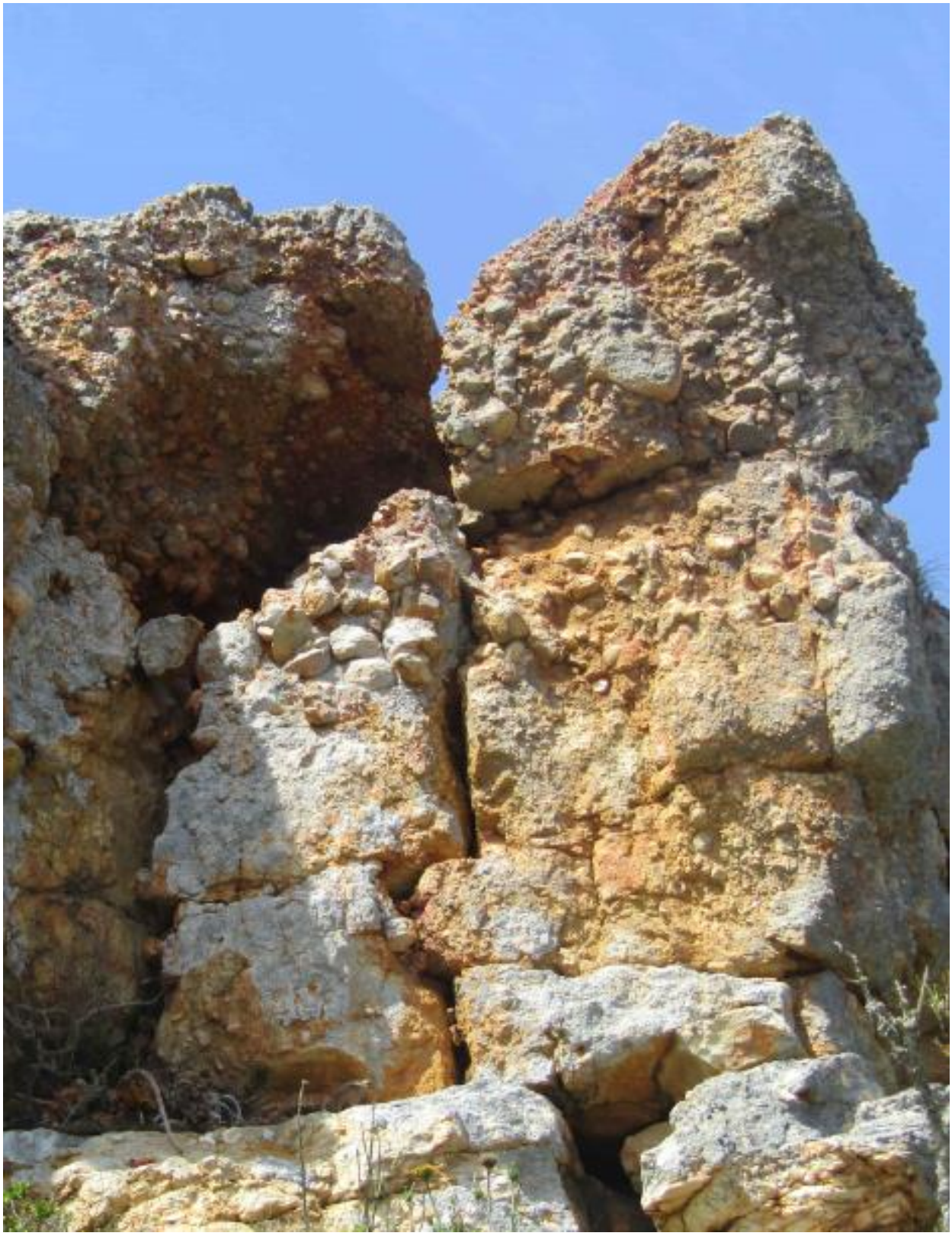
C. GEOLOGY

Field Note C8b. Hilltop silcretes



Hilltop silcrete.

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C. GEOLOGY

Field Note C8b. Hilltop silcretes

Overview

This Field Note describes the morphological characteristics and texture of those 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.

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.

