

## D. DURICRUSTS

### Field Note D4a2. Pedogenic silcretes – B. Capped elevations



**Butte – a silcrete-capped elevation.**

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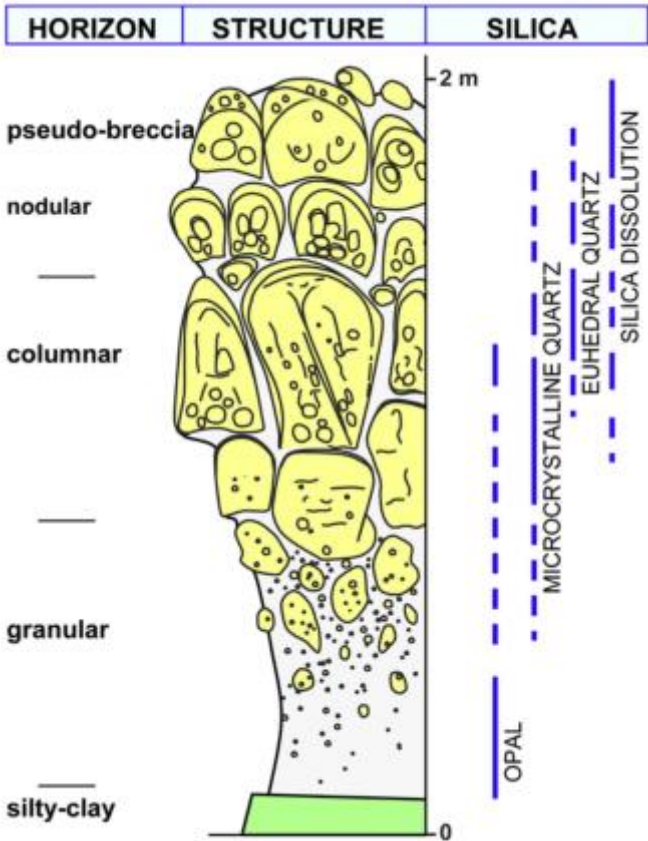
**Overview**

This Field Note describes the morphological characteristics, habits and textures of deep-weathering profile silcretes in the Study Area, which are referred to in the literature and on the maps as ‘high level silcretes’. See also the Desk Note: Silcretes and ferricrete – Overview. [Other types of silcretes are described in the following Field Notes].

Pedogenic silcretes developed near the land surface, within soil environments, and display typical soil structures (geopetal features) related to infiltration of downward percolating water (such as differentiated horizons, eluviation and illuviation structures; see definitions below). Silcretes show numerous variations in their morphology and their spatial arrangement but also vary in their composition and internal texture. The material below the silcrete is kaolin (clay) (Figures 1 to 3).

**Eluvium** or eluvial deposits are those geological deposits and soils that are derived by in-situ weathering or weathering plus gravitational movement or accumulation. The process of removal of materials from geological or soil horizons is called *eluviation* or leaching.

**Illuvium** is material displaced across a soil profile, from one layer to another one, by the action of rainwater. The removal of material from a soil layer is called eluviation. The transport of the material may be either mechanical or chemical. The process of deposition of illuvium is termed *illuviation*.



**Figure 1. Example of a generalised section through pedogenic silcrete (not in the Study Area), showing facial variations also illustrating the complexity of silcrete formation.**

Source: Thiry and Milnes 2017.

In the Study Area, the crusted elevation silcretes have some similarities to the generalised section shown above. The silcrete overlies a layer of kaolin\* (Figures 2 and 3). (*Kaolin* was mined on several hilltops in the Study Area; see Field Notes on mines in Chapter S). Silcretised elevations in the Study Area range from 140 m to 350 m.


\***Kaolin** is a soft, earthy, usually white, mineral (dioctahedral phyllosilicate clay), produced by the chemical weathering of aluminium silicate minerals like feldspar. In many places it is coloured pink-orange-red by iron oxide, giving it a distinct rust hue. Other colours such as cream and yellow are also common.



