C. GEOLOGY

Field Note C6b – The Enon Formation - Subsurface geology

Overview

There are several boreholes in the Soutpansvlakte Basin (Figures 1). Unfortunately, most of the geology records were not kept. Only some information pertaining to certain boreholes can be found on the geology maps.

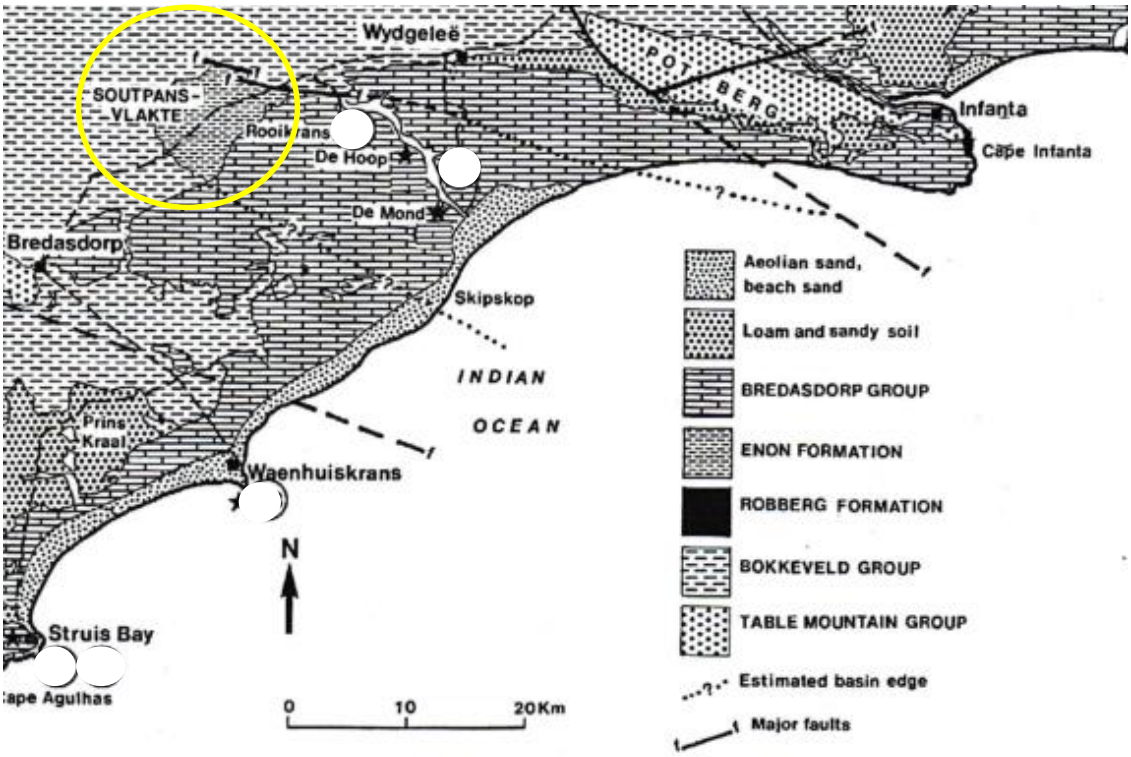

Figure 1. Geology map of the study area. The circle indicates the area in question. The limestone of the Bredasdorp Formations were deposited over the Enon Formation. (*Modified; from Field Trip Guide, 2016, by J Malan and J Viljoen***).**

Recent drillings in the area presented an opportunity to look at the subsurface geology. The drillings are located on the NW slopes of the Hard Dunes, between the Kars River and the Salt River Gorge (Figures 2, 3 and 4).

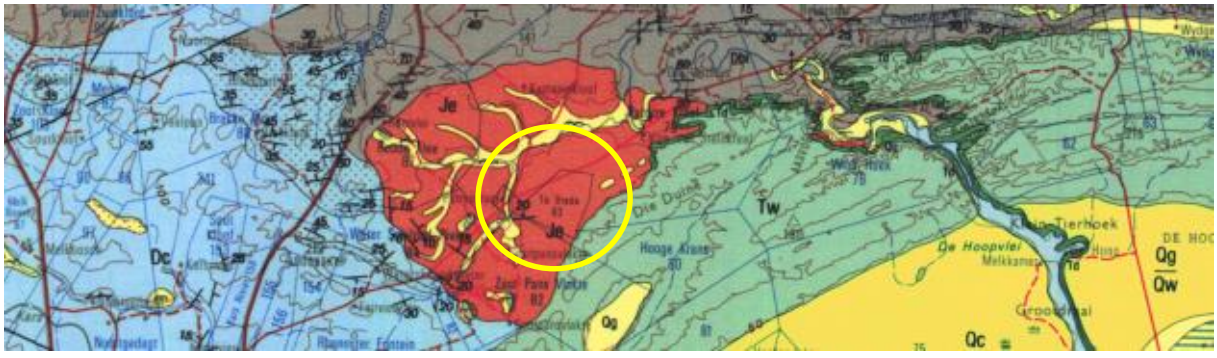

Figure 2. Geology map of a section of the Study Area. The circle indicates the area in question, which is in the southern part of the Soutpansvlakte Basin.

Some of the boreholes, which existed in the area in question before 1984, are marked on the geology field map from that year (Figure 5). The map gives general information on the geology records of a few boreholes only. (Nowadays, many more boreholes dot this cultivated area).

