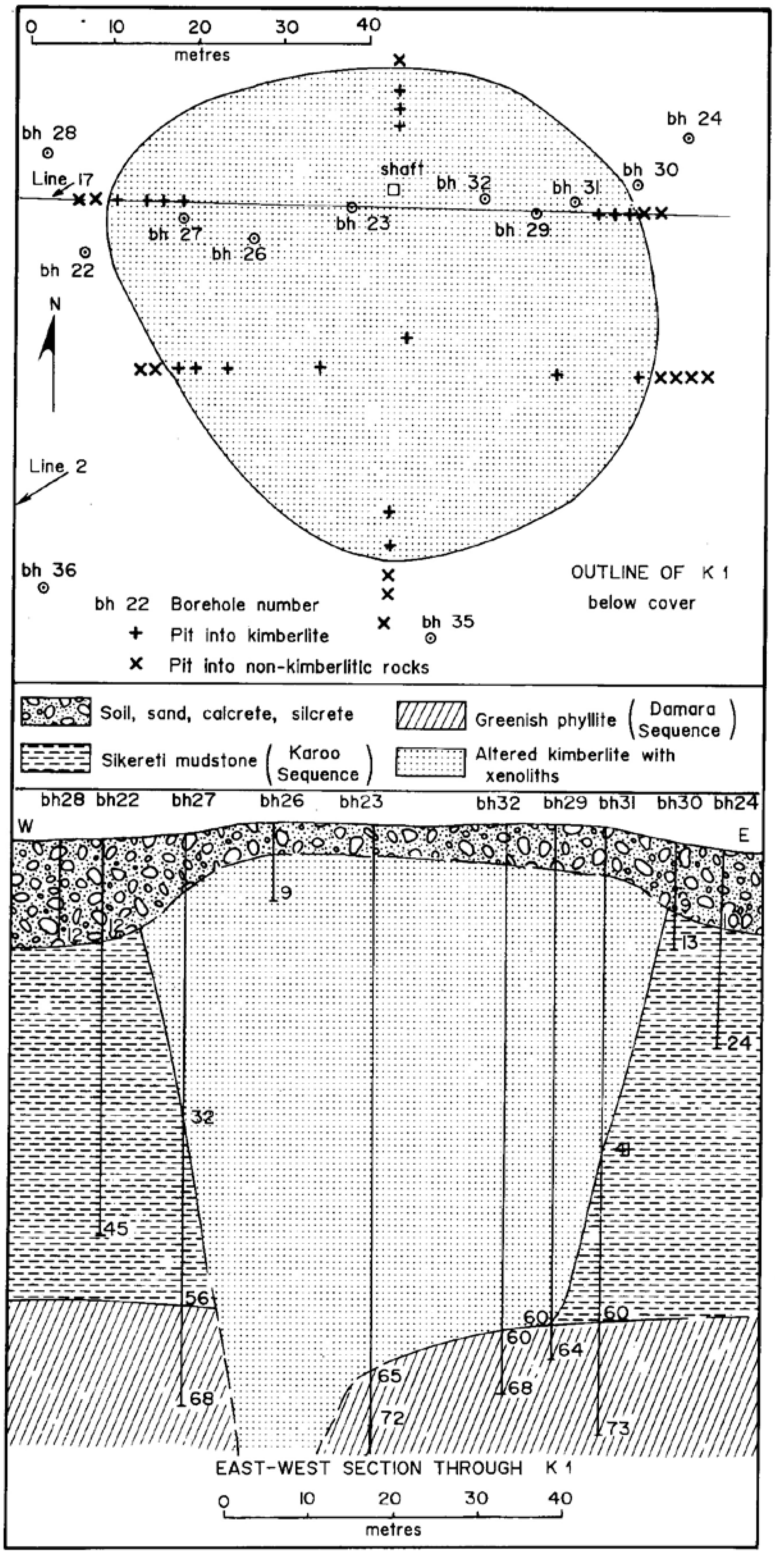

Fig. 3: Borehole K1: plan view (above) and cross-section (below), situation of exploration boreholes and pits (after Wilson 1980 and Balfour 1980).