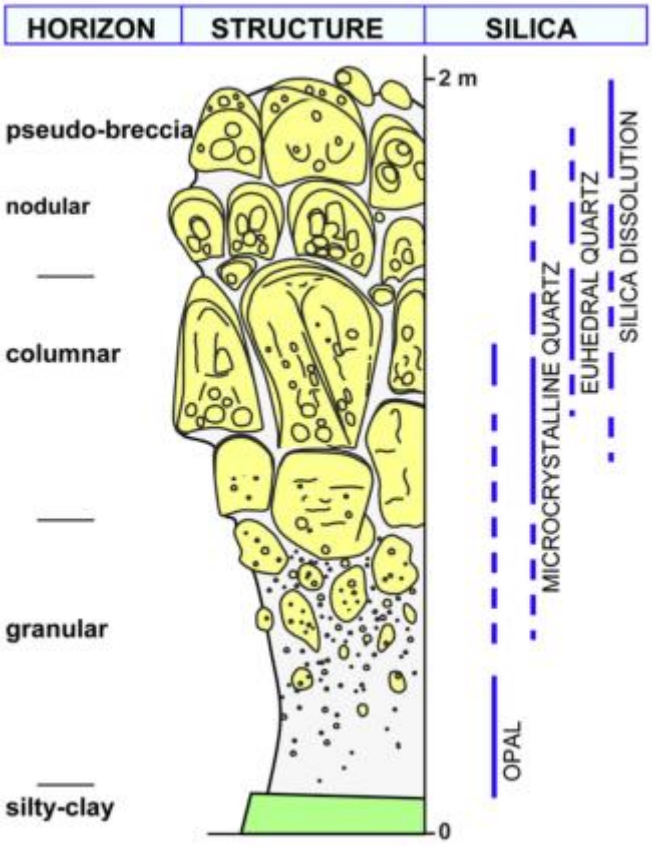

Figure 1. Example of a generalised section through pedogenic silcrete (not in the Study Area), showing facial variations also illustrating the complexity of silcrete formation. (Read below about breccia).

Source: Thiry and Milnes 2017.

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In the Study Area, the hilltop silcretes have some similarities to the generalised section shown above. The silcrete overlies a layer of kaolin (Figures 2 to 5). *(Kaolin* was mined on several hilltops in the Study Area; see Field Notes on mines). Hilltop silcrete elevations are in metres above sealevel; it is noteworthy that they range from 190 m to 347 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 outcrops over kaolin. The exposed parts of the silcrete are grey due to lichens. Top – (columnar silcrete – see below) at the Grootkop kaolin mine; 301 m asl; 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, 314 m asl; view to the north). See also Field Notes on mines.

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Figure 3. Silcrete outcrops over kaolin. The exposed parts of the silcrete are grey due to lichens. Top - at Uitkykheuwel (NE of Ouplaas), 226 m asl; view to the north. Bottom – on a hill close to, and west of, Potberg, 190 m asl; view to the northeast).

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The silcrete layers (2-8 m in thickness) are remnants of a crust, which covered a plateau, or a peneplain (the 'African Surface'). As the silcrete is more erosion-resistant than the sediments which it covers, they form mesa-type, round or elliptical hills as well as ridges (Figure 4).

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

Buttes were once part of flat, elevated areas of land known as **mesas or** plateaus. In fact, the only difference between a **mesa** and a **butte** is its size. Most geographers agree that a **butte** is taller than it is wide, while a **mesa** is a much larger, slightly less elevated feature. (There are no large enough silcrete topped hills in the SW Cape which deserve to be called mesas.

Figure 4. Top and bottom: views of silcrete capped buttes and ridges in the Study Area.

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It is noteworthy that only very few of the hilltops in the Study Area have a horizontal silcrete cap. Most of the hills slope slightly to the north-west, north or north east (see Field Note about the spatial distribution of silcretes and Chapter W).

The silcrete on hilltops can be easily recognised from satellite images by their grey rims (colour due to lichens) and the reddish 'mesa' (colour due to ferrugination) (Figure 5). The rims slowly disintegrate and chunks of silcretes detach and roll down the slopes.

Figure 5. Hilltop morphology. Top – the grey rim and reddish 'plateau', seen on a satellite image. Middle –polygonal joints of a ferruginised 'mesa'. Bottom polygonal joints of the rim.

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The hilltop silcretes can be easily discerned from satellite images. (Figures 6 to 8).

Figure 6. Spitskop. Top – satellite image. Middle – topography map. Bottom – view from the north.

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Figure 7. Kasteelskop. Top – satellite image. Middle – topography map. Bottom – view from the west.

