

N. DE HOOP VLEI GORGE

Field note N5. Geology



Cliffs of the Bredasdorp Group Formations on the east bank of the De Hoop Vlei Gorge.

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The De Hoop Vlei Gorge constitutes a 'window' to the geological formations around it (Figure 1).



Figure 1. Satellite image of the De Hoop Vlei area.

The De Hoop Vlei Gorge, similarly to the Salt River Gorge, cuts into most of the geological formations, which are present in the Study Area: from the basement rocks of the Bokkeveld Formations, through the Enon Formation sediments, to the shallow marine and aeolian formations of the Bredasdorp Group (the extent of the formations is a subject, which is discussed in Chapter W).

The geology of the gorges has been studied by J Malan as part of his 1990 MSc Thesis "*The stratigraphy and sedimentology of the Bredasdorp Group, Southern Cape Province*". Other sources of information are his geology 3420AD field sheet at 1:50,000 (1984), and the Geological Survey 3420 Riversdale geology sheet, at 1:250,000 (1993).

This Field Note describes the formations, which are present around the De Hoop Vlei Gorge, from old to young.

The oldest rocks and sediments around the gorge are of the Bokkeveld Group and the Enon Formation (see Chapters C and M). They outcrop in the northern section of the gorge (Figures 2 to 6).

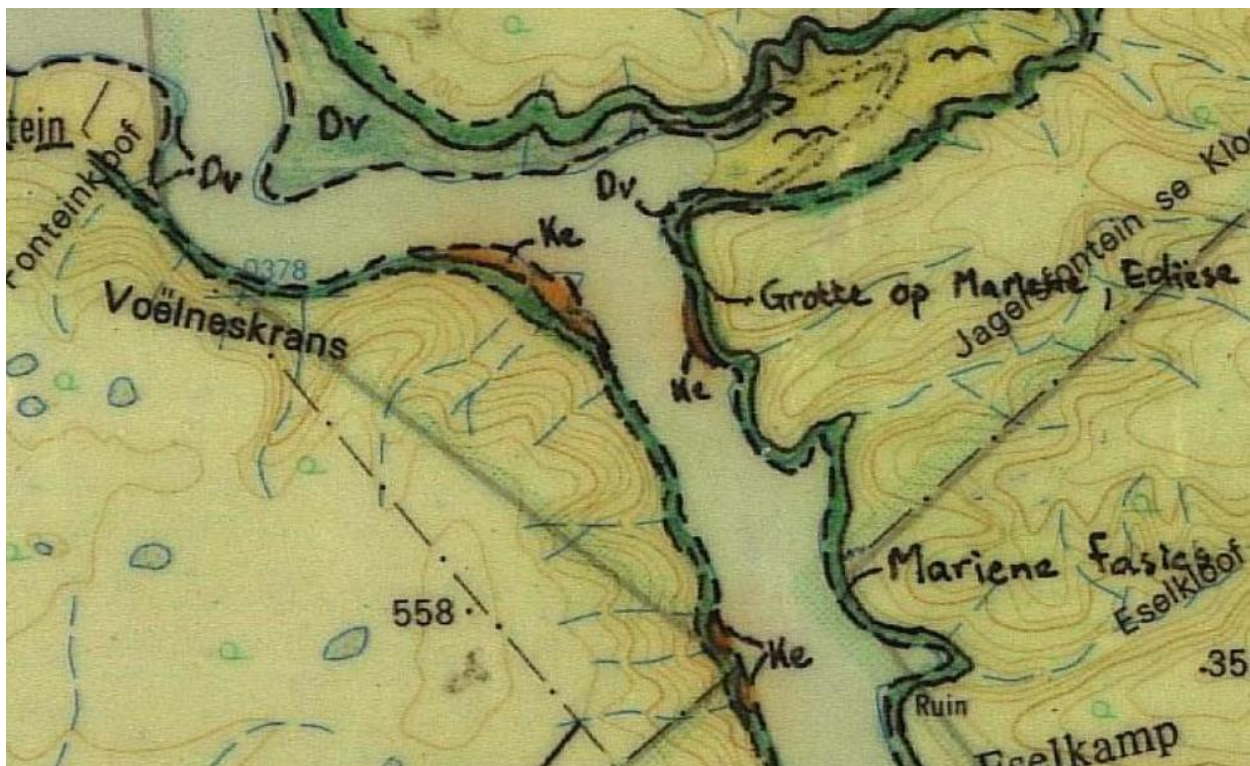
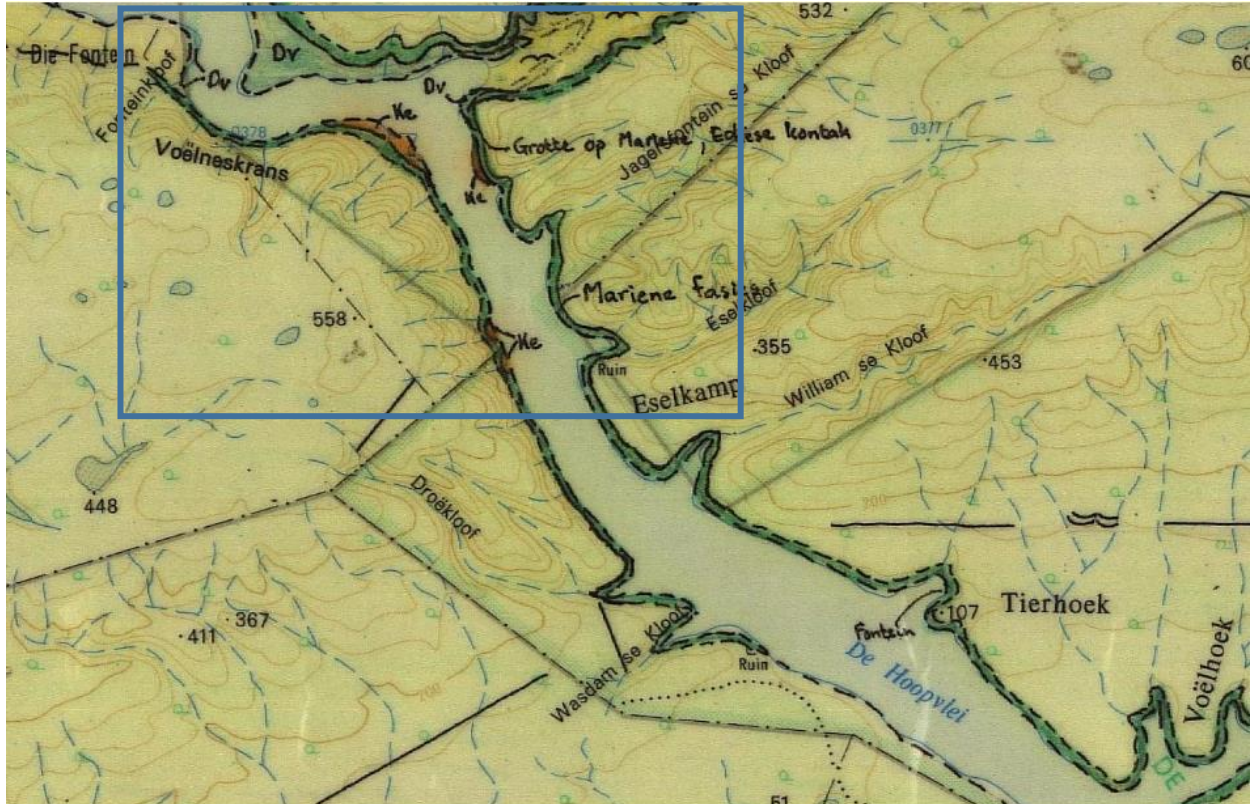