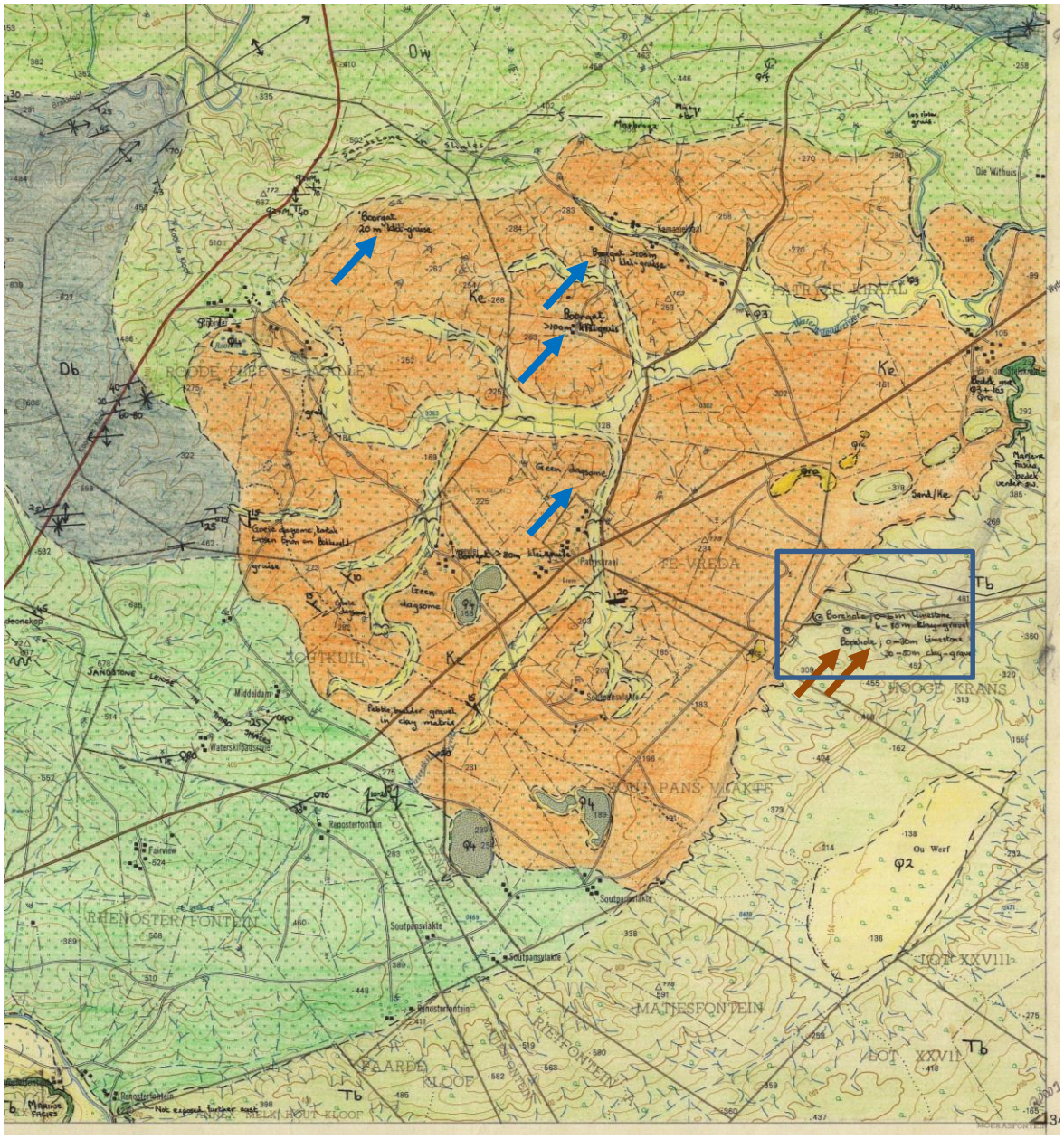

Figure 3. Section of geology map 3420AC (field-sheet of 1984 at 1:50,000; elevations in feet) of the Soutpansvlakte Basin. The cream colour represents the Bredasdorp Group; the orange colour represents the Enon Formation; the green and dark-grey colours represent the Bokkeveld Formations; the yellow colour represents Quaternary deposits; the light-grey colour indicates salt pans. Arrows point to boreholes, which are marked on the map. Four boreholes (blue arrows) were drilled into the Enon Formation and encountered clay and gravel all the way down. Nowadays there are many more boreholes in this cultivated area, but the geological records are not available. Red arrows indicate the two drillings into the slopes of the hills (Hard Dunes) of the Bredasdorp Formations (the blue box is enlarged in Figure 5). Note that the map is from 1984 and some features (roads etc) have changed since.

The general topography of the area in question is shown in Figure 6. The boreholes, old and recent, discussed in this Field Note, are situated on the slopes of the Hard Dunes (Figure 7), close to the boundary with the cultivated area to the north-west (Figure 8).

Seven of the boreholes are situated in two shallow, east-west trending ravines on the farm Patryskraal; the other two are situated in a shallow, south-north trending ravine on the farm vd Stelskraal (Figures 7 to 10).