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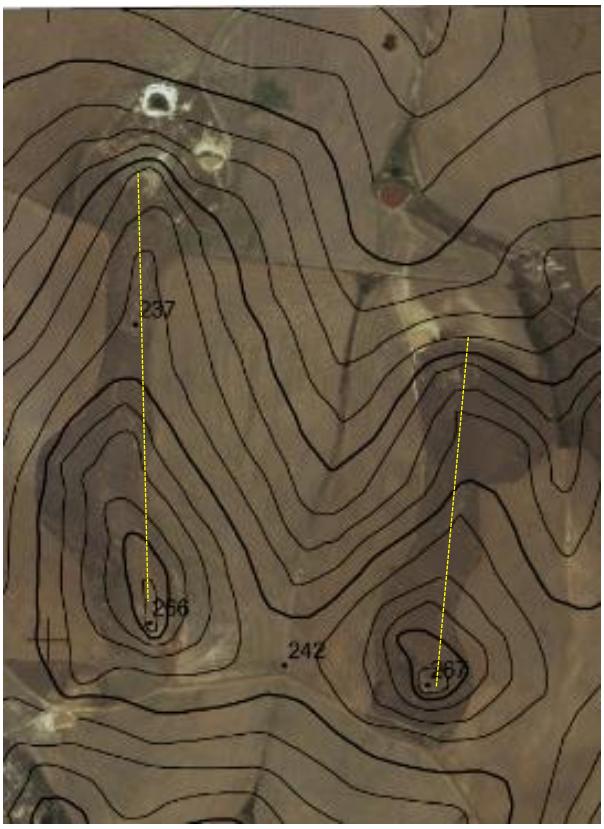
Ridges in the Study Area have different shapes (Figures



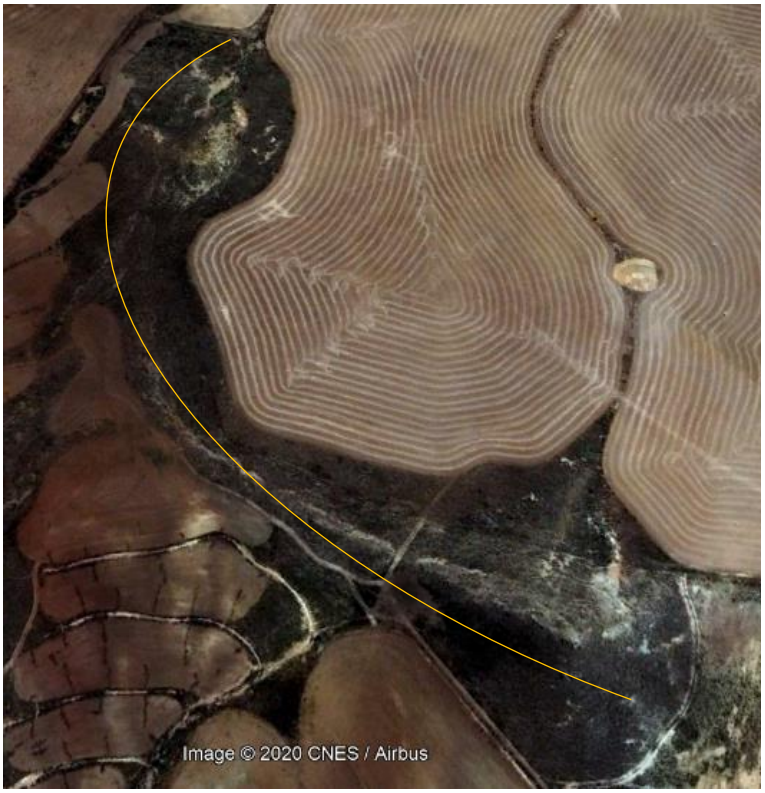


Figure 8. Calcrete-capped ridges in the Study Area, demarcated by dashed lines. Top – straight; bottom – arcuate.

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Hilltops in the Study Area have different shapes (Figure 9).

Figure 9. Top, middle and bottom – hilltops in the Study Area.

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Habits

Pedogenic silcretes display a wide range of habits – bulky, blocky, tabular, columnar, lenticular, bulbous, pillowy, and spherical. Except for one, all names of habits were adopted from the literature (Figures 10 to 20). Grey is the colour of the lichens.

Figure 10. Top and bottom: bulky silcrete (on the farm Witdam, ~40 km NE of Bredasdorp, ~1 km east of the R 319). This is the thickest (>10 m, measured on the south side, where huge chunks detached from the hilltop; see below) and most spectacular hilltop silcrete in the Study Area.
(Grant Forbes, of the Overberg Renosterveld Research centre, on the edge).

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Figure 11. Top and bottom: bulky silcrete. View of the two silcrete chunks (hilltop shown above), the largest in the Study Area; the bigger chunk is >20 m long, 10 m wide and >10 m thick), which were detached from the bulky hilltop.

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Figure 12. Top and bottom: cambered columnar silcrete.

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Figure 13. Distorted columnar silcrete.

Figure 14. Columnar silcrete consisting of conglomerate and nodules (read below).

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Figure 15. Top and bottom: blocky silcrete.