Figure 2. Top - geology field sheet of the northern part of the gorge; bottom – enlargement of the boxed area. Formations: red – Enon Fm; light green – Bokkeveld (Voorstehoek Fm); dark green – De Hoop Vlei Fm; light yellow - Bredasdorp Group (in this area – the Wankoe Fm).



Figure 3. Bokkeveld shales of the Voorstehoek Formation outcrop on the shore of the gorge.



Figure 4. Bokkeveld shales of the Voorstehoek Formation outcrop on the shore of the gorge.



Figure 5. Outcrop of the Enon Formation red soil on the west bank of the gorge. View to the south.



Figure 6. Small outcrop of Enon Formation red soil (arrow) on the west bank of the gorge.

The geology of the middle and south parts of the De Hoop Vlei Gorge poses many questions. There are discrepancies between the information sources and between maps in the description and distribution of the various formations of the Bredasdorp Group (see Chapter W). The geology of the area is not so simple and tectonic processes, which were not considered before, may help understand the formation of some features. (See Field Note on tectonics).

The southern part of the De Hoop Vlei Gorge is where the stratigraphy of the De Hoop Vlei Formation, the lowest formation of the Bredasdorp Group, was studied and described in detail (Figure 7). This formation is overlain by the Wankoe Formation (see Chapters C and M for more on these two formations).

