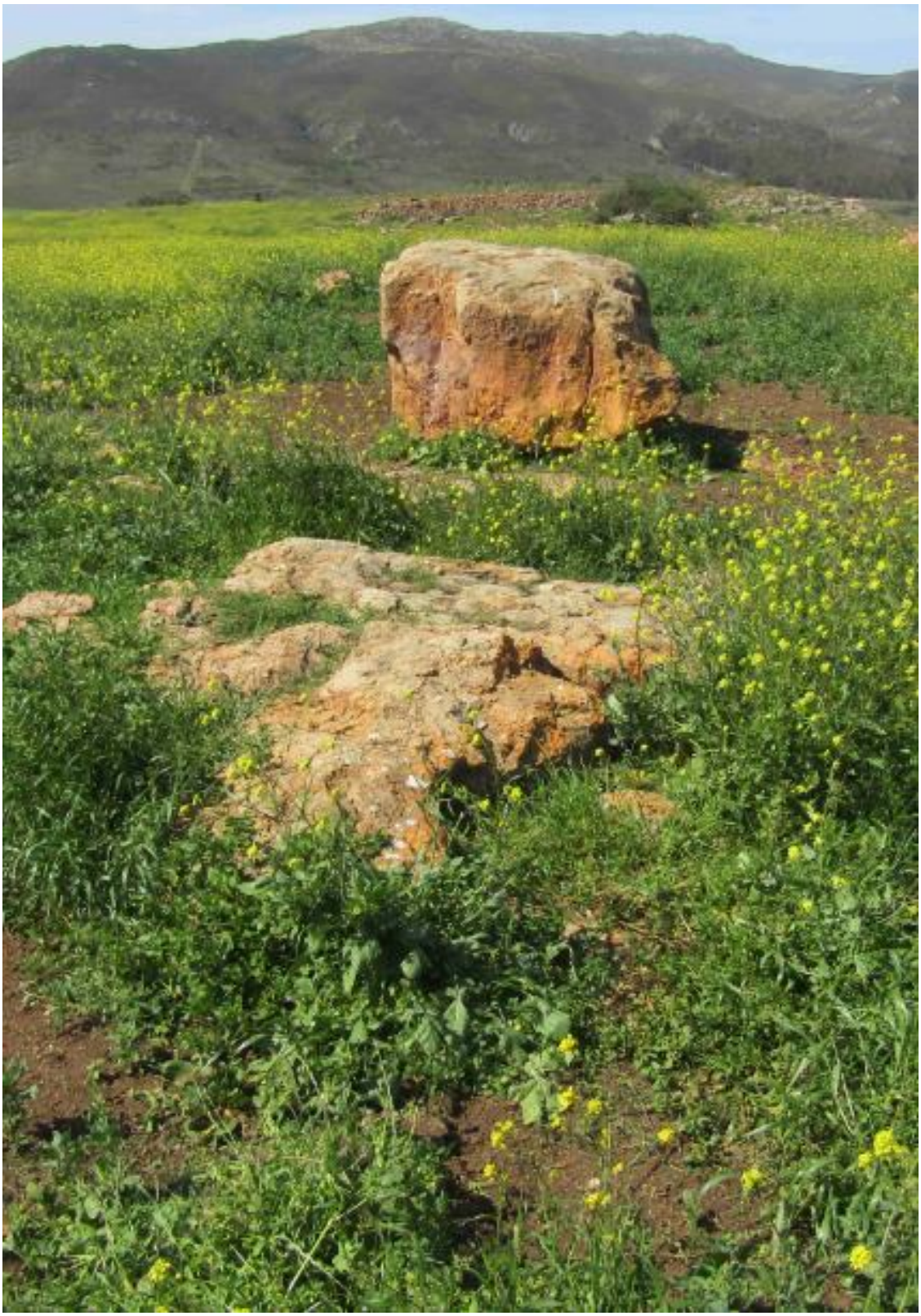
D. DURICRUSTS

Field Note D4e. Non-pedogenic silcretes - A. Groundwater



Blocks of groundwater silcrete.

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1. Introduction

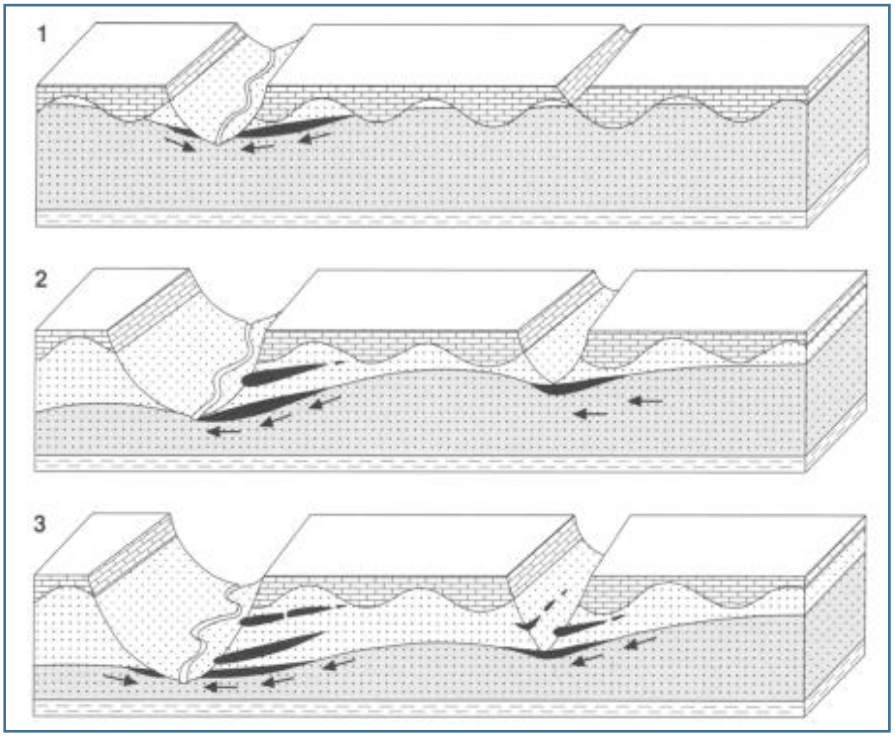
There are three varieties of non-pedogenic silcretes:

A. *Groundwater silcretes* are formed under phreatic conditions (in the zone of saturated groundwater) through silicification at or close to a water table, or at zones of groundwater outflow.