ets of pyrope-almandine (15% MgO, 16% FeO, 0,8% Cr_2O_3)' chrome-pyrope (20% MgO, 7,5-9% FeO, 1-4% Cr_2O_3, 0,06-0,23% TiO_2) and high-titanium chrome-pyrope (20% MgO, 7,7-8,7% FeO, 1,7-4% Cr_2O_3' 0,7-1% TiO_2). Most garnets in soil samples from eastern Bushmanland and Kavango differ from those of K1 by having a higher Cr_2O_3 content (3-10%) (Wyatt 1979).

Ilmenite exceeds the number of kimberlitic garnets by three orders of magnitude (Wilson 1980) and the numerical change of both minerals in the bodies is proportionally related to depth (Balfour 1980). The number of garnets decreases from the centre of a pipe towards the margin and a strong reduction takes place within the marginal 10 m, probably due to leaching by groundwater (Balfour 1980).

Pseudomorphs of *olivine* megacrysts have been identified in thin sections. The grains are either completely serpentinised, or a crust of serpentine, limonite and clay surrounds a core of calcite or limonite. Their size reaches 8 mm across. Olivine was a very common mineral in certain portions of the kimberlite.

Small *phlogopite* laths as well as euhedral *perowskite* (up to 0,08 mm) and *spinel* (0,03 mm) crystals, all partly or completely altered, have been identified by Shee (1979) in thin sections.

Chrome-diopside is rare (Balfour 1980). *Magnetite* predominates in the heavy mineral concentrate of the kimberlite. It may be derived from serpentinite pseudomorphs after olivine, where it occurs in finely disseminated form (Dawson, 1980, p. 74), or from brecciated bedrocks and weathered xenoliths, especially dolerite.