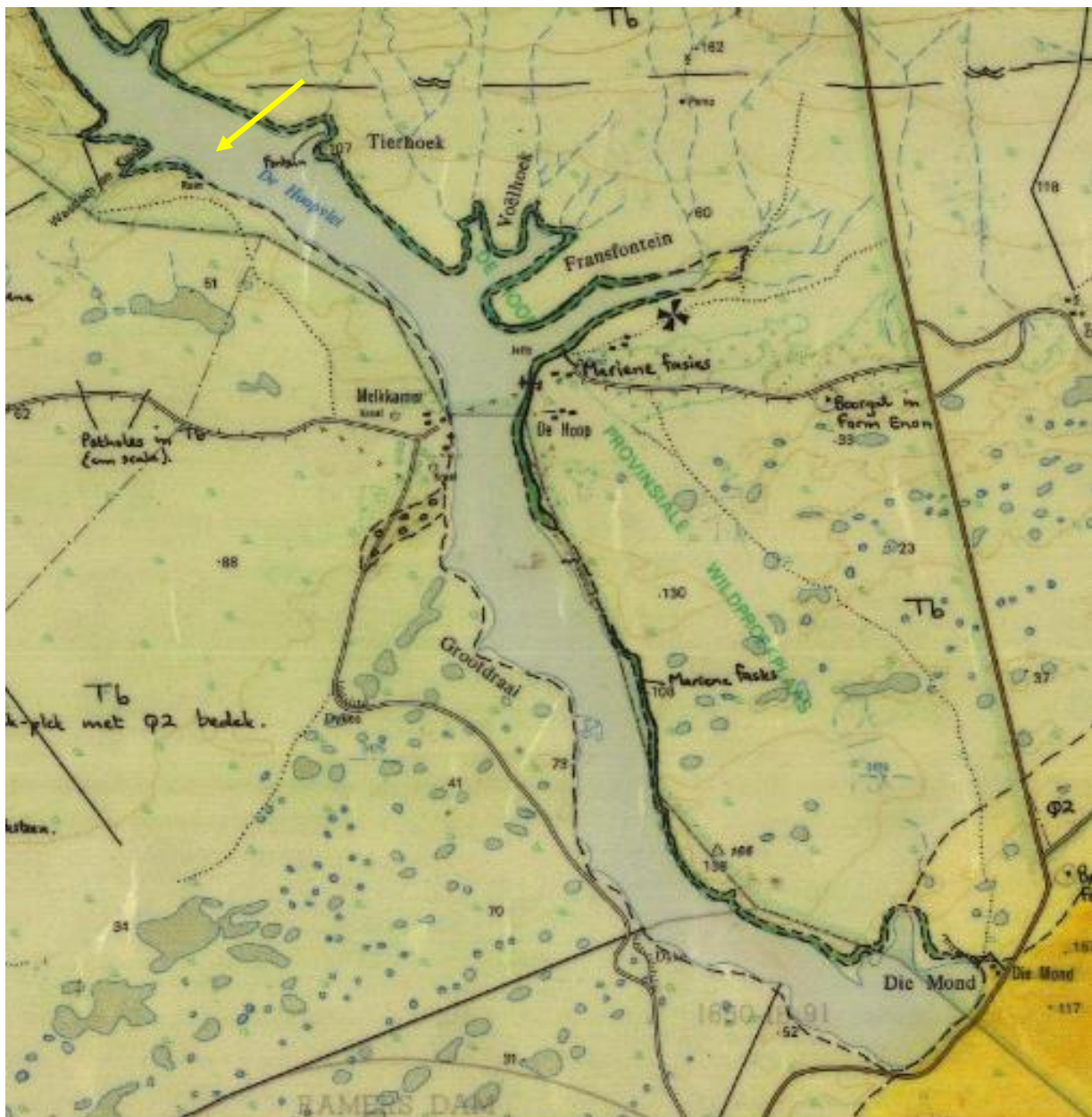


Figure 7. Top - geology field sheet (Malan, 1984) of the middle and southern parts of the gorge. Formations: dark green – De Hoop Vlei Formation [note that this formation is not present on the west side of the gorge from Wasdam se Kloof (arrow) southwards]; light green - Bredasdorp Group (undivided); light yellow – Quaternary soil; dark yellow – shifting sand dunes of the Strandveld Formation.

The stratotypes* of the De Hoop Vlei Formation were studied near the De Hoop resort and between it and Die Mond on the east bank of the gorge (Figures 8 to 20). This formation attains a maximum thickness of 18.9 m at the cliffs of the resort – the thickest in the entire area. The formation becomes thinner south of the resort. Unfortunately, the stratigraphy of the cliffs north of the resort, where the De Hoop Vlei Formation is very thin, was not studied by Malan. It is not present on the west side of the gorge from Wasdam se Kloof southwards.

[* A **stratotype** or 'type section' is a term that names the physical location or outcrop of a particular reference exposure of a stratigraphic sequence or stratigraphic boundary].