B. *Drainage-line silcretes* develop as a result of the silicification of alluvial fills in contemporary or former fluvial systems.

C. *Pan / lacustrine silcrete,* forms as a result of the silicification of sediments at the margins of lakes and pans.

Non-pedogenic silcrete development may be more localised and is often controlled by the position of the local water table; while this would imply an overlying palaeosurface, the silcrete itself does not mark the position of a former land surface. The formation of the above three types of non-pedogenic silcretes is illustrated in Figure 1.



Block diagram illustrating the formation of groundwater silcretes. Silcrete lenses form close to the water table in zones of groundwater outflow (1) and superposed lenses develop (2) with valley deepening due to progressive landscape evolution (3).
Source: Ullyot at al, 1999, in turn adopted from Thiry et all, 1988.

The non-pedogenic silcretes in the Study Area can be grouped into the three types mentioned above. This Filed Note describes the Group A silcretes (ground water).

The groundwater silcretes lumps were formed within the weathered profile of the Bokkeveld shales. With the lowering of the erosion base, the soft sediment (clay) around them was washed away and the silcrete lumps were exposed. They can be grouped into a. Upper Slope - at levels close to the silcretised hilltops, and b. Lower Slope - at levels closer to present-day rivers.

2. Upper Slope

Upper slope groundwater silcretes, usually boulders, are present in many locations in the Study Area, between 200 and 280 m above sealevel. Some examples are given below (Figures 3 to 7).

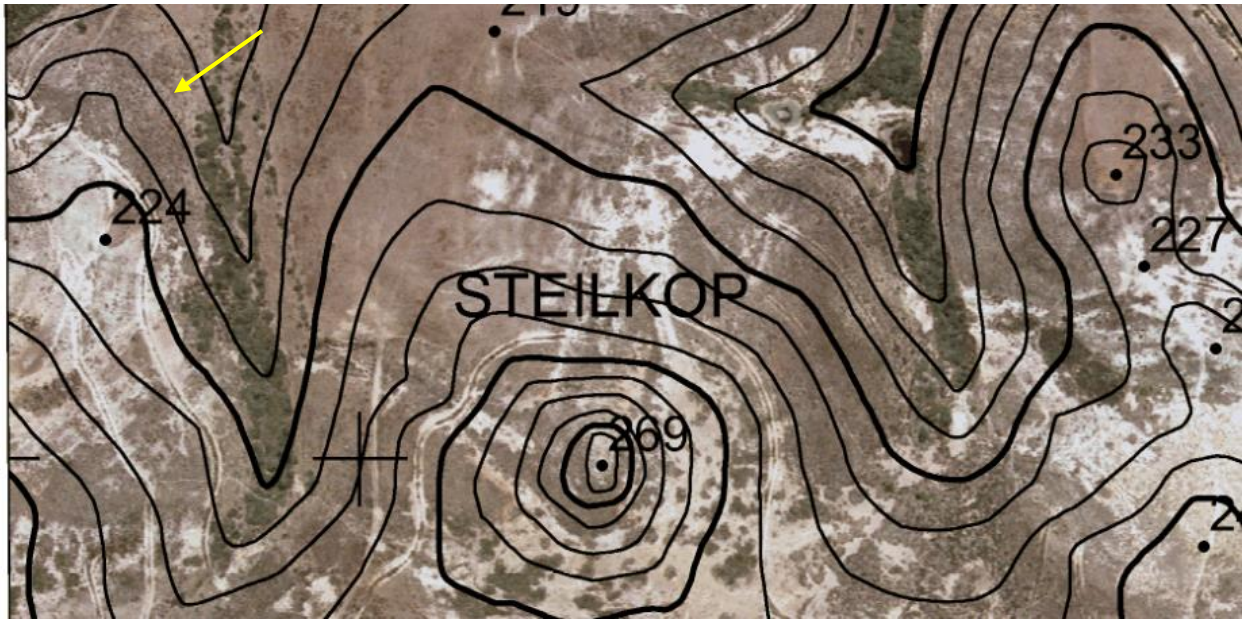


Figure 3. Groundwater silcrete boulders are exposed on a slope of a ravine west of Steilkop. Top – satellite image; arrow points to the location of the silcrete lumps. Bottom – oblique aerial view, from the top of Grootkop; view to the southeast.

Figure 4. Groundwater silcrete boulders are exposed on a slope of a ravine west of Steilkop. Top – oblique aerial view (enlargement of part of Figure 1, bottom). Bottom – ground view.

Figure 5. Groundwater silcrete boulders are exposed on a slope of a ravine west of Steilkop. Note the conglomerate contents.