**Figure 2. Silcrete over kaolin. The silcrete rocks are grey due to the lichens. Top – at the Grootkop kaolin mine; view to the west. The contact line between the white kaolin and the light brown silcrete is clearly visible. Bottom - at the Sonderkoskop kaolin mine; view to the north. See also Field Notes on mines, Chapter S.**



**Figure 3. Silcrete over kaolin. The exposed parts of the silcrete are grey due to the lichens. Top - at Uitkykheuvel; view to the north. Bottom – on a hill close to, and west of, Potberg; view to the northeast.**

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The silcrete layers (2-10 m in thickness) are remnants of a crust, which covered a plateau, or a peneplain (the 'African Surface', or several surfaces, at various elevations; the number of surfaces is debated).

Typically, as the silcrete is more erosion-resistant than the sediments which it covers, *buttes*, *ridges* and *mesas* are formed. These three types of features are herein grouped together and called ***hills***.

### ***Silcrete-capped elevations ('hills')***

In the Study Area there are three types of silcrete-topped elevations:

***Butte*** is an isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments, commonly topped by a caprock of resistant material (silcrete in the Study Area) and representing an erosion remnant.

***Mesa*** is an isolated, flat-topped elevation or hill, which is bounded from all sides by steep escarpments and stands distinctly above a surrounding plain.

The only difference between a ***mesa*** and a ***butte*** is the size. [Most geographers agree that a ***butte*** is taller than it is wide, while a ***mesa*** is a much larger, slightly less elevated feature].

In the Study Area there are a few small and medium mesas. The largest of these mesas was named 'the plateau' (Die Plaat) by the local farmers.

***Ridge*** A continuous elevated crest for some distance. The sides of the ridge slope away from narrow top on either side. In the Study Area, ridges are topped by silcrete, and represent an erosion remnant carved from flat-lying rocks.

In the Study Area some ridges have shapes which do not exactly fit the above definition.

Most of the crusted elevations are sloping to the north or northeast (contrary to 'common knowledge', that they slope southward). Some of the capped elevations appear to be sloping in two directions.

The silcrete-capped elevations in the Study Area are of two types:

- a. Wholly capped, where the top is entirely capped and rimmed by silcrete.
- b. Partly capped, where the top is only partly capped by silcrete, and has a discontinuous, (in places multi-level) rim.

The above-mentioned features are shown and explained below.

Capped elevations ('hills') can be easily identified in the field (Figure 4).



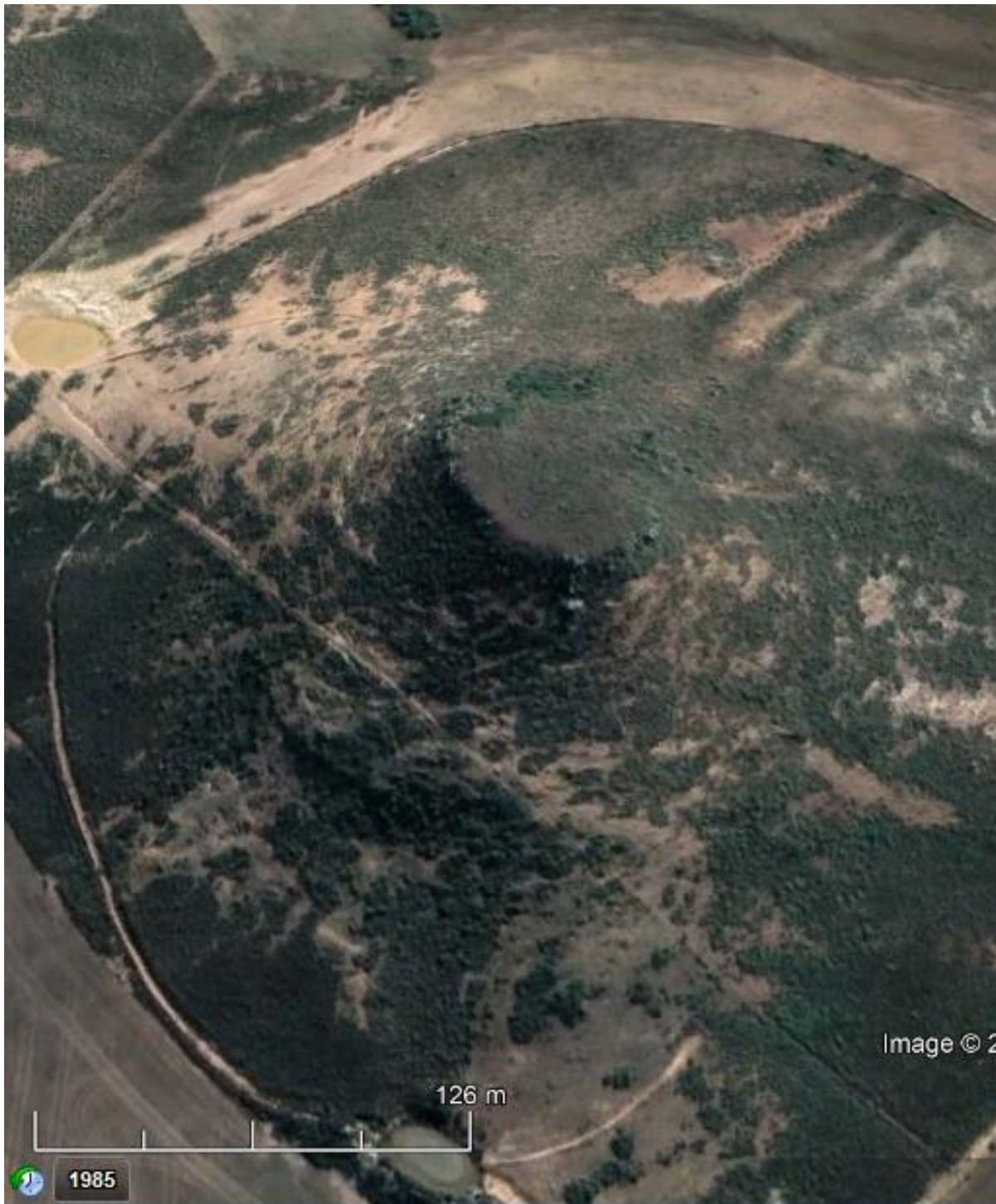
**Figure 4. Views of silcrete-capped buttes and mesas in the Study Area.**