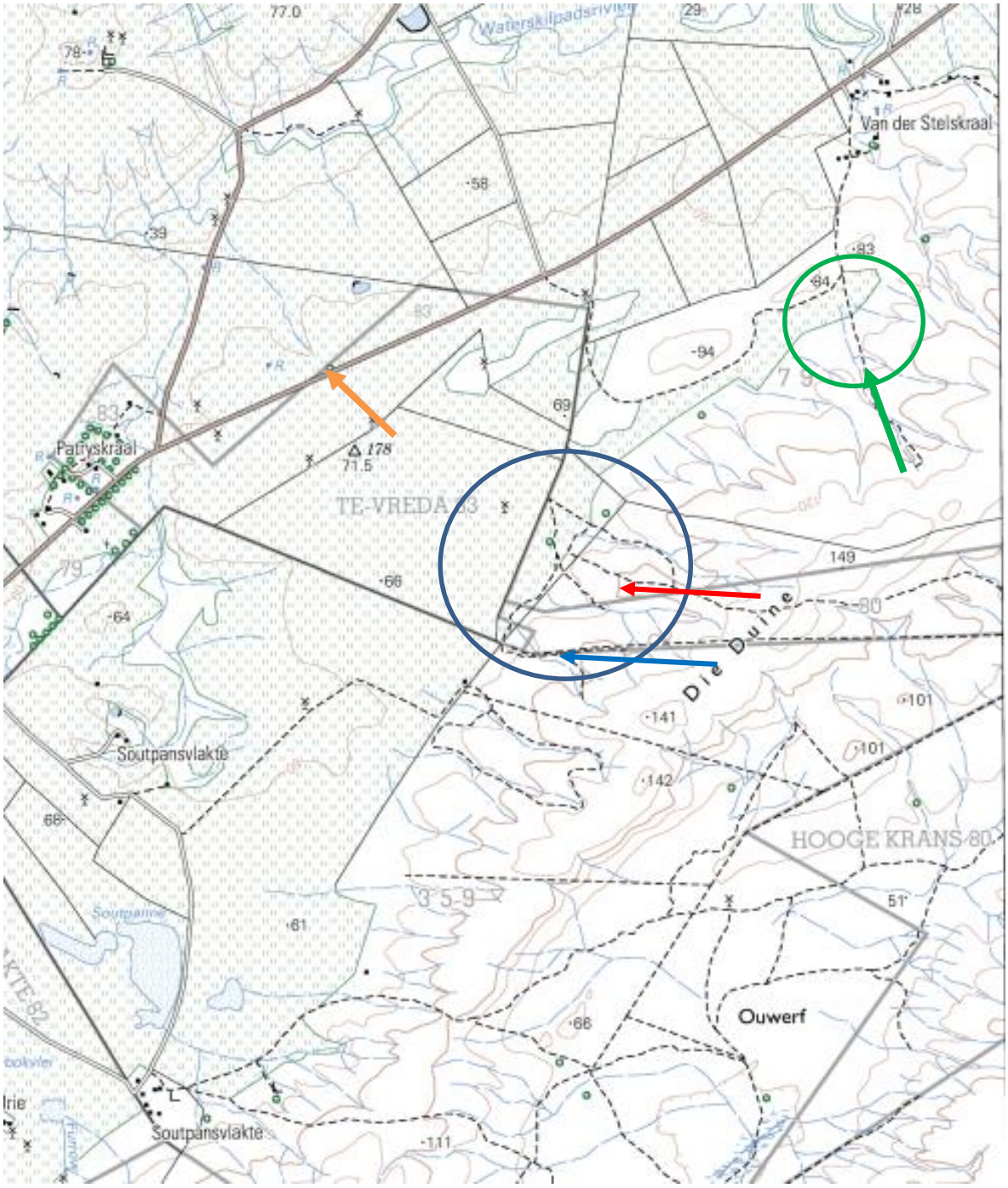

Figure 4: Section of the topography map 3420AC at 1:50,000, 2007. Circles indicate the borehole areas. The blue circle is on the Patryskraal Farm - the blue arrow points to the southern ravine; the red arrow points to the northern ravine. The green circle is on the vd Stelskraal Farm - the green arrow points to the ravine. The orange arrow points to the road from Bredasdorp in the southwest to Wydgeleë (Ouplaas) in the northeast.