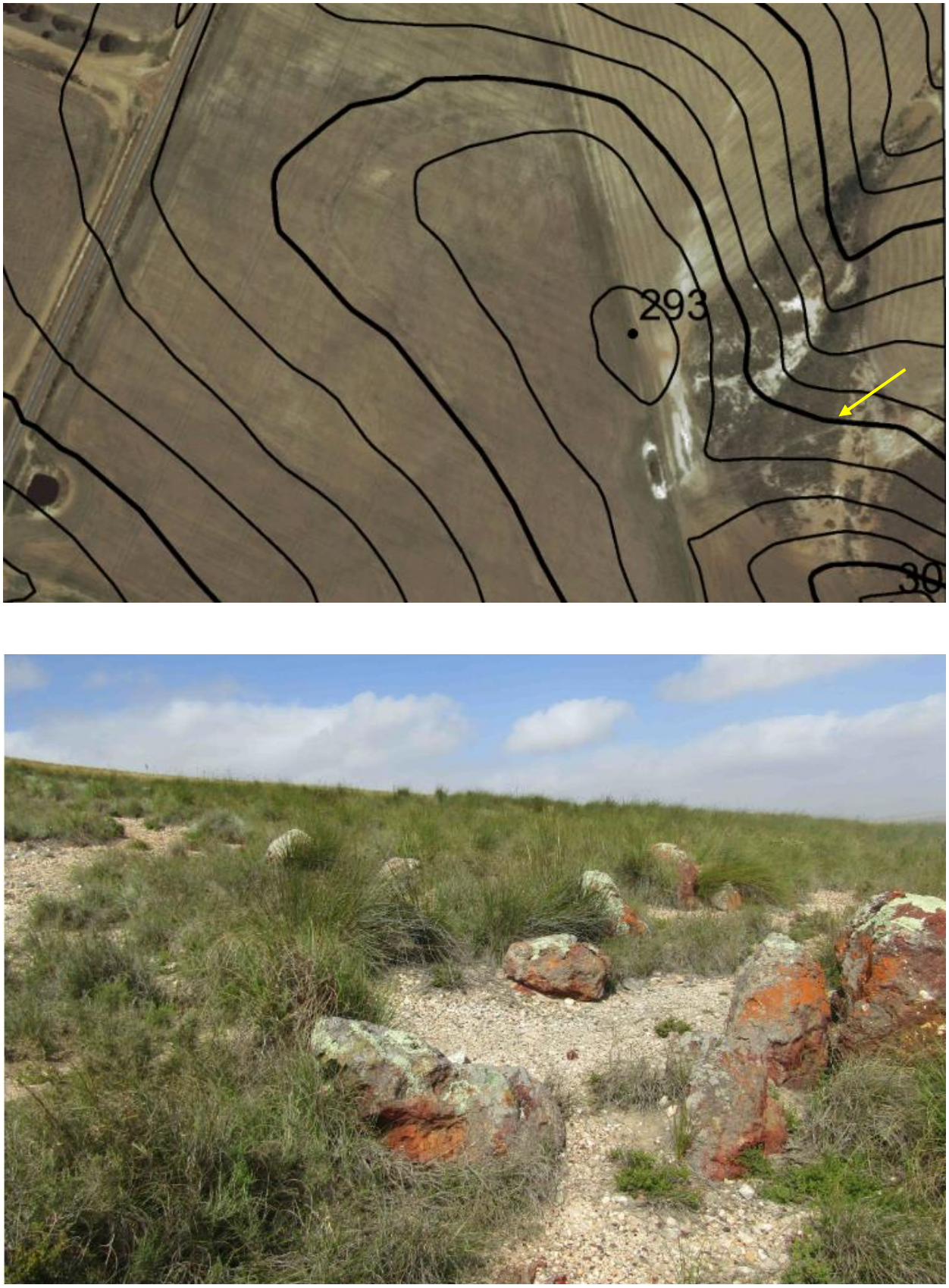


Figure 6. Groundwater silcrete boulders are exposed on a vslope of a raine (west of Kasteelskop). Top – topography map; arrow points to the location of the boulders. Bottom – ground view.

Figure 7. Groundwater silcrete boulders are exposed on a slope of a ravine (west of Sonderkoskop). Top – topography map; arrow points to location of the boulders. Bottom – ground view.

The silcrete boulders are less resistant to weathering than the hilltop silcretes; they disintegrate to form very coarse, angular silcrete gravel (Figure 8).

Figure 8. Coarse, angular silcrete gravel, the result of the disintegration of the groundwater silcrete boulders.

3. Lower Slope

Lower slope groundwater silcretes in the Study Area are present along rivers. They were formed within the weathered profile of the Bokkeveld shales. They have several habits – platy, bulbous and nodular - and are partially exposed. They can be found in several locations in the Study Area, between 100 and 120 m asl. Some examples are given below (Figures 9 to 13).

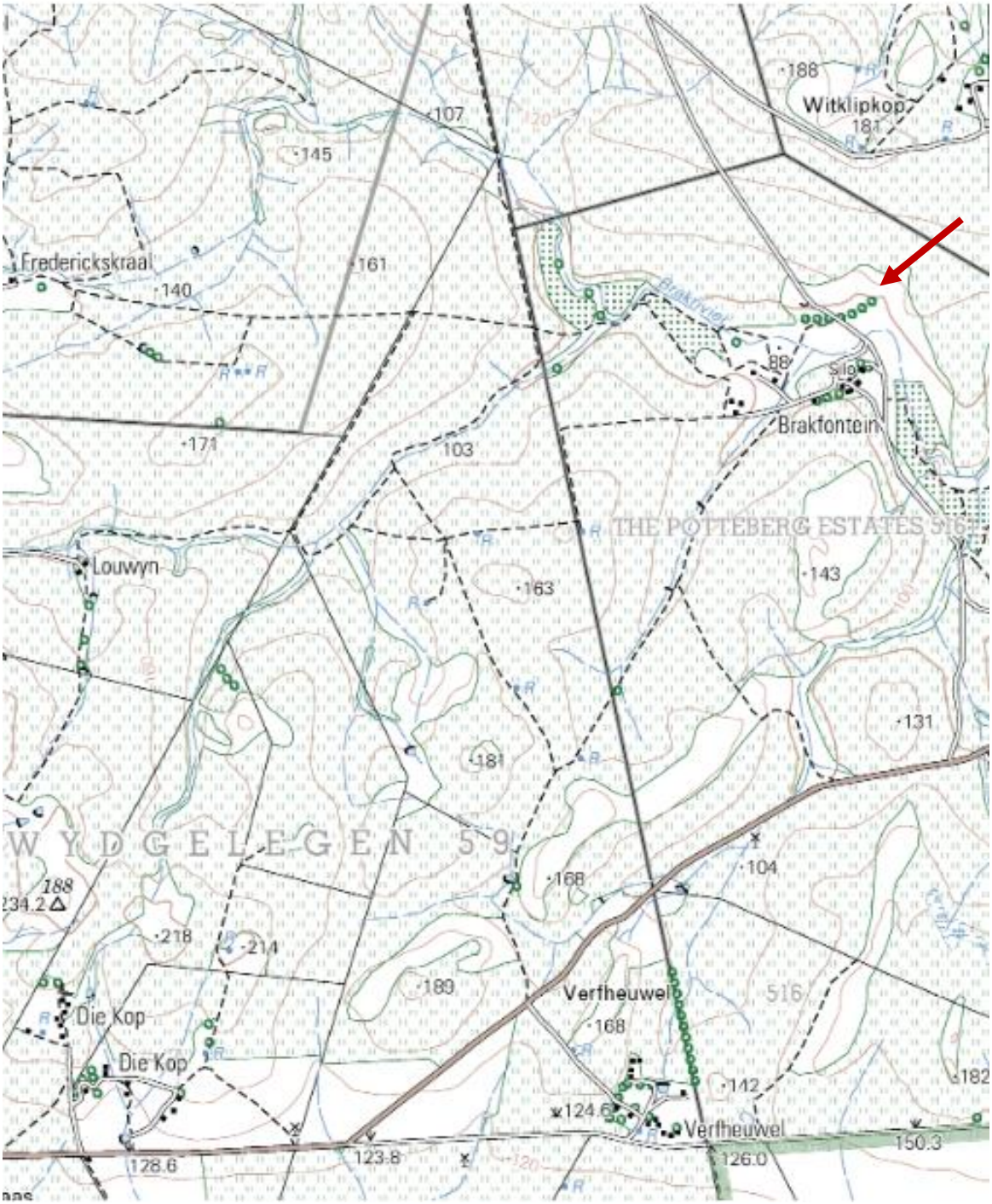


Figure 9. Topography map of the Brakrivier Valley. Arrow points to the slope were groundwater silcrete outcrops are located.