Silcrete-capped elevations can be easily discerned from satellite images and identified in the field. Some of them are shown below.

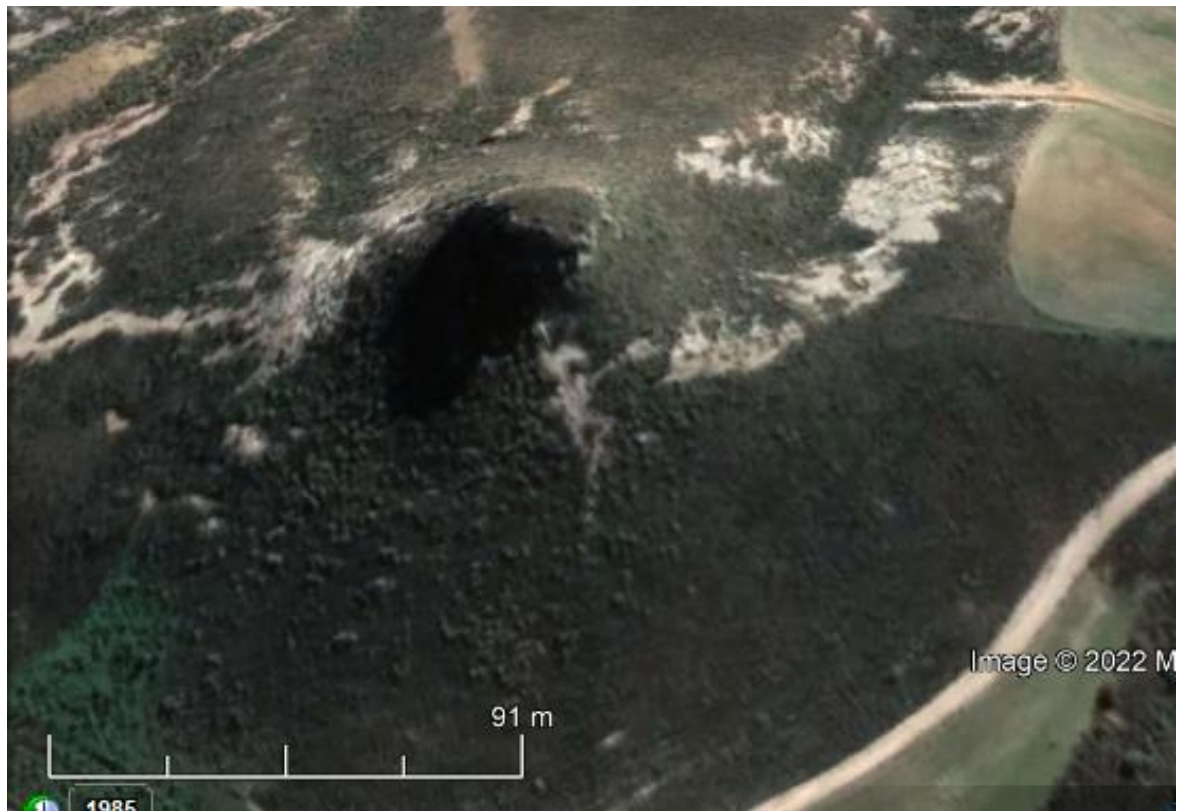
### ***Wholly capped elevations***

#### ***Buttes***

Some buttes in the study area exhibit a nearly perfect conical shape (Figures 5 to 7).