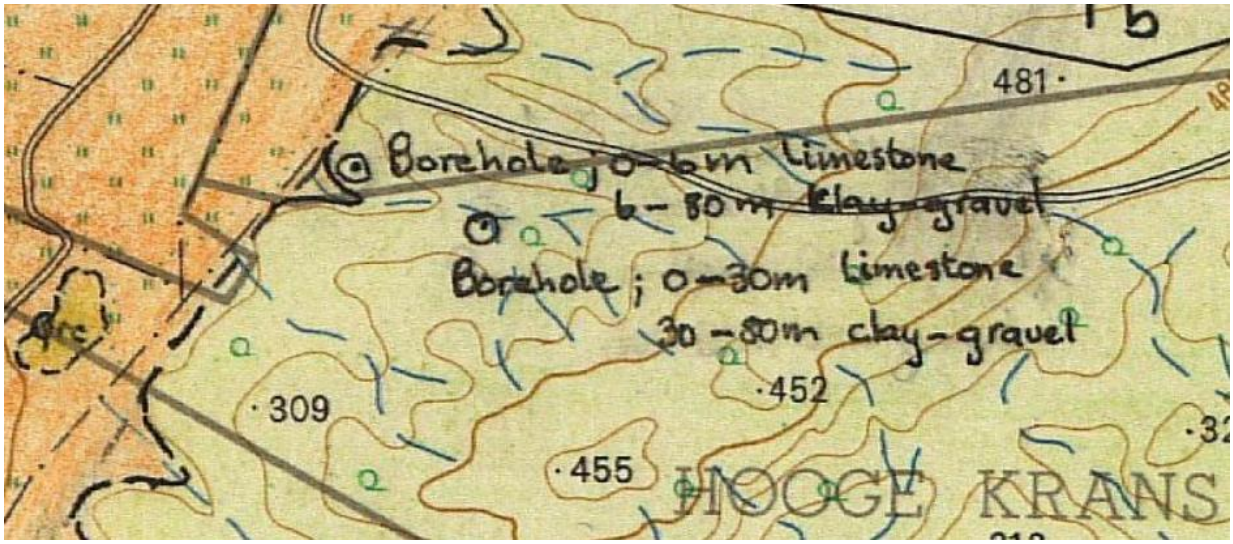

Figure 5. Geology map showing sites of boreholes and the respective geology information.

Figure 6. Typical landscape of the rugged, disintegrating calcrete-capped Hard Dunes (after a fire). [Note the Cape Mountain Zebra].

Figure 7. Typical landscape of the cultivated, relatively flat fields of the Enon Formation in the Soutpansvlakte Basin west of the Hard Dunes in the area in question. The fields close to the Hard Dunes attain elevations of ~70 m above sealevel and are partially covered with calcrete sheets and chunks.

The geology and topography of the area in question are shown in Figures 8 and 9.

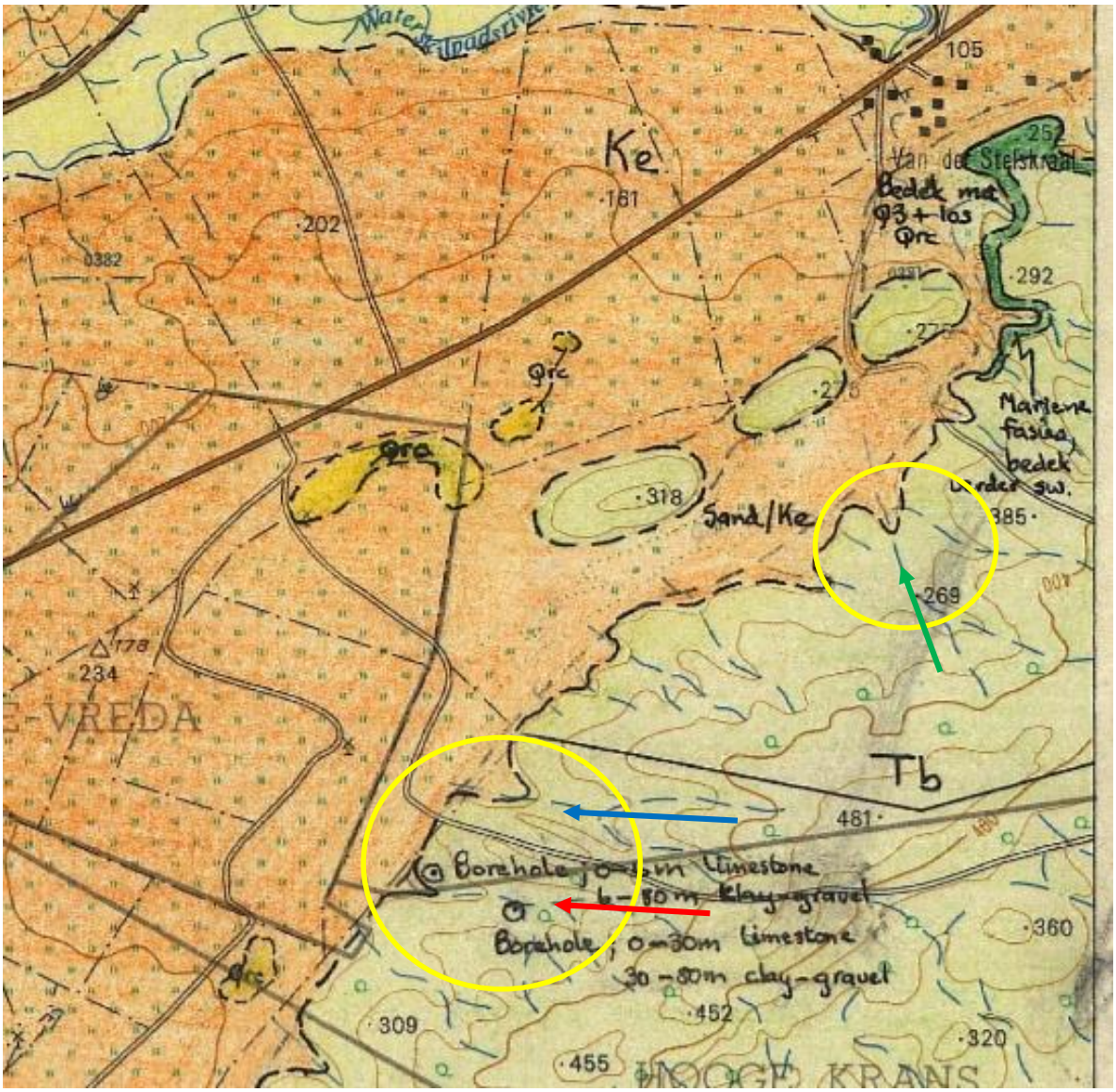

Figure 8. Geology of the area (from geology map 3420AC, field-sheet of 1984, at 1:50,000; elevations in feet). The light-green colour represents the limestone of the Hard Dunes (Bredasdorp Group); the orange colour represents the Enon Formation deposits. The circles indicate the borehole areas. Arrows point to the ravines, where the boreholes are situated. Note that the map is from 1984 and some features (roads etc) have changed since.