Figure 10. Brakrivier Valley, where groundwater silcrete outcrops have been located. Top – topography map superimposed on satellite image. Bottom - geology map (JA Malan, 1984); arrow points to the silcrete outcrops.

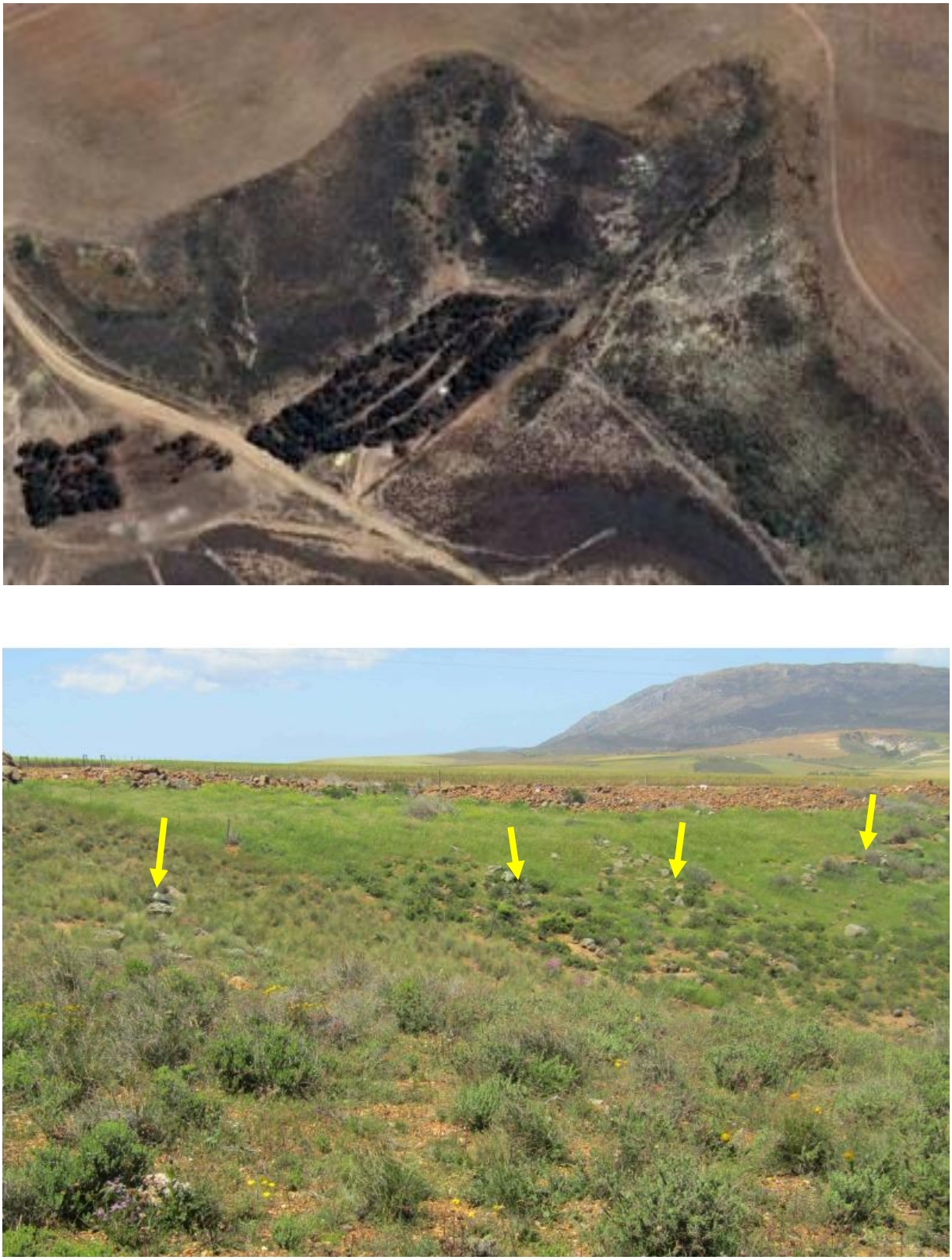


Figure 11. Top - Satellite images of a slope of the Brakrivier Valley, where groundwater silcrete outcrops were located (enlarged box in Figure 11, top). Bottom - view to the northeast on the slope with the silcrete outcrops (arrows).

Figure 12. Top and bottom: platy groundwater silcrete on a slope along the Brakrivier Valley.

Figure 13. Balbous groundwater silcrete on a slope along the Brakrivier Valley.

Figure 13. Nodular groundwater silcrete on a slope along the Brakrivier Valley.

Several exposures of pillowy-bulbous groundwater silcretes are located on either side of Spitskopkloof, NW of Ouplaas (Figures 14 to 18).