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Figure 16. Top and bottom: tabular (platy) silcrete.

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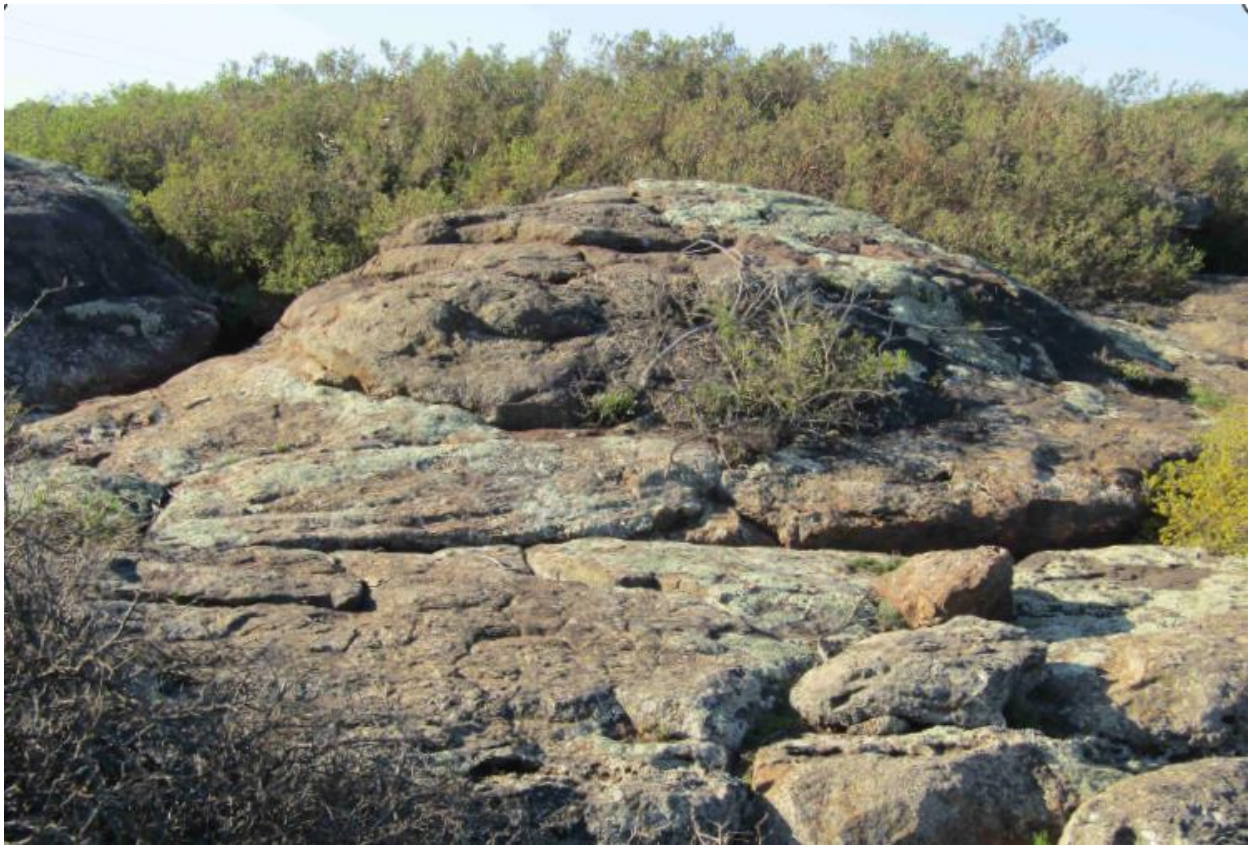

Figure 17. Top and bottom: lenticular silcrete.

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Figure 18. Top and bottom: pillowy silcrete.

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Figure 19. Top and bottom: bulbous silcrete. Note the smooth semi-glossy appearance.

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Figure 20. Top and bottom: spherical silcrete.

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Textures

Pedogenic silcretes display a wide range of texturess range from non-clastic to nodular to conglomerate and breccia. Silcretes contain clasts of other sediments. In the Study Area Most of the silcretes contain rounded clasts (conglomerate); only a few silcretes were found with angular clasts (breccia) (Figure 21).

> A **clastic rock** made of particles larger than 2 mm in diameter is either **conglomerate** or **breccia**. **Conglomerate** has rounded clasts while **breccia** (origin in the Italian language) has angular clasts. Since water transport rapidly rounds large clasts, **breccias** normally indicate minimal transport.

Figure 21. Top – conglomerate silcrete. Bottom - breccia silcrete.

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Nodular (globular –** see definition below**) is another facies, or texture, of silcretes and should not be confused with conglomerate (Figures 22 and 23).