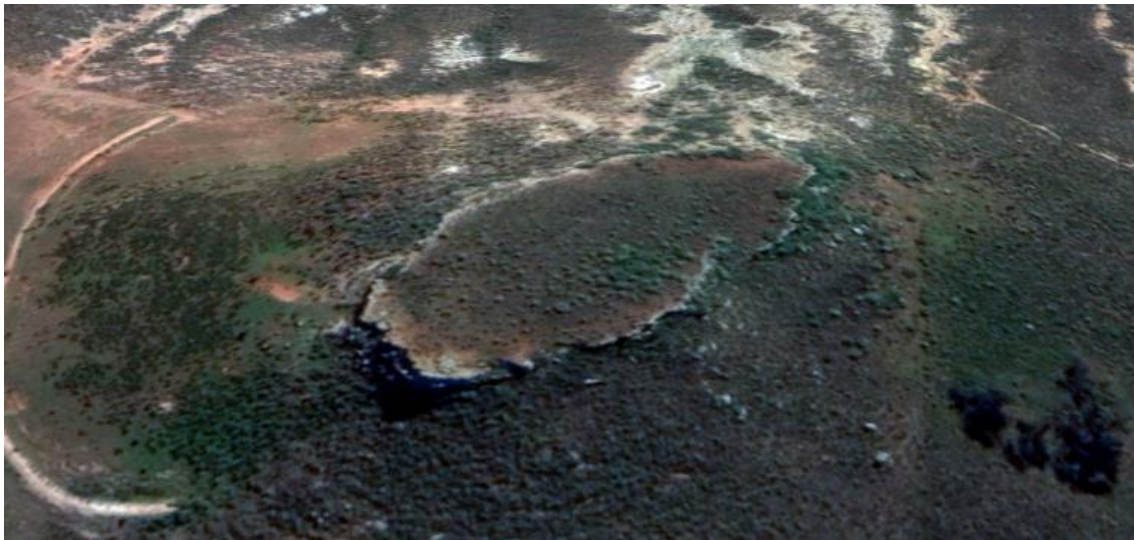


**Figure 5. Satellite image of a wholly capped butte.**



**Figure 6. Wholly capped butte. Top – satellite image. Bottom – ground view.**

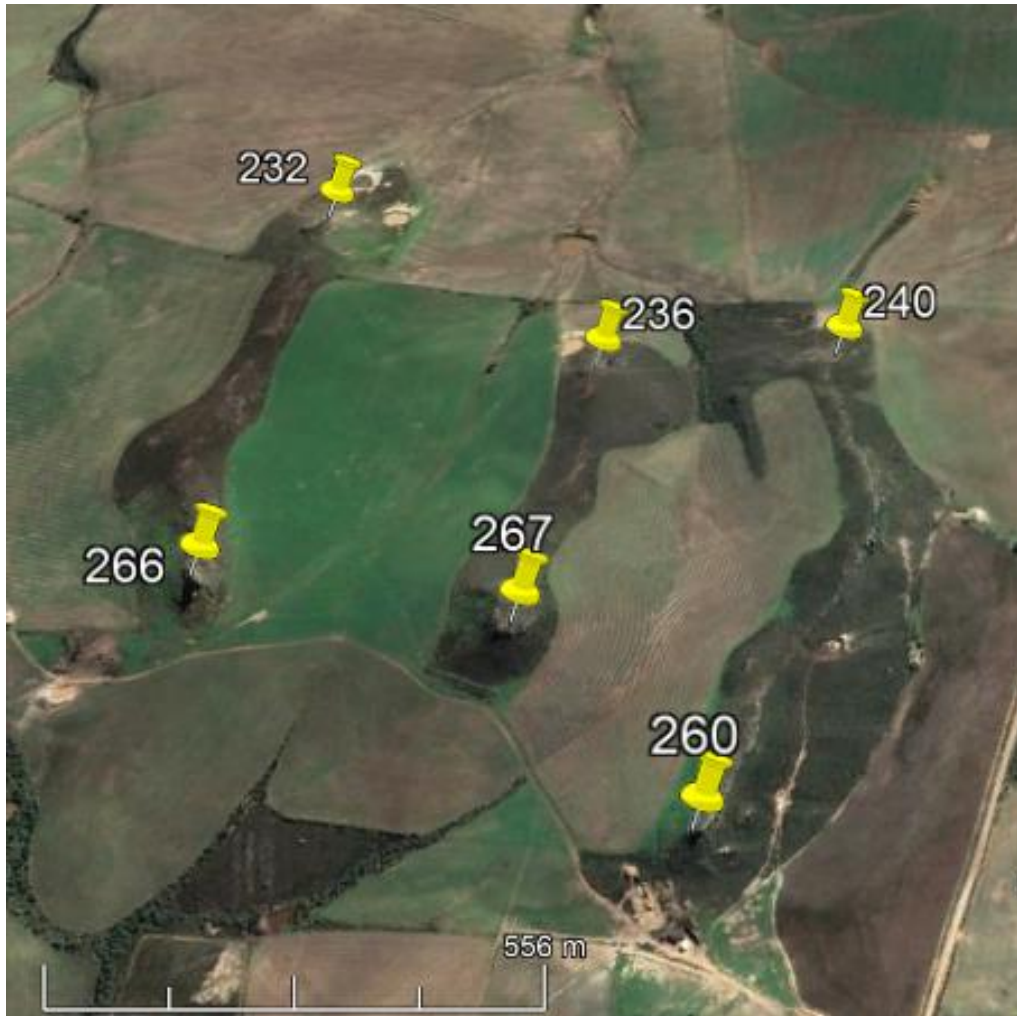




**Figure 7. Wholly capped butte. Top – satellite image. Middle – view from the southeast. Bottom – view from the west.**

### Ridges

There are several silcrete capped ridges in the Study Area (Figure 8).



**Figure 8. Top – satellite image of silcrete capped ridges in the Study Area (arrows). Numbers of thumbnails indicate elevations in meters above sealevel, illustrating the prevailing northward sloping. Arrow indicates point and direction of the photo below. Bottom – view to the west on the eastern ridge, showing wholly capped top.**

Some ridges are sloping in two directions (Figure 9).



**Figure 9. Top – satellite image of silcrete capped ridges in the Study Area. Numbers of thumbnails indicate elevations in meters above sealevel, illustrating northward sloping. Bottom – view to the south on the southern section of the ridge, showing the cap sloping to the west as well.**

The tops of the wholly capped elevations are flat, solid 'platform' from edge to edge, with some soil and vegetation (Figure 10).



**Figure 10. Wholly capped elevations. Top – the grey rim and reddish (ferruginised) cap, seen on a satellite image. Middle - view of the top of the cap. Bottom - polygonal joints of the rim.**

***Partly capped elevations***

Mesa tops are not flat and do not constitute a continuous layer of silcrete (Figures 11 to 13).

***Small mesas***



**Figure 11. Satellite image of Louwyn Mesa (average elevation 225 m above sealevel). A rim is seen around the top; the top itself comprise vegetated soil, with rocky patches.**



**Figure 12.** Views to the east on the side of the partly capped Louwyn Mesa. The top of the mesa is convex and there are probably two levels of rims, with the soil rising above the rim. See figure 13.



**Figure 13. The Louwyn Mesa top. Top – view to the north of the western flank, showing a ‘double’ rim (?). Middle - view to the south, showing silcrete patches at the top of the mesa. Bottom - view of the top of the mesa.**

Another example of a small mesa with a convex top made of soil with a few patches of silcrete is The Die Kop Mesa, shown below (Figure 14).