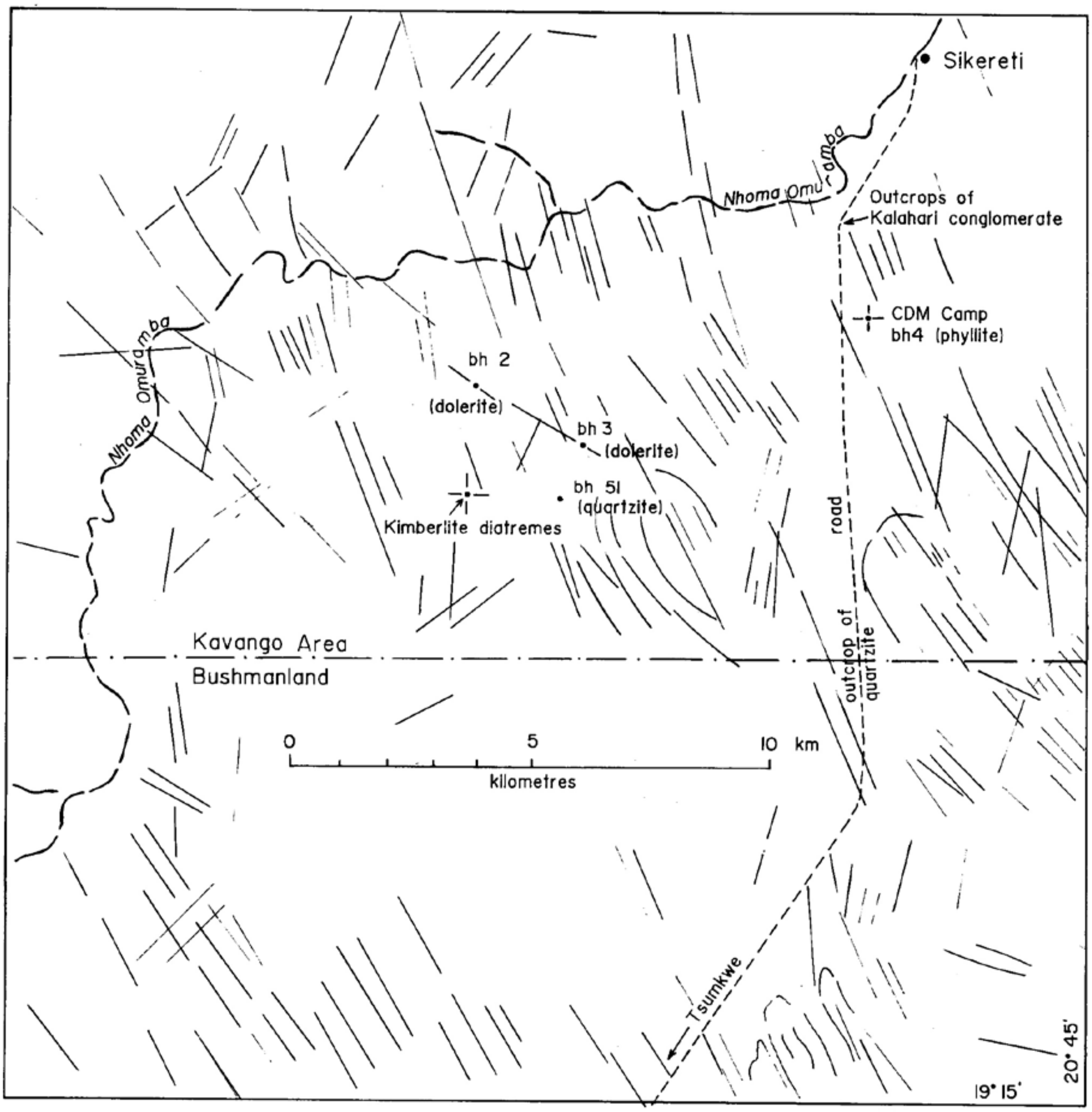

Fig. 4: Position of linear features seen on air-photos, indicating the structural pattern of a portion of Area 1920 BA; also of outcrop areas, kimberlite diatremes and of several exploration boreholes.

3.2 The Xenoliths

Xenoliths of Nosib quartzite, Karoo sediment, dolerite, and Kalahari conglomerate and sandstone are present. Dolerite xenoliths predominate in K1, ranging in size from pieces some millimetres across up to boulders more than one cubic metre in volume. The xenoliths are angular to subrounded with a sharp, calcrete-rimmed outer edge; pieces smaller than a few centimetres may be weathered throughout and assumed a red-brownish colour; less weathered dolerite is greyish to brown, of semihedral texture. The ‘dolerite contains much magnetite. In K3, small pieces were recorded only between 6 and 10 m. These xenoliths are derived from a dyke swarm of late Karoo age (Hegenberger 1983). Few pieces of fine-grained to glassy, amygdaloidal igneous rock, found in K1 and K3, resemble basalt of the upper Karoo Sequence, but dolerite can have assumed similar texture, too.

Several small boulders up to 30 cm across, of red-brown to greyish, slightly feldspathic quartzite in K1 and K3 resemble Nosib quartzite which outcrops some kilometres away (Fig. 4; see Hegenberger 1983, Fig. 1). They are the oldest rocks which have been identified among the xenoliths.

A small piece of black shale and an inclusion of gabbro have been reported from K3 by Wilson (1980); their age is unknown.