> '**Glaebule'** is a pedological term for a concretionary or nodular structure, which encloses greater amounts of certain constituents, or has a different fabric, or a distinct boundary with the surrounding matrix.

Figure 22. Top and bottom: nodular (globular) silcrete.

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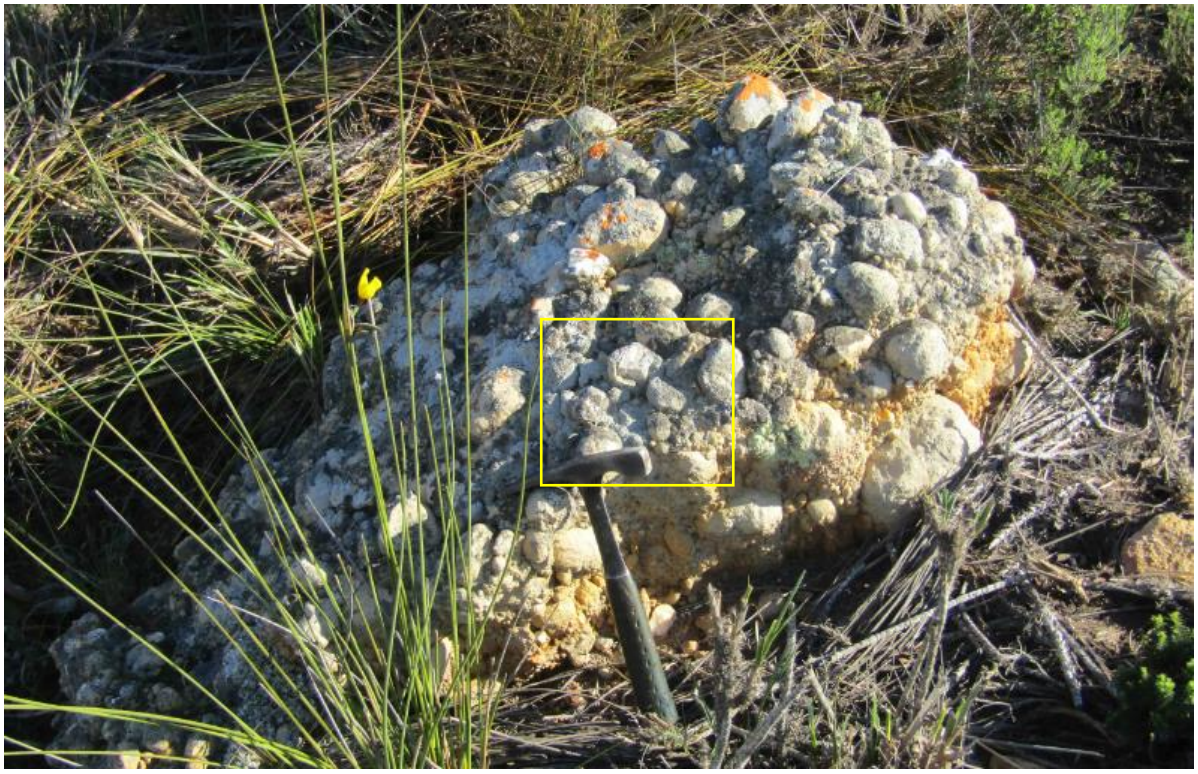

Figure 23. Top and bottom: nodular (globular) silcrete. Box at top photo enlarged at bottom photo. Note the angular clast within a nodule (arrow).

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On several hilltops, silcretes have candle wax drips and botryoidal textures (Figures 24 and 25).

Figure 24. Top and bottom: candle wax drips. Box in top photo enlarged in bottom photo.

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A ***botryoidal*** texture is one in which the mineral has a globular external form resembling a small bunch of grapes (*botrys* in ancient Greek). This is a common form for many minerals, particularly hematite, the classically recognised shape. It is also a common form of goethite, smithsonite, fluorite and malachite.

Figure 25. Top and bottom: botryoidal silcrete. (See also Field Note on manganese and other minerals in ferruginised shales).

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Disintegration

As the kaolin under the hilltop silcrete is eroded, the cap is cracked and huge and small chunks of silcrete are detached from the top and roll down the slopes (Figures 26 to 28).

Figure 26. Top - satellite image: huge chunks detached from hilltop silcrete. Arrow points to a chunk ~20 m long, ~10 m wide and ~10 m thick. Bottom – detached silcrete chunks on a hillslope.

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Figure 27. Top and bottom – hollowed out hilltop silcretes.

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Figure 28. Top and bottom – hollowed out hilltop silcretes.

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