**Figure 14. The Die kop Mesa cap. Top – view to the south, showing the convex nature of the cap, and the surrounding silcrete rim. Bottom - view of the top of the mesa, showing small patches of silcrete.**



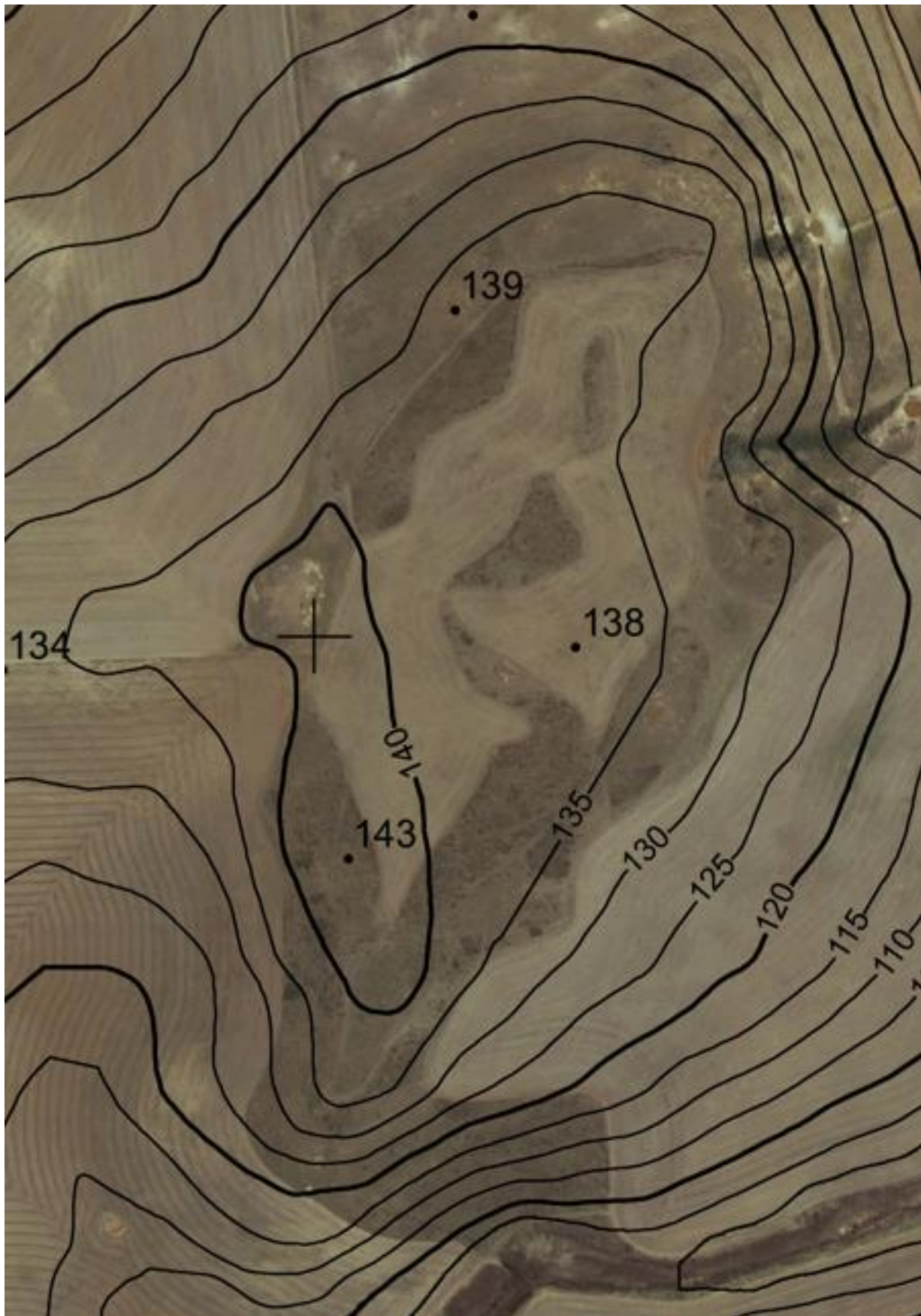
## Medium mesas

### Brakfontein Mesa

A medium-size mesa (~800 m long) at average elevation of 138 m above sealevel, is located on the farm Brakfontein, some 4.5 km east of the abovementioned mesas (Figures 15 to 18).