The correlation of several of the xenoliths remains dubious, viz.: a boulder in K3, exceeding 50 cm in size, of pink-grey to pale red conglomerate consists mainly of fine to medium-grained, feldspathic quartzite pebbles and some granite pebbles, set in a fine-grained, calcareous sandstone matrix. The pebbles are elongated, measuring up to 6 cm, and are imbricated; the parent rock of the quartzite pebbles resembles Nosib quartzite. Another xenolith in K3 is composed of calcite-cemented, fine-grained, pale red sandstone with a distinct reddish layering and crossbedding; an erosional channel within the sandstone is filled with quartzitic conglomerate of the same appearance as that mentioned above. Both inclusions resemble Kalahari conglomerate, the first one might be correlated with the basal conglomerate which outcrops in the road south-west of Sikereti (Fig. 4). However, it cannot be ruled out that the xenoliths are derived from the Karoo succession, more specifically from the Sikereti Mudstone of the Omingonde Formation. Although very little is known about the occurrence of Karoo sediments in Kavango and Bushmanland, their presence near the kimberlites is known (see Chapter 4). Furthermore, small xenoliths might have undergone alterations, especially carbonatisation, and thus resemble Kalahari rocks. Abundant patches of sandy to silty, calcite-cemented material in K3 could be misinterpreted as xenoliths, but ubiquitous nodules of serpentine included in this matter indicate that it is actually a decomposed kimberlite matrix contaminated by unconsolidated country rocks.

One sample of arenaceous limestone with fine-grained, well-rounded quartz grains comprises two different rock types: a pinkish rock with abundant serpentine nodules (proving a kimberlitic nature) enclosing patches, up to several centimetres across, of greenish calcareous sandstone that is devoid of serpentine. The boundary between both rock types is either sharp, accentuated by calcite seams, or gradational. The greenish sandstone resembles Kalahari sandstone; it forms apparently xenoliths which are enclosed in impure kimberlite.

Numerous red, soft mudstone xenoliths, rounded to angular, with diffuse to sharp boundaries, measure from less than 1 cm to more than 1 m across. They are derived either from the uppermost country rocks of the diatremes (see below) or from originally still higher strata which have been eroded in the meantime.

4. COUNTRY ROCKS OF THE DIATREMES

The oldest rocks known in this area comprise gneiss, granite and schist which have been tentatively correlated with the Grootfontein Complex. They are unconformably overlain by sedimentary rocks of the Damara Sequence which had been deposited on the northern platform of the Damara Orogen and subsequently were only weakly metamorphosed: quartzite and limestone are correlated with the Nosib and the Otavi Groups respectively, while phyllite and siltstone occurring at isolated outcrops might belong to any pelitic portion of the Damara Sequence. The distribution of sedimentary and igneous rocks (basalt and dolerite) of the Karoo Sequence is known insufficiently as they are covered everywhere in this region by the Kalahari Group. The latter, up to more than 200 m thick, was sub-divided into three formations by Albat (1978); the fourth and uppermost unit is the Kalahari Sand which covers most of the area.

As the diatremes occur in a region completely covered by unconsolidated Kalahari sediments, the nature of the country rocks could only be inferred from boreholes and xenoliths:

The oldest rocks recorded in the diatremes are correlated with the Nosib Group; quartzite of this group was intersected in borehole 51, situated 1,3 km to the east of the kimberlites (Fig. 4), from 27 m downwards (see appendix). Boreholes in the immediate surrounding of the kimberlites met with Damaran phyllite, siltstone and very fine sandstone of greenish to brownish colour from 60 m downwards (Fig. 3 and appendix). Metamorphic alteration of these rocks attests to their pre-Karoo age, but their exact position within the Damara Sequence cannot be determined (see above).