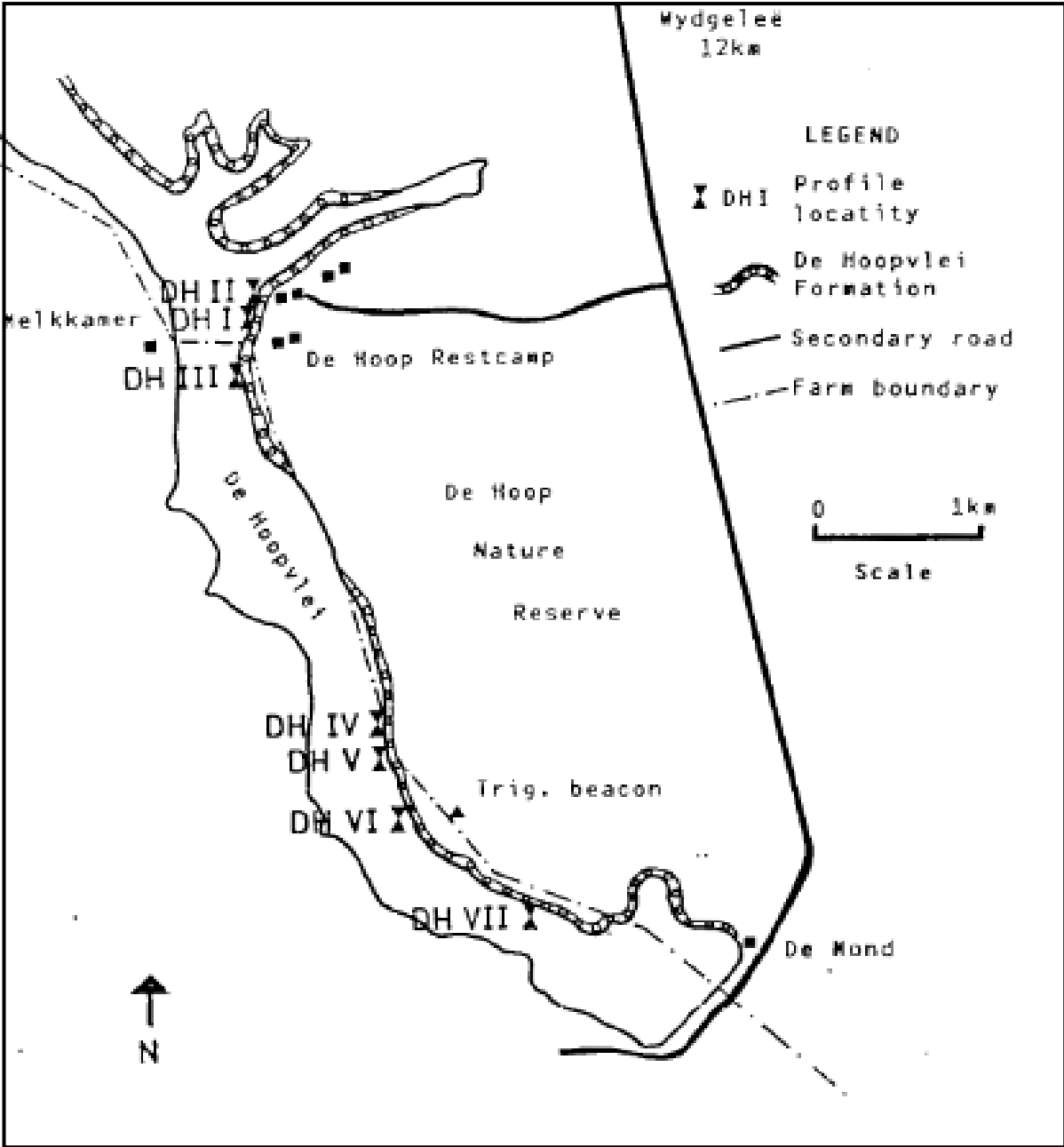


Figure 8. Geology map of the De Hoop Vlei Formation, indicating the sites (stratotypes) where the stratigraphy of this formation was studied by J Malan.

Source: J Malan, MSc Thesis, 1990.

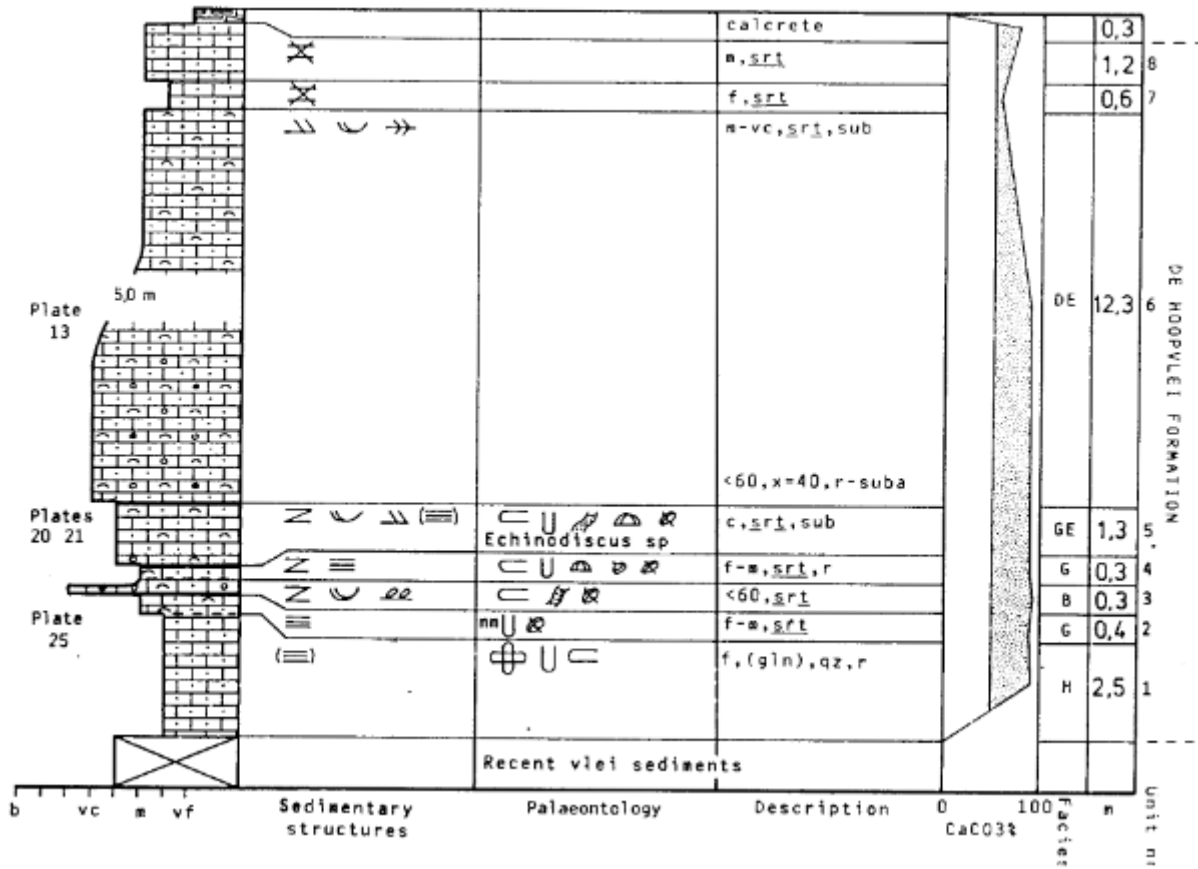


Figure 9. Profile DH II (see location in Figure 8) is the northernmost of the seven profiles in this part. The thickness of the De Hoop Vlei Formation at this point is 18.9 m (it is possible that more of this formation is buried under the recent sediments of the vlei. For stratigraphic legend, see the last pages of this field note.

Source: J Malan, MSc Thesis, 1990.



Figure 10. Approximate site of Profile DH I near the resort (see Figure 8 for the profile location).