**Figure 15. Satellite image of the Brakfontein Mesa. The brown area is cultivated.**



**Figure 16. Topography map of the Brakfontein Mesa. The light grey areas are cultivated.**



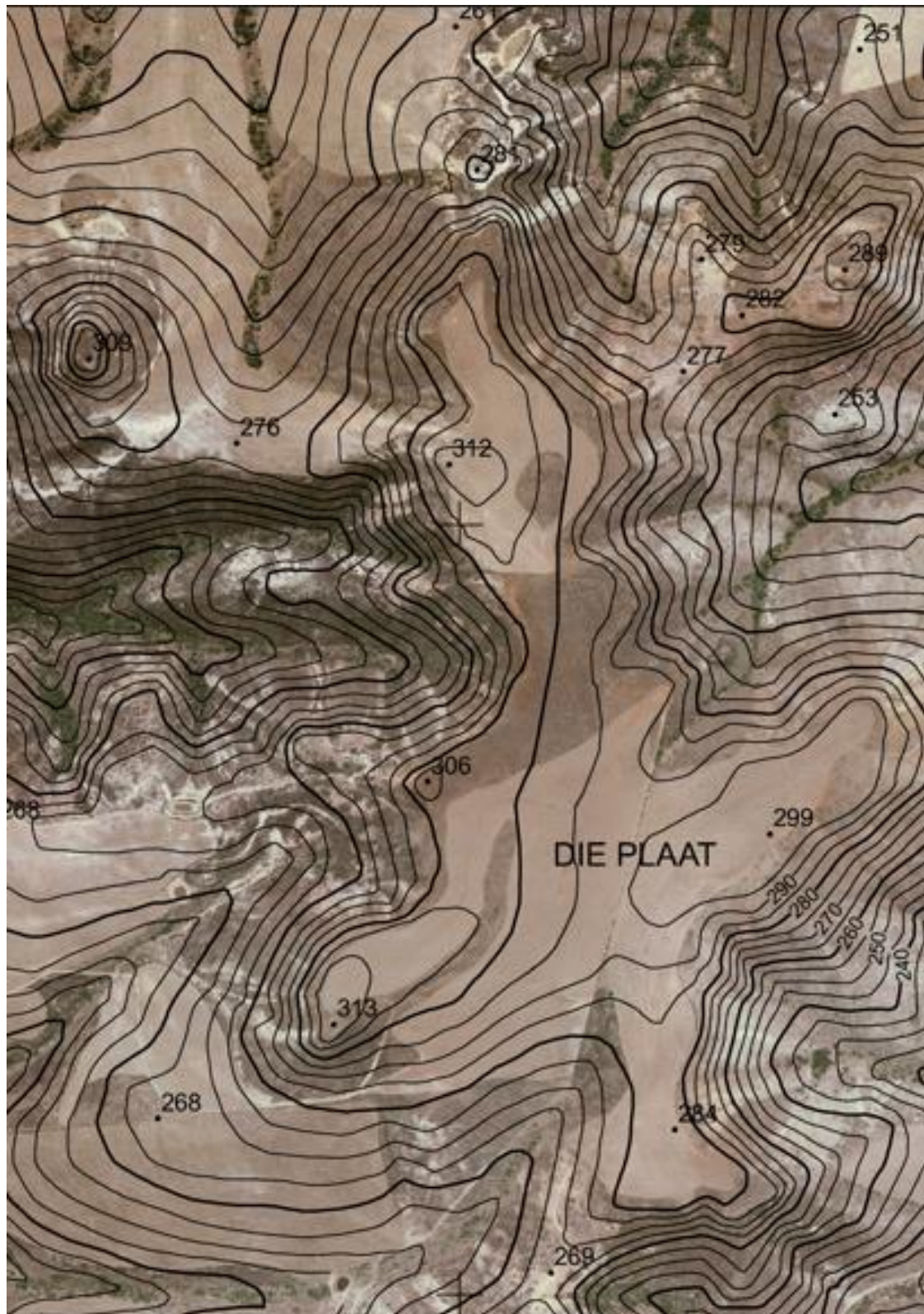
**Figure 17. Oblique satellite image of the Brakfontein Mesa. The top is flat and cultivated; silcrete patches are indicated by arrows. Many silcrete boulders were dug out of this field and heaped around it. See Figure 18.**