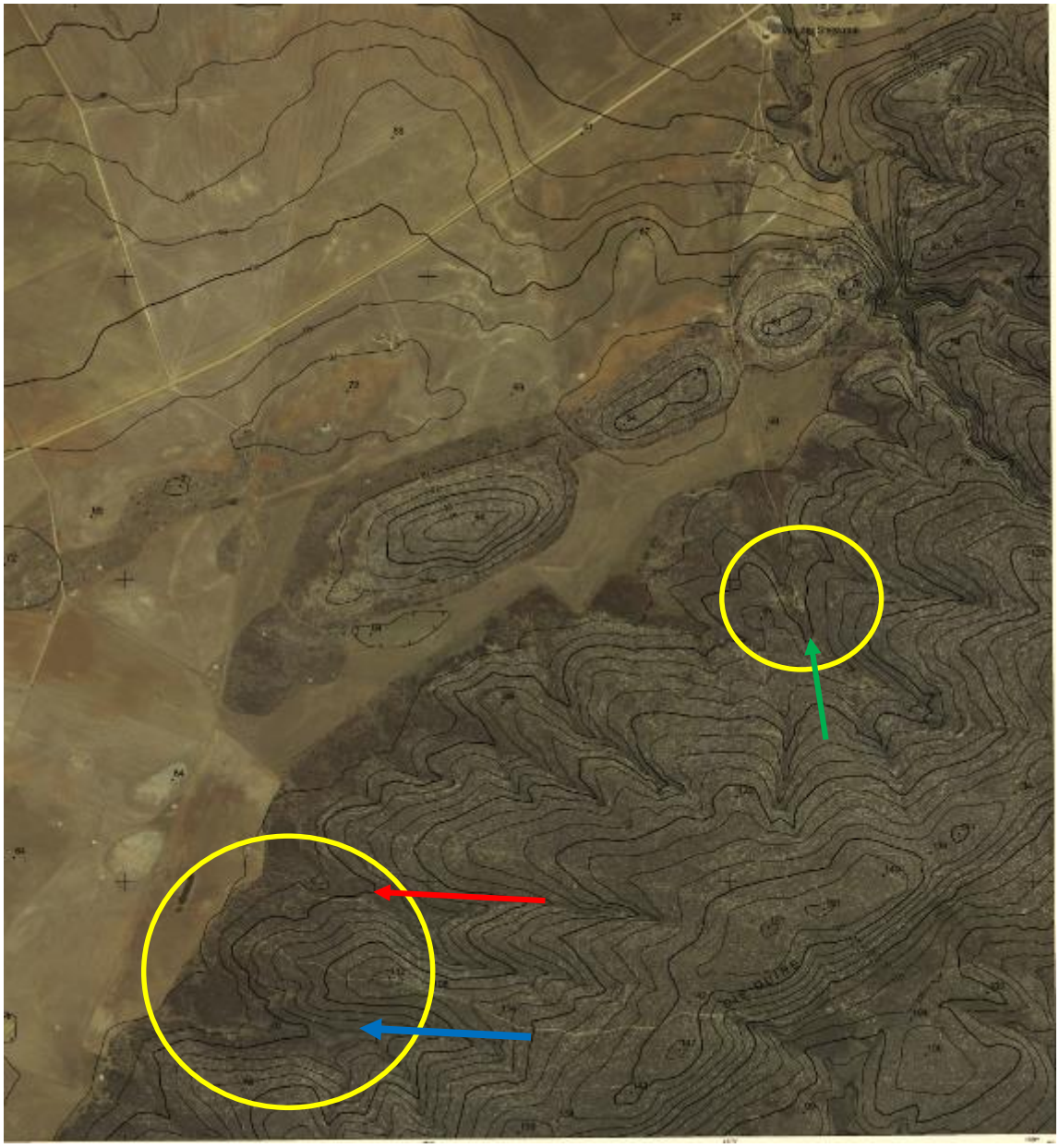

Figure 9. Topography of the area (section of topography map 3420AC sheet 20, 2014 at 1:10,000; elevations in metres; contour interval – 5 m). Circles indicate the borehole areas. Arrows point to the ravines where the boreholes are located.

Boreholes on the Patryskraal Farm

Figure 10 shows all boreholes in the area on the Patryskraal Farm. There are 5 boreholes in the southern ravine (Figure 11). Two of them are old (1 and 2), and their approximate positions were inferred from the geology map. Three boreholes (11, 12 and 13) are new (late 2017 and early 2018).

There are 2 boreholes in the northern ravine (Figure 12). One (21) is yielding and a new one (22) was drilled next to it.