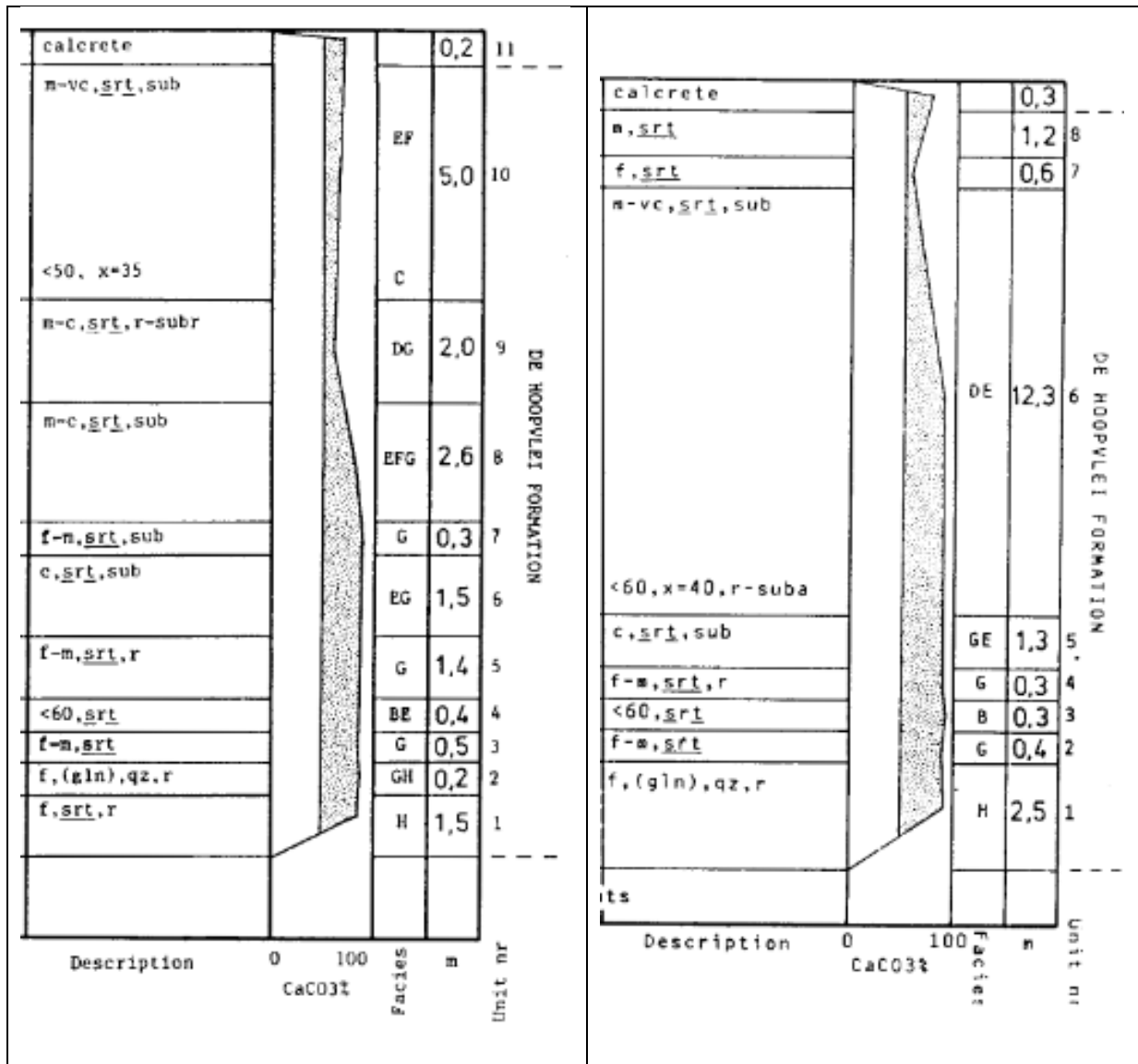


Figure 11. The right-hand columns of the stratigraphy of Profiles DH I (left) and DH II (right) (see profile locations in Figure 8), shown here to demonstrate the lateral changes within this formation (over a short distance of 100-200 m). The thickness of the formation in Profile DH I is 16.4 m, and in Profile DH II the thickness is 18.9 m – the thickest in the entire area. Note that these are the only profiles where the Wankoe Formation is absent, and the De Hoop Vlei Formation is capped by calcrete (see Figure 12). For stratigraphic legends, see the last two pages of this field note.

Modified from: J Malan MSc Thesis, 1990.



Figure 12. Top and bottom: satellite images of the resort. Arrow points to the sites of Profiles I and II. The grassy area (2.5 x 0.5 km) east of the resort is covered with Quaternary soil.



Figure 13. Part of the De Hoop Vlei Formation near Profiles DH I and DH II. Note the shells embedded within the rock.



Figure 14. Part of the De Hoop Vlei Formation near Profiles DH I and DH II.



Figure 15. Part of the De Hoop Vlei Formation near Profiles DH I and DH II.