Between the underlying phyllitic succession and the duricrusts which are of undisputed Kalahari age, mainly reddish brown to pink mudstone up to 50 m thick was intersected in boreholes; this “Sikereti Mudstone” is unlithified and disintegrates in water which, however, may be due to weathering. In several boreholes the mudstone was found to be non-calcareous (see Appendix), while two samples from the lower portion of borehole 22 proved strongly calcareous. In borehole 40 (see Appendix) a few metres of a "basal quartz conglomerate" are recorded underneath the mudstone, while in borehole 51 (Fig. 4) pebbles of silcrete and quartzite occur within the mudstone succession between 12 and 27 m. This description would suggest a correlation of the mudstone and conglomerate with the Tsumkwe Formation of the Kalahari Group (Albat 1978; SACS, 1980; Hegenberger 1983). Unfortunately, no borehole samples of the conglomerate could be examined, but the basal conglomerate of the Kalahari is exposed 10 km north-east of the diatremes in the road to Sikereti (Fig. 4) and a similar rock is known as xenoliths (chapter 3.2). The correlation of the Sikereti Mudstone with the lower portion of the Kalahari Group, is, however, contradicted by the position of a dolerite dyke about 2,5 km north-east of the diatremes. It forms part of the dyke swarm of late Karoo age (Reeves 1978; Hegenberger 1983, and Fig. 5) and is covered by 1 m of sand and calcrete only (boreholes 2 and 3, Fig. 4). In pits it was found to have intruded and baked red mudstone (Medlycott, 1980), the latter being an equivalent of the mudstone intruded by the kimberlites. This implies that conglomeratic Sikereti Mudstone around the diatremes predates the dolerite of late Karoo age and most probably should be correlated with the Omingonde Formation of the Karoo Sequence.

The dyke swarm of late Karoo age is recorded by abundant dolerite xenoliths in K3 (chapter 3.2), by boreholes 2 and 3 (Fig. 4) and by aeromagnetic anomalies, indicating individual dykes under apparently thin Kalahari cover. Few small xenoliths of amygdaloidal igneous rocks are not considered as a proof of former occurrences of late-Karoo basalt, eroded after emplacement of the kimberlites, but could be also derived from dolerite dykes and sills, instead.

5. AGE OF EMPLACEMENT

The kimberlites post-date the youngest rocks which have been affected by the eruption. Xenoliths of dolerite