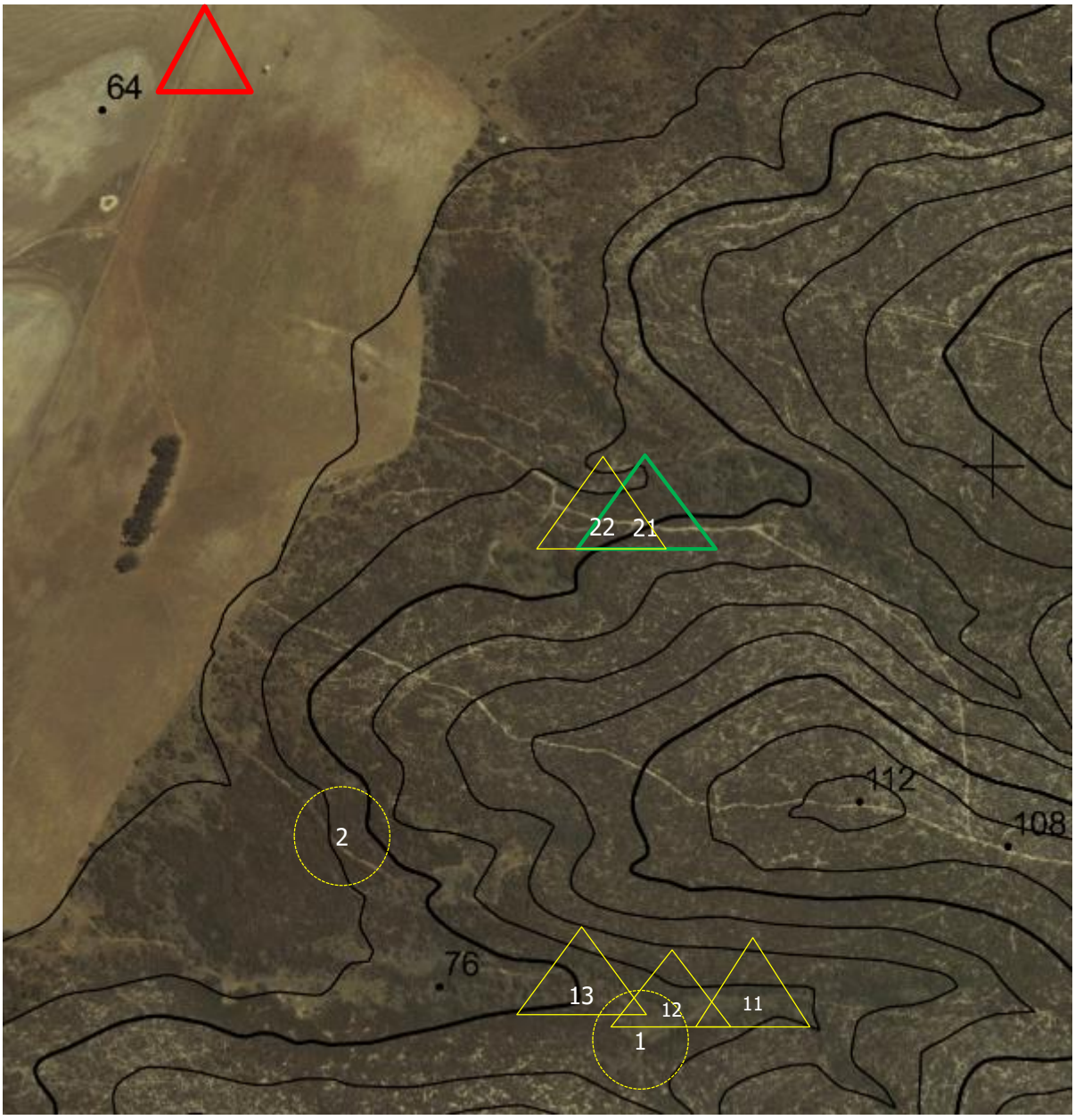

Figure 10. Topography of section of the Patryskraal Farm (from topography map 3420AC sheet 20, 2014 at 1:10,000; elevations in metres; contour interval – 5 m). Yellow dotted circles indicate estimated locations of old boreholes 1 and 2; yellow triangles indicate sites of new boreholes 11, 12 and 13 and 22; the green triangle indicates the yielding borehole 21 (Figure 13).

Figure 11. Drilling operations in the southern ravine, Patryskraal Farm. View to the southwest.

Figure 12. The yielding borehole (BH 21) in the northern ravine, Patryskraal Farm. Arrow points on the site of new borehole (BH 22). View to the south east.

Boreholes on the vd Stelskraal Farm

On the vd Stelskraal Farm there is a yielding borehole (31) and a new drilling (32) about 70 m north of it (Figures 13 to 15).

Figure 13. Topography of section of the vd Stelskraal Farm (from topography map 3420AC sheet 20, 2014 at 1:10,000; elevations in metres; contour interval – 5 m). The green triangle indicates the site of the yielding borehole 31, with a wind pump; yellow triangle indicates the site of a new borehole, 32 (see also Figures 15 and 16).

Figure 14. BH 31 and site of new borehole 32 (yellow arrow), in a ravine on the vd Stelskraal Farm. View to the south. The fire which raged in the area in early 2017 spared this ravine.

Figure 15. The site of the new borehole 32 (yellow arrow), in a ravine on the vd Stelskraal Farm. View to the west.