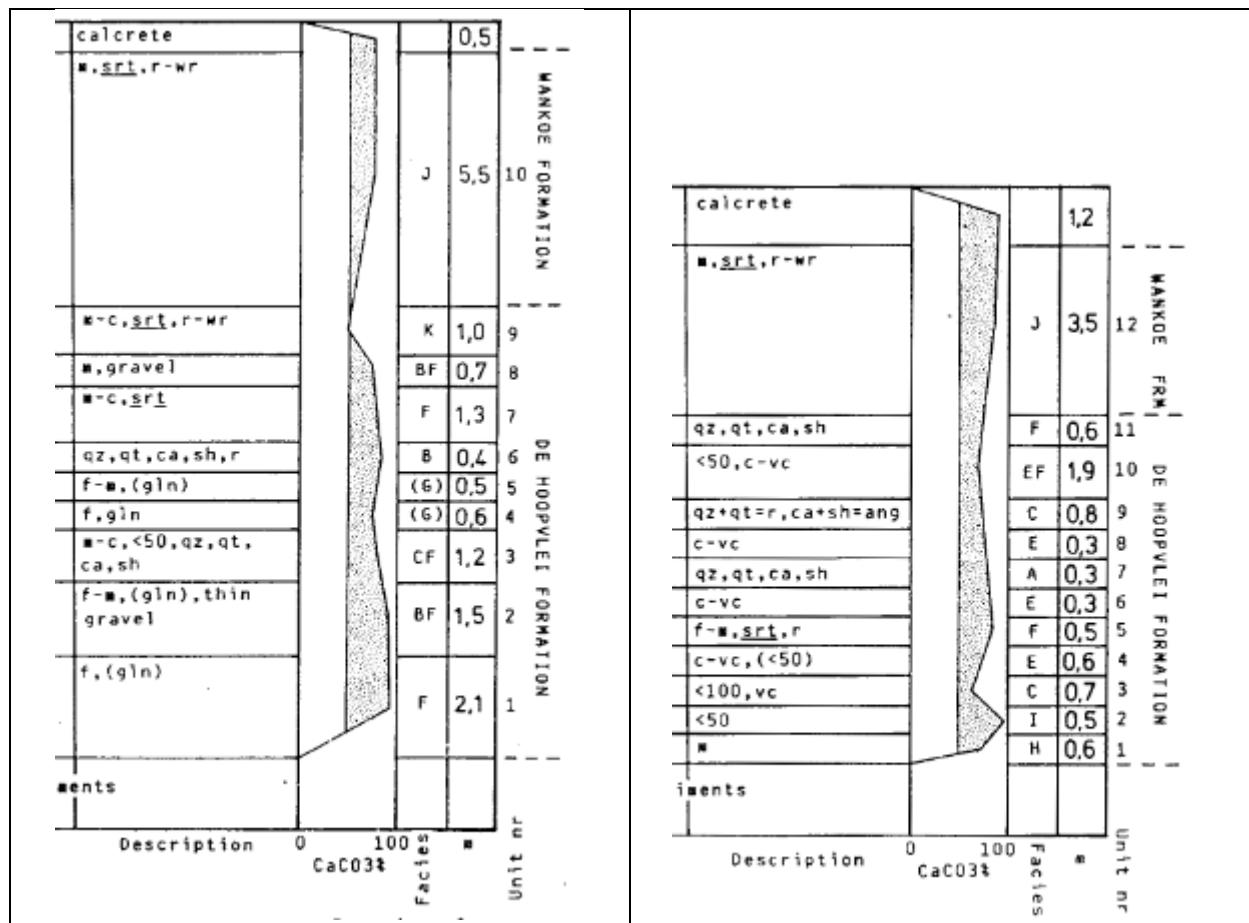


Figure 16. The right-hand columns of the stratigraphy of Profiles DH IV (left) and DH VII (right) (see profile locations in Figure 8), shown here to demonstrate the lateral changes within this formation (over a distance of about 1.5 km). The thickness of the formation in Profile DH IV is 9.3 m and in Profile DH VII it is 7.1 m. For stratigraphic legends, see the last two pages of this Field Note.

Modified from: J Malan MSc Thesis, 1990.

The cliffs north of the De Hoop Rest Camp were not studied by J Malan, hence there are no stratigraphic profiles from that area. Photographs of the De Hoop Vlei Formation in that part of the gorge are given below (Figures 17 to 19).



Figure 17. Part of the De Hoop Vlei Formation (coquina – a layer consisting wholly of shells) on the west bank of the gorge.



Figure 18. The De Hoop Vlei Formation at the outlet of Droëkloof, on the west bank of the gorge. View to the west.



Figure 19. top and bottom: the De Hoop Vlei Formation (below the dashed lines?) is obscured by the talus, which was accumulated at the base of the cliff, overlain by (probably) the Wankoe Formation (hosting a few small caves) on the east side of the gorge (Tierhoek Coves). Views to the west.

The De Hoop Vlei on the west bank disappears next to Wasdam se Kloof (Figure 7), but on the east bank it extends all the way southwards to the northeast corner of Die Mond, and (according to Malan) overlain by the Wankoe Formation along a few sections (Figures 20 to 23).



Figure 20. Approximate site of profile DH IV south of the resort (see Figure 8 for the location).



Figure 21. Part of the De Hoop Vlei Formation (?) with no presence of shells, south of Profile DH VII, near the hydrometer.



Figure 22. Part of the De Hoop Vlei Formation (?) south of Profile DH VII.



Figure 23. The De Hoop Vlei Formation is thinning out at the north shore of Die Mond. Note the shells.

The De Hoop Vlei Formation, as well as other surfaces in the De Hoop Vlei Gorge, are capped with tabular calcrete, which attains thickness of over 1 m in places (Figures 24 and 25).



Figure 24. The De Hoop Vlei Formation is capped with calcrete. Top – view to the northeast; arrow points to the site where the bottom photo was taken. Bottom – calcrete over De Hoop Vlei Formation (?). Dashed line indicates contact.



Figure 25. Calcrete slabs. Top – on ‘The Tongue’ (indicated by the arrow in the inset; name given by the author). Bottom – on the shore north of ‘The Tongue’. See also Field Note on Die Mond.

Whereas dolines are abundant on either side of the south part of De Hoop Vlei, only one sinkhole was found by the author. It is located at the northeast end of the De Hoop Depression (see field note) (Figure 26).