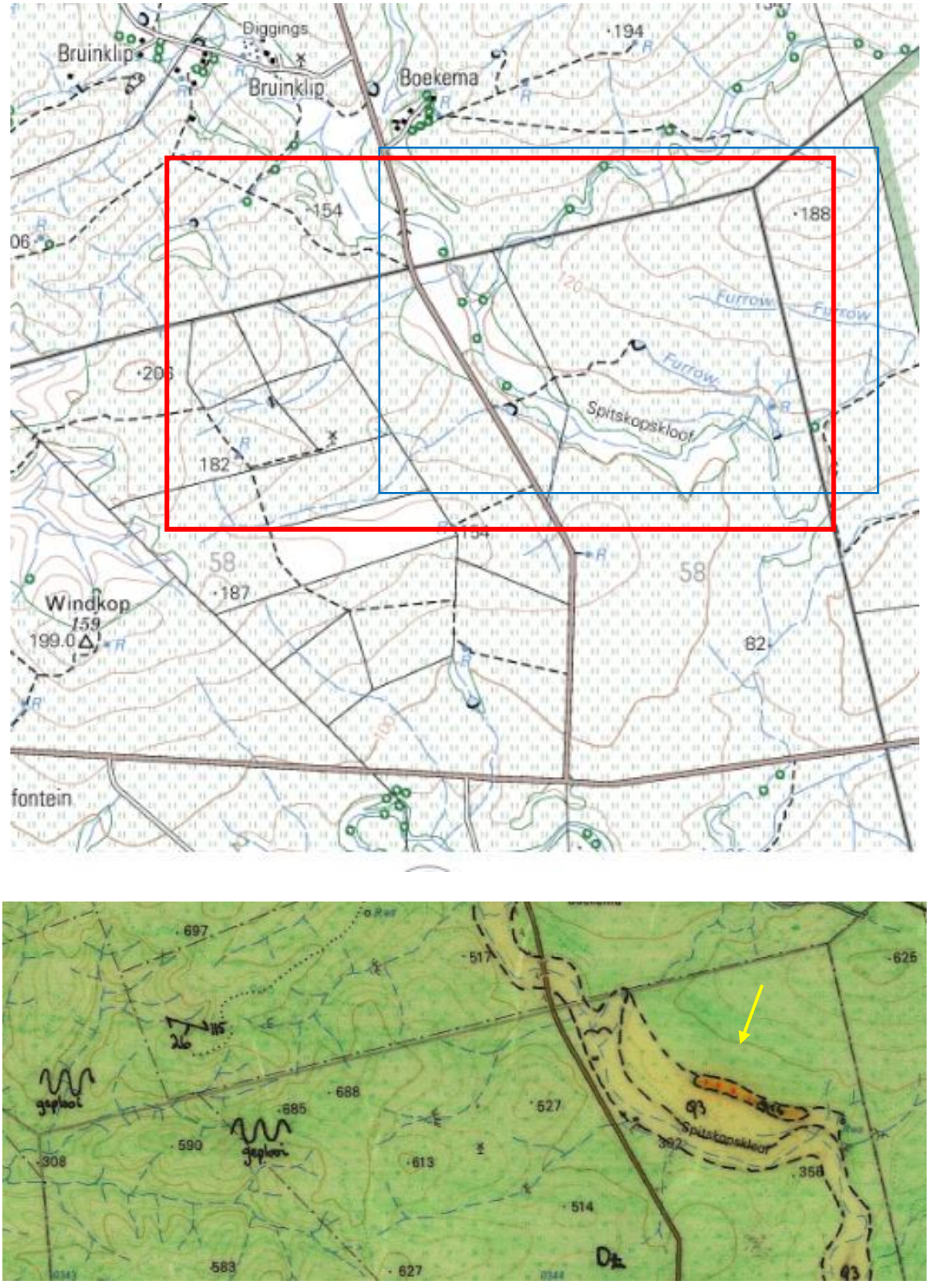


Figure 14. Spitskopkloof. Top - topography map; box shown at bottom. Bottom – geology map (JA Malan, 1984), showing a silcrete outcrop (arrow).

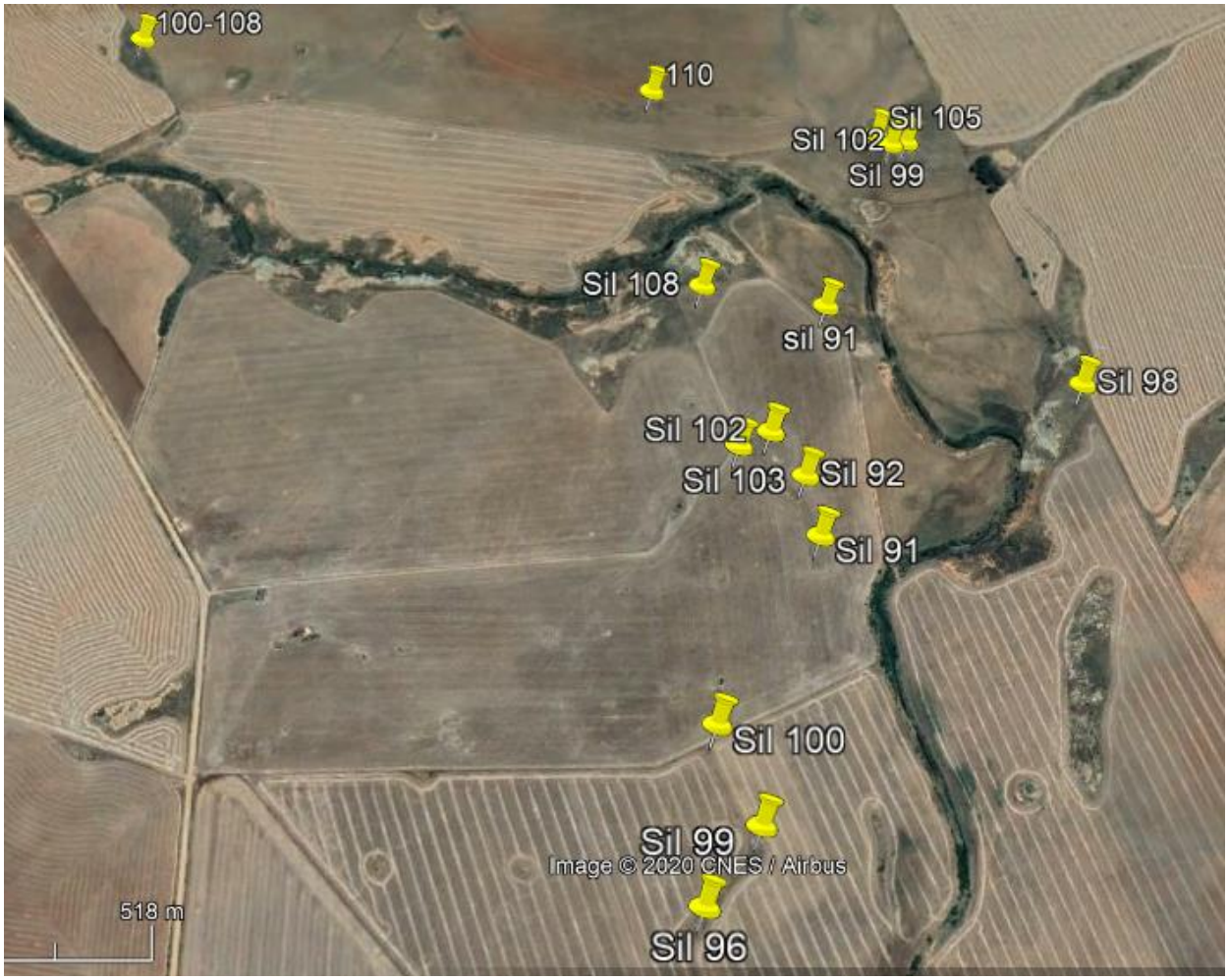


Figure 15. Spitskopkloof is, in fact, not a kloof but a wide valley. Top – satellite image; elevations of silcrete above sealevel in metres. Bottom – view northward into the valley.