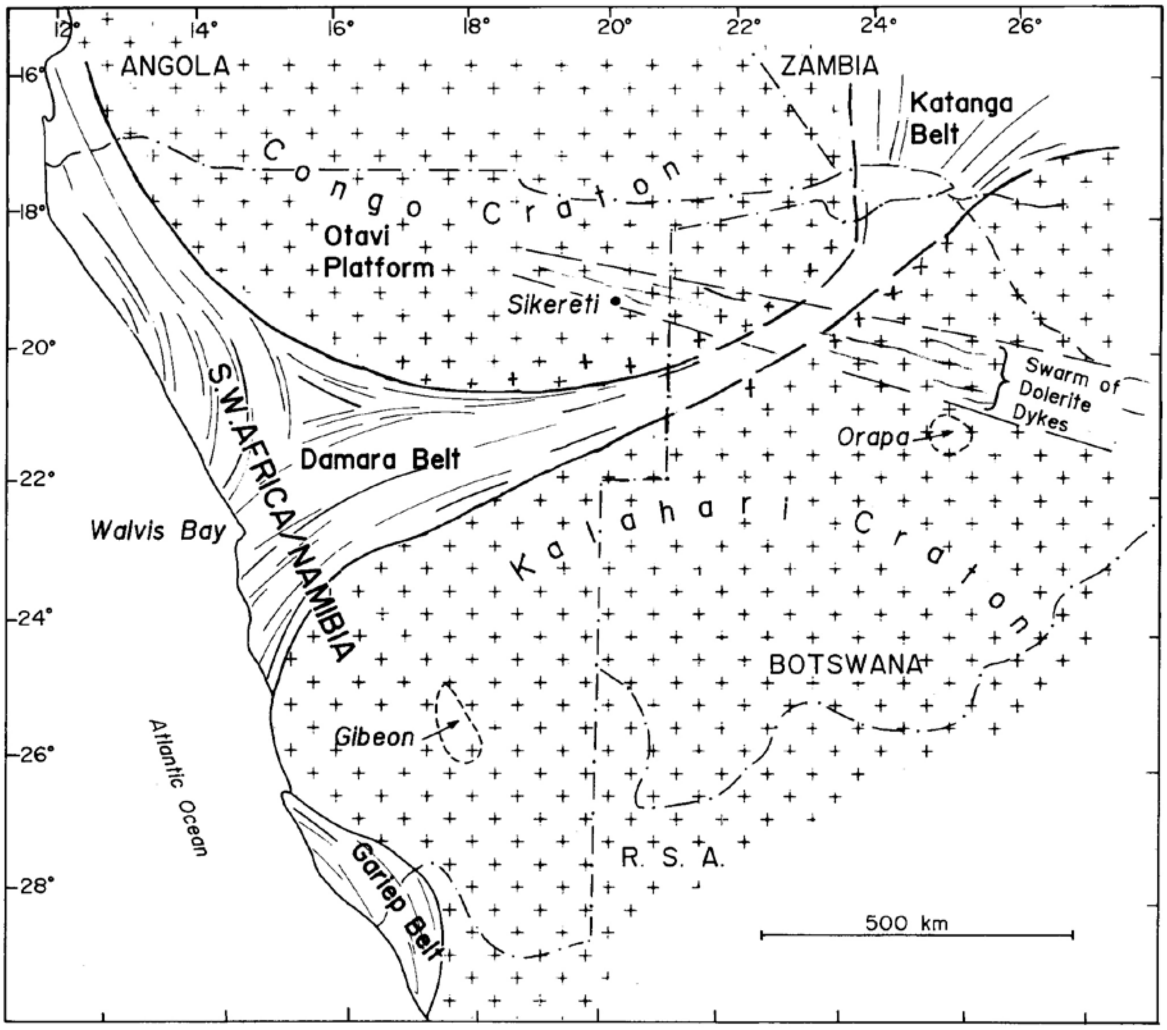

Fig. 5: Situation of kimberlite provinces (Orapa, Sikereti, Gibeon) and their relations to cratons and the Damara orogenic belt. Trend of late-Karoo dolerite dyke swarm in Botswana and north-eastern South West Africa/Namibia.

prove that the diatremes are not older than late Karoo, i.e. about 150 m.y. Xenoliths of conglomerate and sandstone resemble rocks of lower Kalahari age, derived from a higher level which has been eroded since emplacement. A Karoo age, however, cannot be altogether excluded (see chapter 3.2). As the base of the Kalahari is assumedly about coeval with the base of the Tertiary, the first interpretation (lower Kalahari age) would imply that the diatremes are less than 65 m.y. old, younger than the Gibeon Kimberlite Province (83 to 127 m.y. for phlogopite - Allsopp and Barrett 1975; SACS 1980). The Orapa-Letlhakane Kimberlite Province is of post-Karoo, probably Cretaceous age, but alterations proved too strong to obtain a reliable radiometric age (Coates *et al*. 1979); Dawson (1980) quotes an age of 93 M.y.

6. STRUCTURAL RELATIONS

Kimberlitic magma originates from deep seated sources in the upper mantle at about 200 km and is expected to be channelled by deep reaching crustal fractures into higher levels (Dawson 1980).

The Sikereti kimberlites are situated on the Congo Craton, near the southern margin of the Otavi Platform (Fig. 5).

Three major linear elements, visible on aerial photographs and LANDSAT imagery, attest to the tectonic structure of the area (Figs. 4 and 5):

a) NW to NNW trending fractures, parallel to the alignment of the diatremes;
b) NE trending fractures which together with (a) probably form of conjugate set, having caused block-faulting of the area;
c) a WNW trending swarm of late-Karoo dolerite dykes. Dextral shearing along this set of dykes may have reopened the fractures of set (a) (Coates *et al.* 1979). As this swarm has been interpreted as a failing spreading axis (Reeves 1978), rifting may have penetrated the upper, brittle, layer of the crust (Bott 1981), opening the way for magma of low density which has risen into the crust.