**Figure 18. The top of the Brakfontein Mesa is cultivated. Silcrete boulders have been dug out and heaped around the field.**

### **Die Plaat Mesa**

Another medium size mesa, ~850 m long, named “Die Plaat” by the local farmers, is situated some 20 km NW of the previously described mesas, adjacent to Sonderkoskop on the farm Paatjieskraal, at an average elevation of 300 m above sealevel (Figures 19 and



**Figure 19. Topography map of Die Plaat. Note the steep slopes around the mesa.**

Die Plaat is another example of a partly capped elevation, where the non-crusted parts are cultivated (Figures 20 and 21).

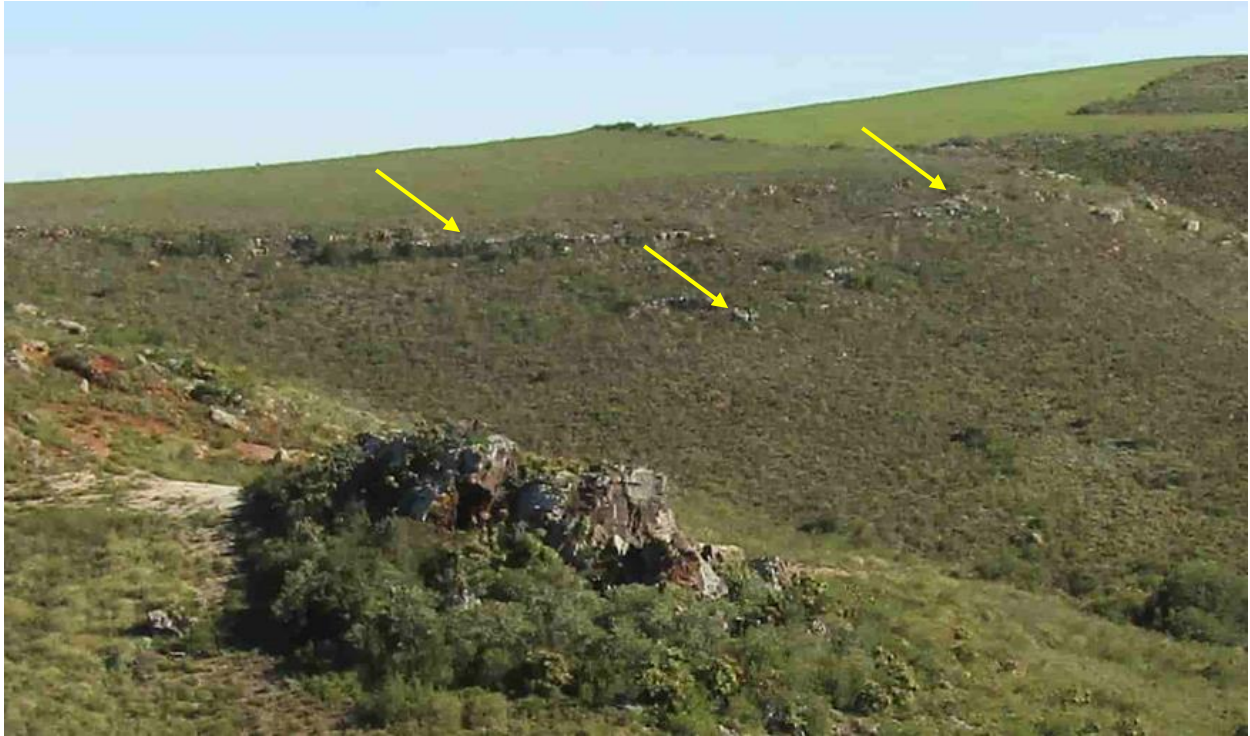


**Figure 20. Oblique satellite image of Die Plaat, showing elevations in meters above sealevel. The dark areas are silcrete crust and boulders; the light areas are cultivated fields.**



**Figure 21. View to the west on the northern part of Die Plaat.**

Some sections of Die Plaat appear to have more than one level of rim (Figure 22).



**Figure 22. Views of sections of the rims around Die Plaat (arrows).**