Figure 16. Top and bottom: silcrete bulbs protrude the ground on the southwest slopes of Spitskopkloof.

Figure 17. Top and bottom: silcrete bulbs protrude the ground on the southwest slopes of Spitskopkloof.

Figure 18. Top and bottom: silcrete bulbs protrude the ground on the southwest slopes of Spitskopkloof.

Another type of lumpy groundwater silcretes, forming huge boulders, can be found on the farms Verfheuwel (near Potberg) and Middeldam (NE of Bredasdorp)

On the Verfheuwel Farm the silcretes outcrop are located on the northern slope into the Potberg River, on elevations between 120 and 150 m above sealevel, or 20 to 50 m above the floor of the valley (Figures 19 to 22).

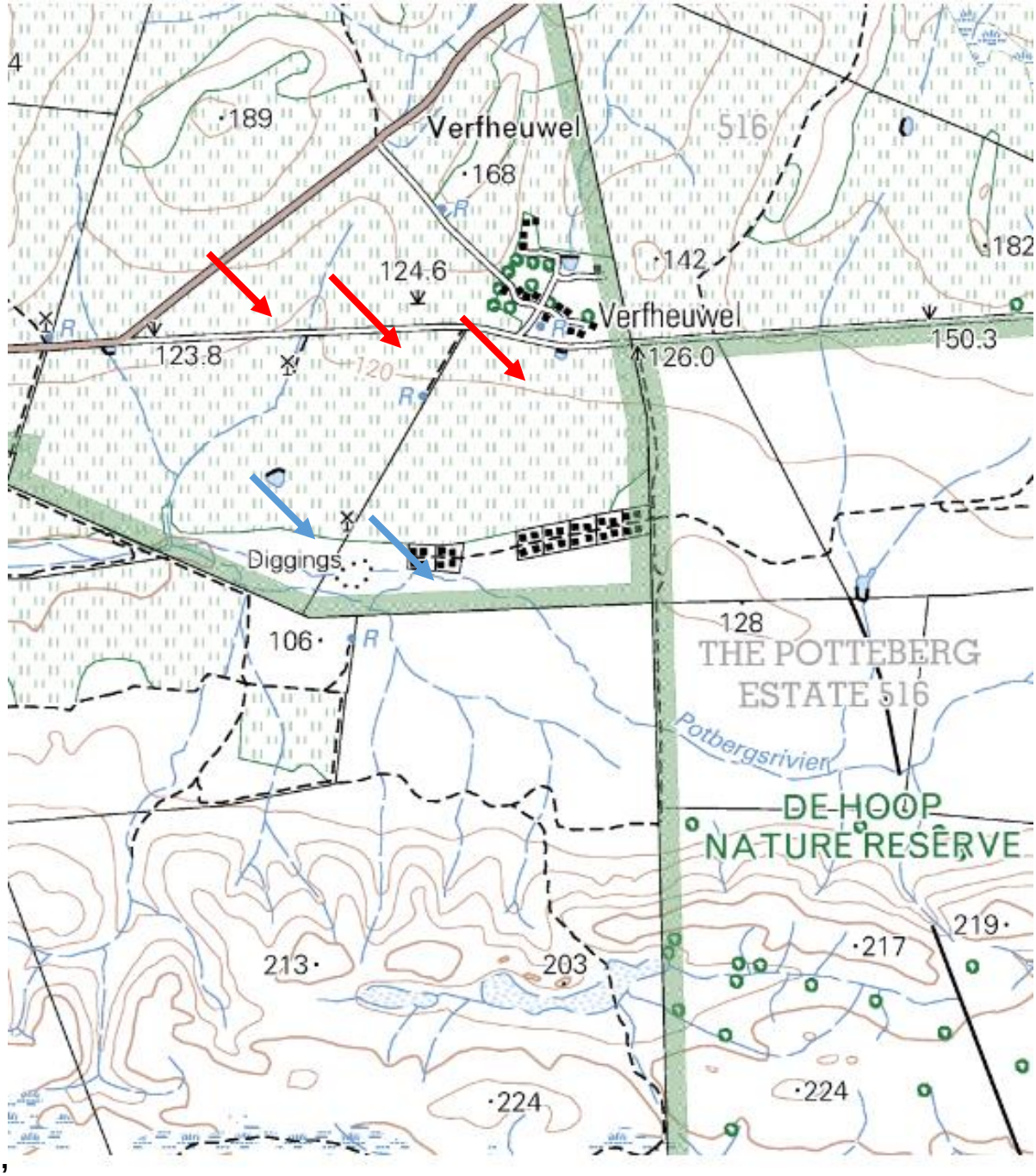


Figure 19. Topography map of the upper Potberg River Valley, south of Verheuwel Farmhouses. Silcrete lumps were bulldozed away from the cultivated fields (red arrows) and heaped next to the river (blue arrow, Figure 20).

Figure 20. Top, middle and bottom - huge lumps of groundwater silcretes, some ferruginised, on Verfheuwel Farm, removed from the fields to the riverside.

Figure 21. Top and - groundwater silcretes lumps on the Verfheuwel Farm.

Figure 22. Groundwater silcretes on the Verfheuwel Farm. Top – pillowy silcrete lumps protrude the ground. Bottom – blocky silcrete lumps removed by farmers.

On the Middeldam Farm the silcretes outcrop are located on the slopes into the Waterchilpad River, about 115 m above sealevel, or 30 m above the floor of the valley (Figures 23 to 24).