Seemingly, the emplacement of the Sikereti kimberlites as well as that of the Orapa-Letlhhakane Province (Coates *et al.* 1979) has been controlled by common structural features (Fig. 5). These are:

a) situated near the margins of the Congo and Kalahari Cratons respectively;
b) located near the southern margin of the dyke swarm;
c) related to NW to NNW trending features.

APPENDIX

Percussion boreholes in the Sikereti area, logged by T.D. McGhee 1979.

Bhs 2 and 3 Site: About 2 and 3 km north and north-east of the kimberlites; see Fig. 4.

0 - 1 m Sand and calcrete (Kalahari Group)
- 15 m Dolerite (Iate-Karoo)

Bh 4 Site: CDM camp, about 5,5 km south-south-west of Sikereti; see Fig. 4.

0 - 1,5 m Calcrete
- 3 m Grey micaceous sandstone
- 6 m Alternating grey silcrete and calcareous mudstone
- 12 m Fractured mudstone with calcareous infilling
- 15 m Predominantly brown-red mudstone
- 21 m As above, but with some red and green micaceous sandstone
- 24 m Red and greenish micaceous sandstone, thin clay bands
- 27 m Sandstone with some phyllite
- 60 m Phyllite

0 - 1,5 m (1,5 m) Kalahari Group
- 25 m (23,5 m) Sikereti Mudstone of the Karoo Sequence
- 60 m (35 m) Damara Sequence

Bh 22 Site: immediately west of K1; see Fig. 3.

0 - 3 m Pinkish calcareous silcrete
- 12 m Reddish silcrete
- 36 m Reddish calcareous mudstone with conglomerate bands
- 45 m Red mudstone with few pebbles

0 - 12 m (12 m) Kalahari Group
- 45 m (33 m) Sikereti Mudstone of the Karoo Sequence

Bh 23 Site: K_1; see Fig. 3.

0 - 12 m Calcrete, dolerite boulders, weathered kimberlite
- 45 m Calcretised dolertie pieces, some kimberlite
- 57 m Quartz veins, some kimberlite
- 65 m Fresh, fine-grained kimberlite
- 84 m Grey, micaceous phyllite

0 - 65 m (65 m) Kalahari Group and diatreme
- 84 m (19 m) Damara Sequence

Bh 24 Site: about 15 m north-east of K1; see Fig. 3

0 - 3 m Sand and ferricrete gravel
- 10 m Reddish and grey silcrete
- 24 m Pinkish mudstone with pebbles of chalcedony

0 - 10 m (10 m) Kalahari Group
- 24 m (14 m) Sikereti Mudstone of the Karoo Sequence

Bh 27 Site: K1; see Fig. 3.

0 - 9 m Calcrete with some dolerite
- 24 m Weathered kimberlite with calcite veins
- 32 m Slightly fresher kimberlite
- 56 m Red mudstone
- 68 m Phyllite

0 - 9 m (9 m) Kalahari Group
- 32 m (23 m) Diatreme
- 56 m (24 m) Sikereti Mudstone of Karoo Sequence
- 68 m (12 m) Damara Sequence

Bh 29 Site: K1; see Fig. 3

0 - 8 m Calcrete, silcrete, dolerite and weathered kimberlite
- 28 m Kimberlite and dolerite
- 36 m Kimberlite with minor dolerite
- 44 m Kimberlite, dolerite, phyllite
- 60 m Fairly fresh pink kimberlite (?)
- 64 m Phyllite

0 - 6 m (6 m) Kalahari Group
- 60 m (54 m) Diatreme
- 64 m (4 m) Damara Sequence

Bh 31 Site: K1; see Fig. 3

0 - 9 m Calcrete and silcrete with dolerite chips
- 33 m Pinkish mudstone with kimberlite, dolerite chips and scattered pebbles
- 41 m Fresher kimberlite (?)
- 60 m Red mudstone
- 73 m Phyllite