Borehole information

A sample from each meter down the borehole was laid on the ground, in a sequential order (increasing depth from the ground), next to the hole. The samples were arranged in columns. Each column comprises six samples - the shallower sample is at the top of the column and the deeper sample is at the bottom of it. Examples of the sample arrangements are given in Figures 16 to 18.

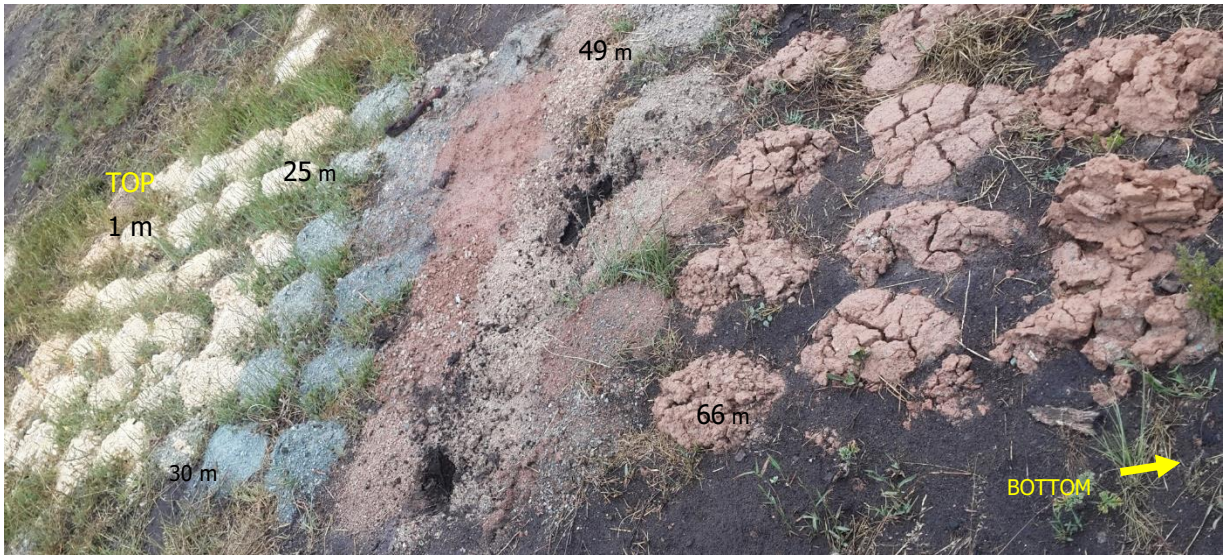

Figure 16. The sample arrangement from the upper section of BH 11 (in the southern ravine on the Patryskraal Farm). The sequence from top: 0-1 m – alluvium; 2-29 m – limestone; 30 m – limestone and gravel; 31-43 m – gravel; 44-80 m – gravel and clay. Depths below the surface to several samples are indicated. The deeper section of the sample arrangement is outside the photograph.

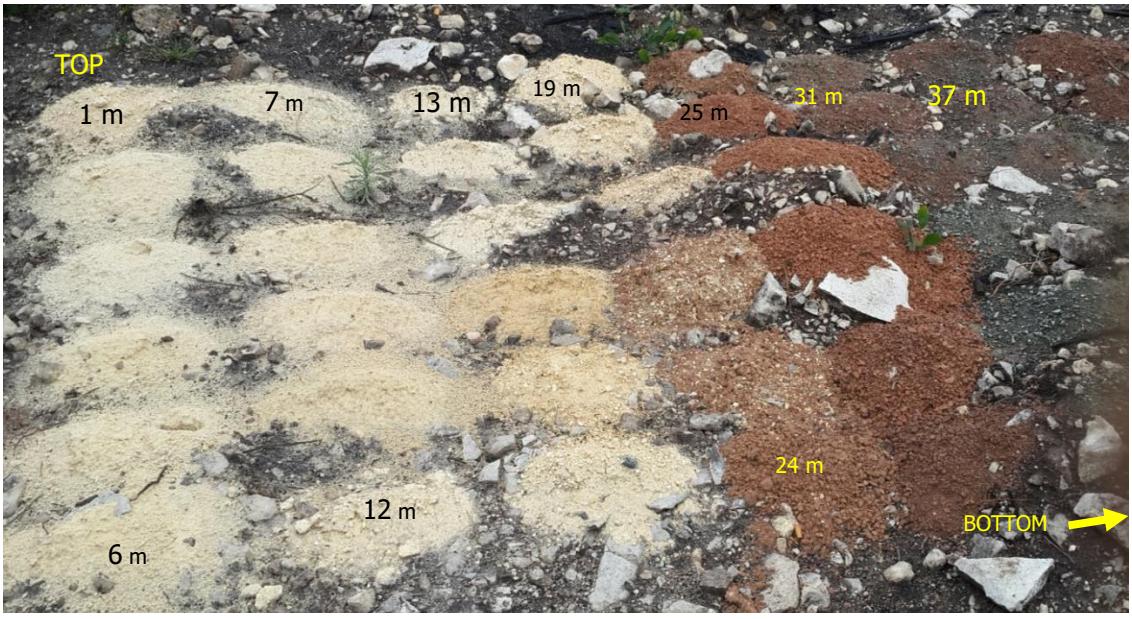

Figure 17. The sample arrangement from the upper section of BH 22 (in the northern ravine on the Patryskraal Farm). The sequence from top: 0-21 m – limestone; 22-80 m – gravel and clay. Depths below the surface to several samples are indicated. The deep smaples section of the sample arrangement is outside the photograph.