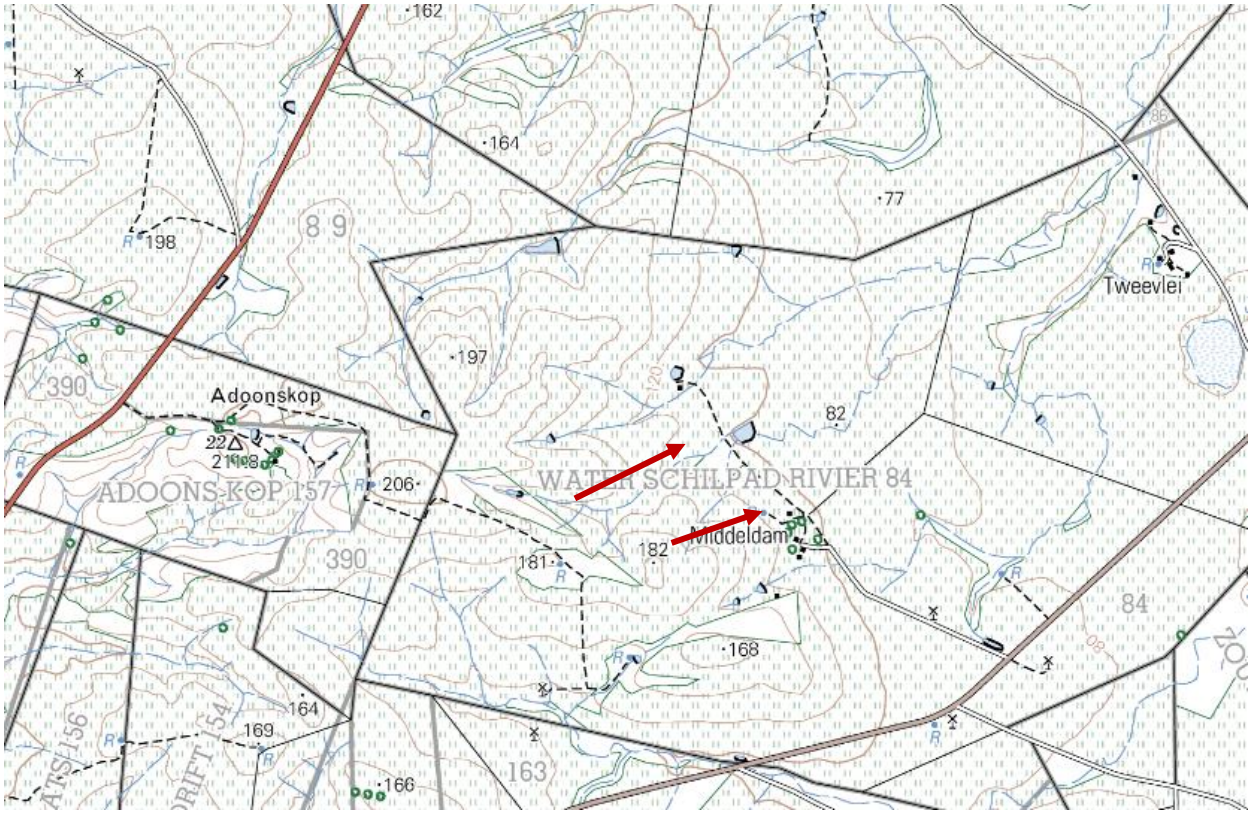


Figure 23. Silcrete lumps on Middeldam Farm. Top – topography map; arrows show the locations of the outcrops. Bottom - the hills to the west, sloping into the tributaries of the Waterschilpad River. This outcrop was too large to be taken out of the ground (as was done with the silcrete lumps in Figure 24).

Figure 24. Top and bottom- silcrete blocks on Middeldam Farm, formed at the bottom of the hill west of the farm building, and pushed to the edge of the cultivated area. The lump in the bottom photograph is the largest seen so far in the Study Area.

Pillowy groundwater silcretes protrude the slope of a hill along the Nuwejaars River near Elim (Figure 25).