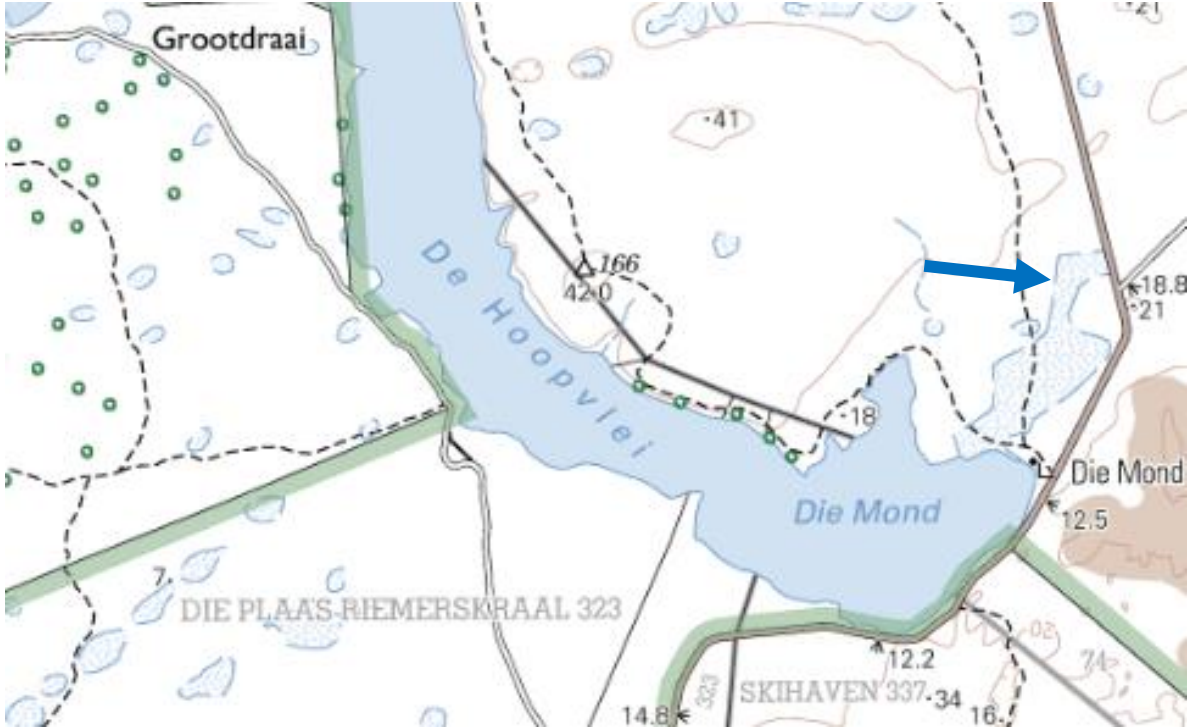


Figure 26. Sinkhole at the back dolines of the De Hoop Depression. Top – topography map (1:50,000) showing the location of the sinkhole. Bottom – view of the opening.

Below a layer of calcrete, the sinkhole is cut into aeolian rocks, sandwiching a ~1 m thick layer of conglomerate (Figures 27 and 28).