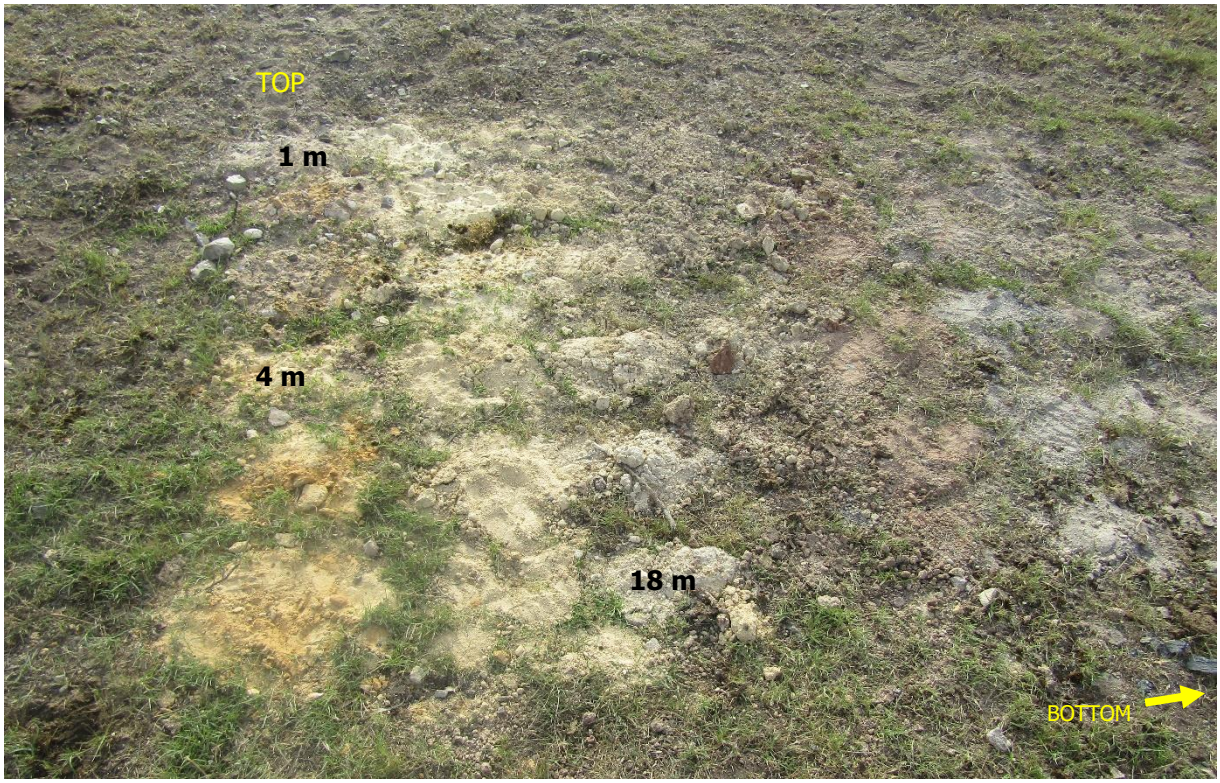

Figure 18. The sample arrangement from the upper section of BH 32 (in a ravine on the vd Stelskraal Farm). The sequence from top: 0-3 m – alluvium; 4-18 m – limestone; 19 - 96 m – sand, gravel and little clay. Depths below the surface to several samples are indicated. (The deep samples section of the sample arrangement is outside the photograph).

A summary of the borehole information is given in Table 1.

Borehole number	Elevation above sealevel (m)	Thickness of alluvium	Thickness of limestone (m)	Elevation of limestone base above sealevel (m)	Material underlying the limestone
Patryskraal south					
BH 1 (Old)	83 (est)		30	53 (est)	Gravel, clay
BH 2 (Old)	75 (est)		6	69 (est)	Gravel, clay
BH 11 (2017)	83	1	29	53	Gravel, clay
BH 12 (2018)	82	8	14	60	Grave, clay
BH 13 (2018)	81	4	19	58	Grave, clay
Patryskraal north					
BH 21 (Old, yielding)	81				
BH 22 (2017)	81	0	21	60	Gravel, clay
VD Stelskraal					
BH 31 Old, yielding)					
BH 32 (2018)	76	3	15	58	Sand, gravel and little clay

Table 1. Summary of borehole information. The clay, gravel and sand underlying the limestone are probably the Enon Formation. BH11 and BH 22 reached a maximum depth of 80 m (which is some 10 m below the present sealevel).

The elevations above sealevel of the limestone base, (or the top of the Enon Formation), as mapped from the borehole records, are lower than the elevations of the surface contacts. It suggests the presence of buried topography or the sloping to the southeast of the Enon Formation deposits, as shown in Figures 19 and 20.

Figure 19. Buried morphology on the Patryskraal Farm, based on borehole information. The numbers within the hexagons: yellow - number of borehole; white - elevation above sealevel. The numbers outside the hexagons are the calculated elevations of the base of the limestone.

Figure 20. Elevations above sealevel of the buried topography, from borehole information on both farms.