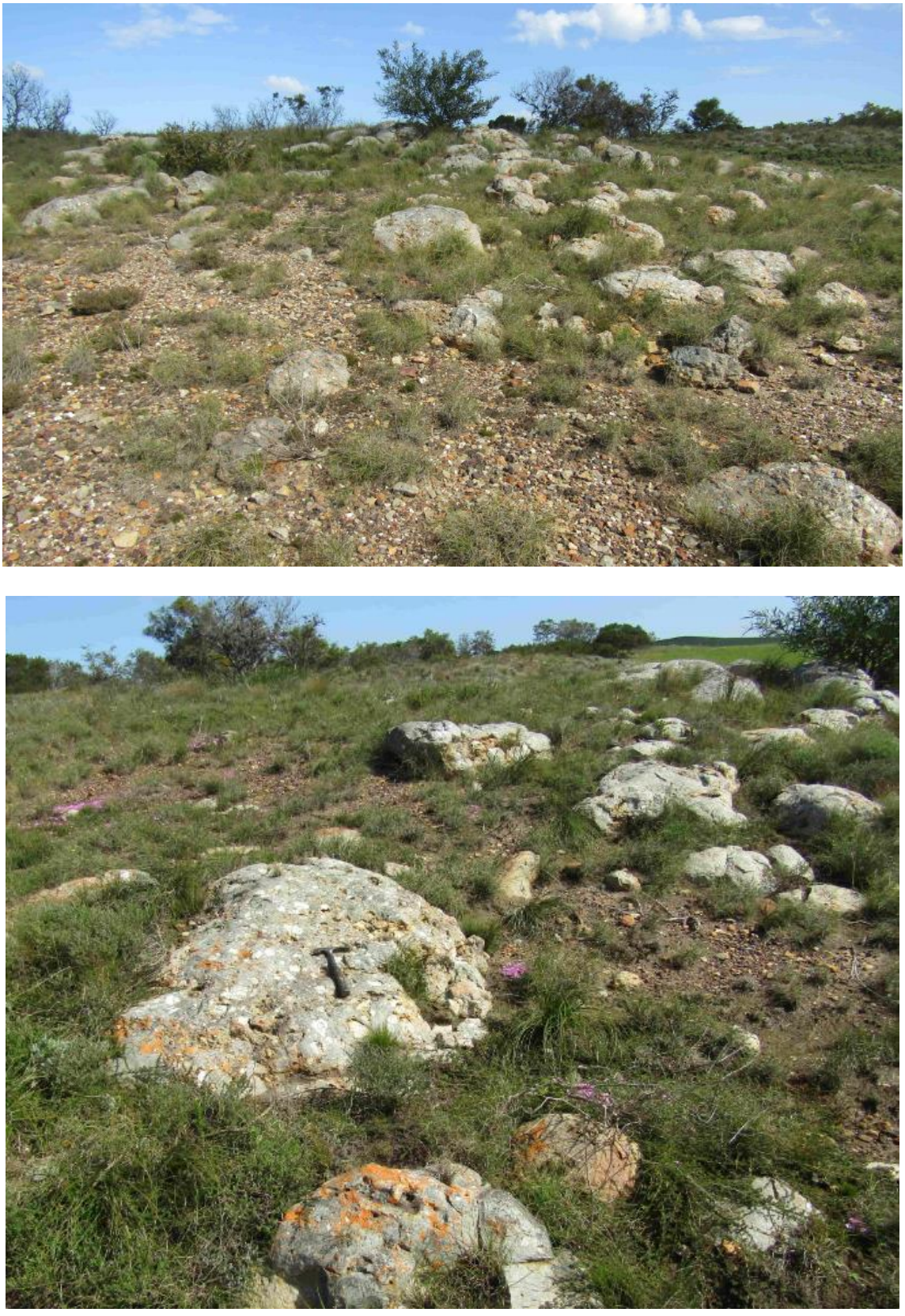


Figure 25. The pillowy silcretes on a slope close to Elim.

The eastern East Valleys are sandy. Most of the silcrete lumps in these valleys have a gravestone shape (Figures 26 and 27).

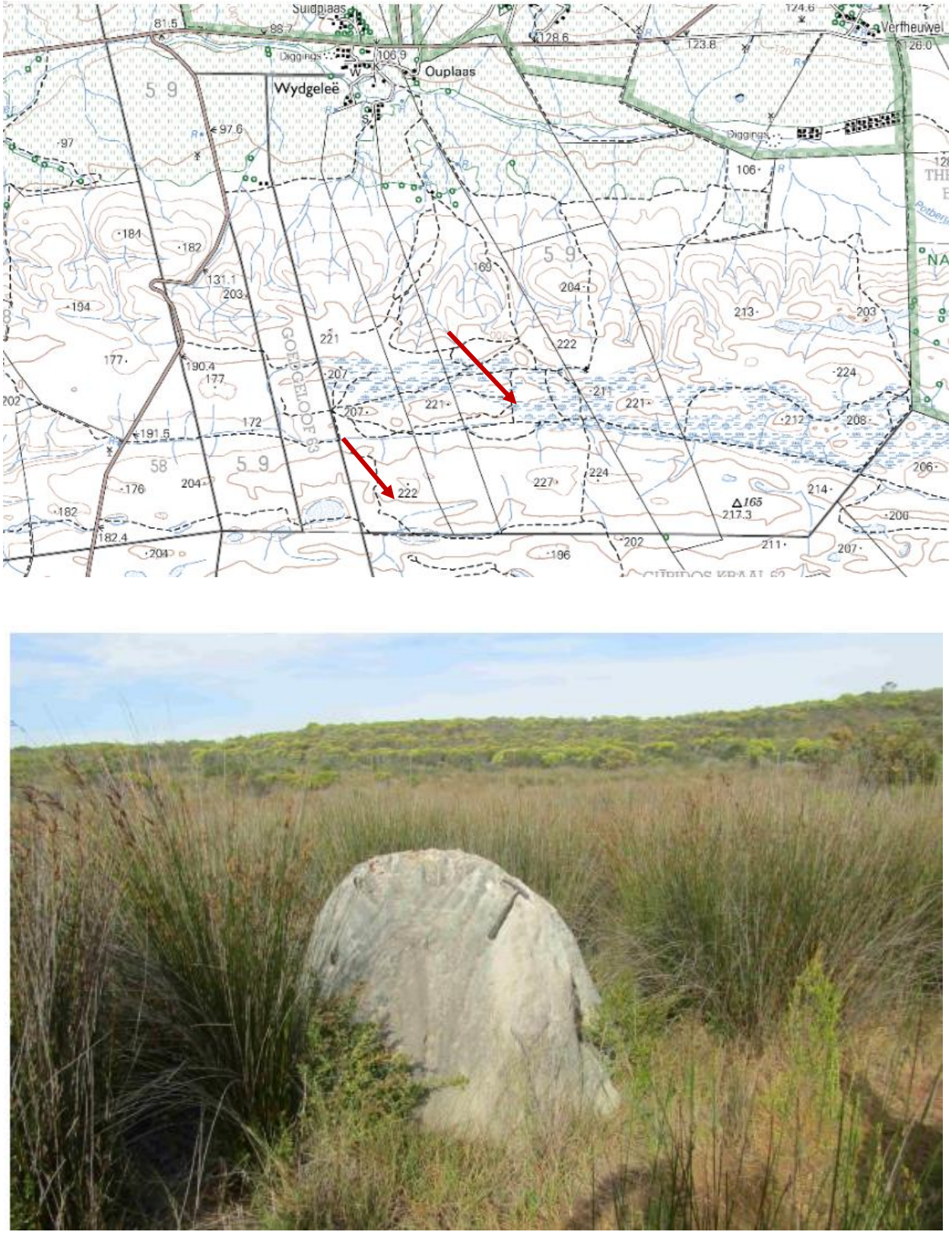


Figure 26. groundwater silcrete lumps on the floors of the eastern East Valleys. Top – topography map. Arrows point to the locations of the silcrete lumps. Bottom – a silcrete 'gravestone' lump.

Figure 27. Top and bottom - silcrete lumps ('gravestones') on the floor of one of the eastern East Valleys.

Silcrete / calcrete intergrade

In places silcrete looks like calcrete and the other way around. Intergrade duricrusts have been researched by Nash, DJ and Shaw, PA, 1998. They wrote:

> Silcrete-calcrete intergrade duricrusts (surface or near-surface chemically precipitated crusts with a cement comprising a mixture of silica and $CaCO_3$) have been widely identified in the geological, geomorphological and pedological literature.

The photograph below, taken on a slope of a calcrete-capped Wankoe Formation Hard Dune, west of the De Hoop Vlei, shows a possible intergrade lump.

Figure 29. Silcrete lump (arrow) was formed on a calcrete cover of a Hard Dune. Upper Langkloof.

See Field Note on riverine silcretes for more examples of possible silcrete-calcrete intergrade.