0 - 9 m (9 m) Kalahari Group
- 41 m (32 m) Diatreme
- 60 m (19 m) Sikereti Mudstone of the Karoo Sequence
- 73 m (13 m) Damara Sequence

Bh 34 Site: about 50 m south-east of K1

0 - 12 m Calcrete
- 16 m Pinkish mudstone
- 20 m Pinkish mudstone with some silcrete
- 56 m Pinkish mudstone
- 64 m Phyllite

0 - 12 m (12 m) Kalahari Group
- 56 m (44 m) Sikereti Mudstone of the Karoo Sequence
- 64 m (8 m) Damara Sequence

Bh 40 Site: about 160 m east .of K1

0 - 4 m Sand and ferricrete
- 8 m Calcareous silcrete
- 16 m Silcrete
- 24 m Pinkish mudstone
- 56 m Reddish mudstone
- 60 m Mudstone, light brown, possibly banded
- 64 m Basal quartz conglomerate and phyllite
- 68 m Phyllite

0 - 16 m (16 m) Kalahari Group
- 62 m (46 m) Sikereti Mudstone of the Karoo Sequence, with basal conglomerate
- 68 m (6 m) Damara Sequence

Bh 43 Site: about 50 m north-east of K1

0 - 4 m Sand and ferricrete
- 8 m Sand and silcrete
- 12 m Calcareous silcrete
- 16 m Silcrete and pink mudstone
- 20 m Mudstone and silcrete chips
- 40 m Mudstone with some silcrete pebbles
- 56 m Deep red mudstone
- 60 m Mudstone with some grey limestone
- 64 m Grey limestone

0 - about 12 m Kalahari Group
- 58 m (46 m) Sikereti Mudstone of the Karoo Sequence
- 64 m (6 m) Omingonde Formation, Karoo Sequence (?)

Bh 51 Site: about 2 km east of K1; see Fig. 4

0 - 3 m Calcrete and reddish silcrete
- 12 m Reddish silcrete
- 27 m Reddish mudstone conglomerate; pebbles consist of silcrete and quartzite
- 42 m Purple quartzite

0 - 12 m (12 m) Kalahari Group
- 27 m (15 m) Sikereti Mudstone of the Karoo Sequence
- 42 m (15 m) Nosib Group, Damara Sequence

Bh 76 Site: about 1,4 km west of K2; logged by K. Wilson 1980.

0 - 3 m Calcrete, grey, slightly sandy, some ferricrete
- 9 m Mudstone, red, well compacted, probably partially silicified; minor ferricrete and grey calcrete clasts
- 15 m Pale red siltstone, not calcareous, bedding visible; grit bands; minor quartz clasts
- 18 m As above, but with small amount of soft red mudstone
- 33 m Red mudstone, soft, not calcareous

0 - 3 m (3 m) Kalahari Group
- 33 m (30 m) Sikereti Mudstone of the Karoo Sequence

Bh 77 Site: about 1,4 km west of K2; logged by K. Wilson (1980).

0 - 3 m Calcrete, white, grey and pink, with few quartz clasts and red silcrete chips
- 9 m Red, non-calcareous siltstone with fine carbonate veinlets, subordinate buff, hard mudstone; calcrete chips and quartz clasts common, minor ferricrete (impurity from above?)
- 12 m Red and buff siltstone; quartz clasts and calcrete chips common
- 15 m Red siltstone and impure sandstone; quartz clasts max. 2 mm across in silty matrix; some pale red mudstone, soft; locally crystalline carbonate in siltstone; some calcrete chips
- 18 m pale red mudstone, soft, porous, not calcareous
- 21 m As above, with dirty sandstone of green-yellow tinge
- 27 m Largely clasts of impure sandstone, probably all that has remained from a soft mudstone; some mudstone and siltstone

0 - 3 m (3 m) Kalahari Group
- 27 m (24 m) Sikereti Mudstone of the Karoo Sequence

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