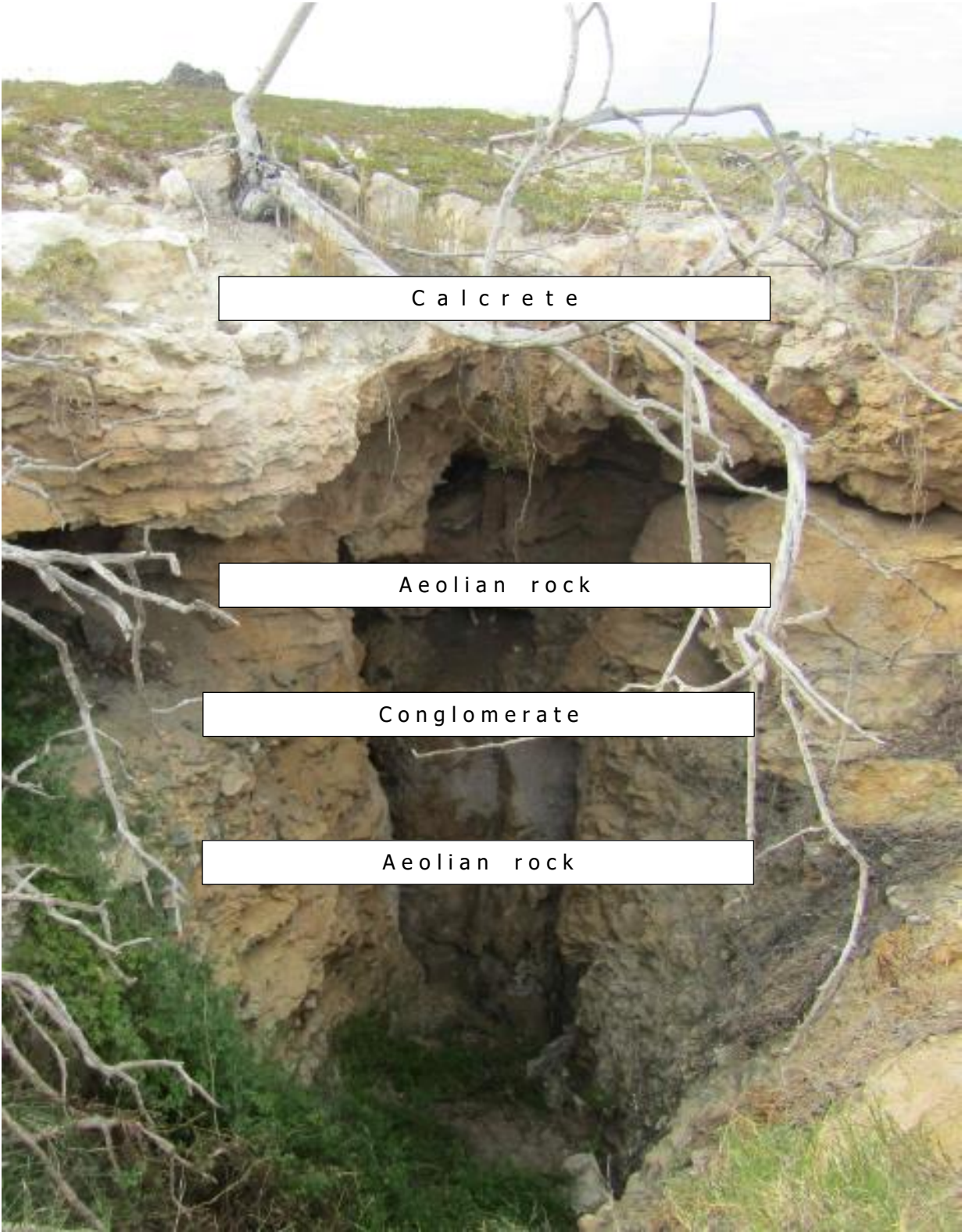


Figure 27. Geology of the sinkhole. See Figure 28.

The conglomerate layer contains rounded pebbles, discoidal pebbles (shales) as well as shells (Figure 28).



Figure 28. The conglomerate layer in the opening. Top – the left side. Bottom – the right side.

Discoidal pebbles of shales are strewn around the sinkhole as well as in the canal to the west (Figure 29).



Figure 29. Discoidal shale pebbles are abundant near the sinkhole and in the canal to the west.

Rocks containing round and angular clasts, as well as marine organisms are found near the sinkhole (Figure 30).



Figure 30. Top and bottom - rocks which may represent the De Hoop Formation near the sinkhole. Arrow points to a gastropod.

The geology map indicates the presence of the Enon Formation in a borehole ~300 m east of the sinkhole (Figure 31).
































Figure 31. Geology map (Malan's field sheet, 1984) showing the location of the borehole, where the Enon Formation is present. The depth to the formation is not mentioned.

The settlers of De Hoop claimed that the vlei is drained by sinkholes like the one described above, which they sealed to 'prevent the vlei water running to the sea via an underground systems of karst tunnels' (read other field notes in this chapter and the appendix on the people of De Hoop). This is very much doubted.

The geology of Die Mond is complex and deserves a detailed study.

Appendix: Stratigraphic legends

LITHOLOGY	SEDIMENTARY STRUCTURES
 Siltstone	 No visible structures
 Sandstone	 Vague structures
<ul style="list-style-type: none"> ○ conglomeratic ● intra-formational ◡ shelly ⊥ calcareous 	 Massive
 Limestone	 Ripples
<ul style="list-style-type: none"> ○ calcirudite ● intra-formational ⊥ calcarenite ◡ shelly ✕ crystalline 	 Horizontal lamination
 Conglomerate	 Graded bedding
<ul style="list-style-type: none"> ● intra-formational ⊗ matrix-supported ◡ shelly 	 Micro crossbedding
 Calcrete	 Inclined bedding
 Peat	 Reactivation surfaces
 Alternating lithologies	 Crossbedding (general)
 No outcrop	 Planar crossbedding
	 Trough crossbedding
	 Herringbone crossbedding
	 Imbrication
	 Palaeostream directions
CONTACTS	TEXTURE
 Gradational contact	b Boulder
 Sharp contact	p Pebble
 Eroded contact	g Gravel
BIOGENIC STRUCTURES	vc Very coarse grained
 <u>Ophiomorpha</u>	c Coarse grained
 <u>Skolithos</u>	m Medium grained
 Bioturbation	f Fine grained
U Vertical burrows/tubes	vf Very fine grained
C Horizontal burrows/tubes	wr Well rounded
⚡ Plant roots	r Rounded
	subr Subrounded
	sub Subrounded- Subangular
	suba Subangular
	ang Angular
	<u>srt</u> Well sorted
	<u>sr</u> Moderately sorted
	(srt) poorly sorted

Lithological profile legend (page 1).
Source: J Malan, MSc Thesis, 1990.

ABBREVIATIONS	FOSSILS
X Mean size (mm)	∞ Fish remains
< Maximum size (mm)	☪ Shark's teeth
200 Size (mm)	Y Bryozoa
200x100x50 Max. clast size (mm)	☉ Echinoidea
— Highly	☪ Bivalvia
- - Moderately	▲ Gastropoda
() Slightly	☪ Comminuted shells
gln Glauconite grains	☪ Foraminifera
qz Quartz grains/clasts	☪ Spines
qt Quartzite grains/clasts	▲t Terrestrial
ca Calcarenite clasts	☪ Algae
sh Shale clasts	
ssh Sandy shale clasts	
hm Heavy minerals	▷ Lenticular beds
m Thickness in metre	▶ Lenticular litho-units
mm Thickness in mm	◻ Semi-consolidated
Nr Unit number	◻ Unconsolidated
340/25 Dip and dip direction	
org Organic material	
t Terrestrial	
>1m Large-scale crossbedding	
GRP Group	
FRM Formation	
K Facies	

Lithological profile legend (page 2).

Source: J Malan, MSc Thesis, 1990.