CAPE GEOSITES

TABLE MOUNTAIN

Natural wonder of the World

Table Mountain viewed across Table Bay from Bloubergstrand with Devil's Peak on the left flank and Lion's Head on the right flank. The dark grey rocks in the foreground comprise amygdaloidal andesite lava (Bloubergstrand Member) locally occurring within the Tygerberg Formation's (Malmesbury Group) phyllitic shale and siltstone.

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THE CAPE GEOSITES SERIES

Table Mountain is just one of the many geologically interesting sites in the Cape. This brochure forms part of an educational series that was compiled by the Geoheritage Subcommittee of the Western Cape Branch of the Geological Society of South Africa and is downloadable free of charge from the Branch website (https://www.gssawc.org.za). Bilingual descriptive plaques were placed at the sites during a programme sponsored by SANLAM in the 1990s.

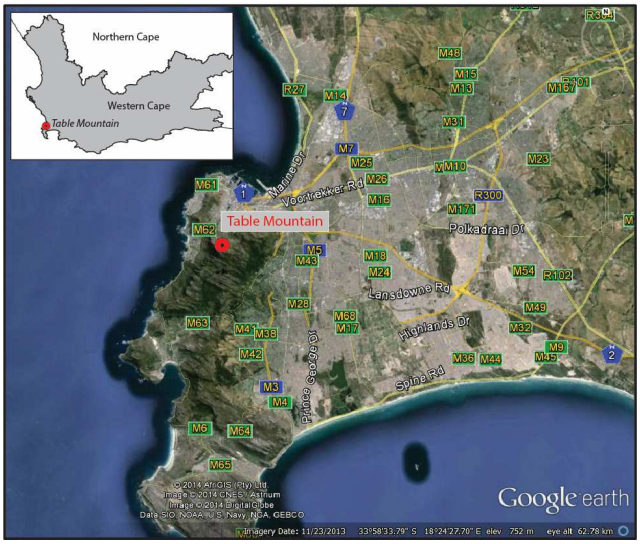

Figure 1: Location map for Table Mountain. See geological map below for more detail and GPS co-ordinates.

INTRODUCTION

Table Mountain forms the bold northern front of the lofty range stretching some 50 km south to Cape Point. Flanked by Lion's Head and Devil's Peak, it presents a natural amphitheatre of unique grandeur, with a level skyline at an elevation of 1 086 m, a 600 m vertical face of bare, layered sandstone, and a sloping pedestal covered with green fynbos and forest plantations.

Figure 2: Table Mountain viewed from Signal Hill. The northern vertical face of the mountain is composed predominantly of sandstone (Table Mountain Group). 33.91825°S/18.40236°E.

GEOLOGY

In the vicinity of Cape Town the oldest formation at the base of the mountain consists of interbedded dark grey metamorphosed shale, siltstone and minor sandstone belonging to the Malmesbury Group. The rocks are well displayed along the beach front from Cape Town harbour towards Sea Point and in road cuts and quarries of Signal Hill and the slopes of Devil's Peak. The beds display open to tight northwest-trending folds and show a well-developed axial-plane cleavage.

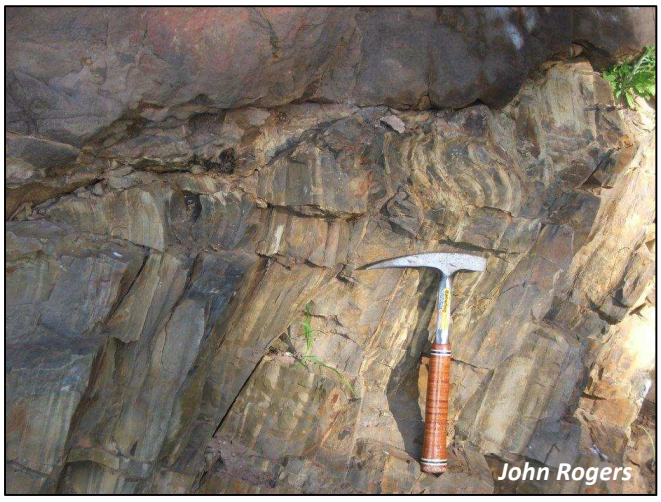

Figure 3: Sandstone and minor conglomerate of the Graafwater Formation resting unconformably on steeply-dipping metamorphosed shale and siltstone of the Tygerberg Formation (Malmesbury Group). The conglomerate contains clasts of Malmesbury Group shale and siltstone. Southern side of Tafelberg Road, west of Devil's Peak at Second Waterfall. 33.94788°S/18.43442°E.

From Sea Point up to the footslopes of Lion's Head and Table Mountain, Malmesbury Group rocks terminate against granite of the intrusive Cape Granite Suite along a contact passing south-eastwards underneath the saddle of Devil's Peak towards Kirstenbosch. To the south, as far as Noordhoek and Muizenberg, the base of the range consists only of granite. Elsewhere, readily weathered rocks of the Malmesbury Group, as well as granite, underlie the more mature foothills and gentle slopes below the towering cliffs of sandstone. Along the shore, coarse-grained granite, with its large white feldspar crystals and glistening flakes of black mica (biotite), is sculpted into odd-shaped, rounded forms. Further landward, scattered spheroidal core-stones of granite project through the slope wash and hillside soil.

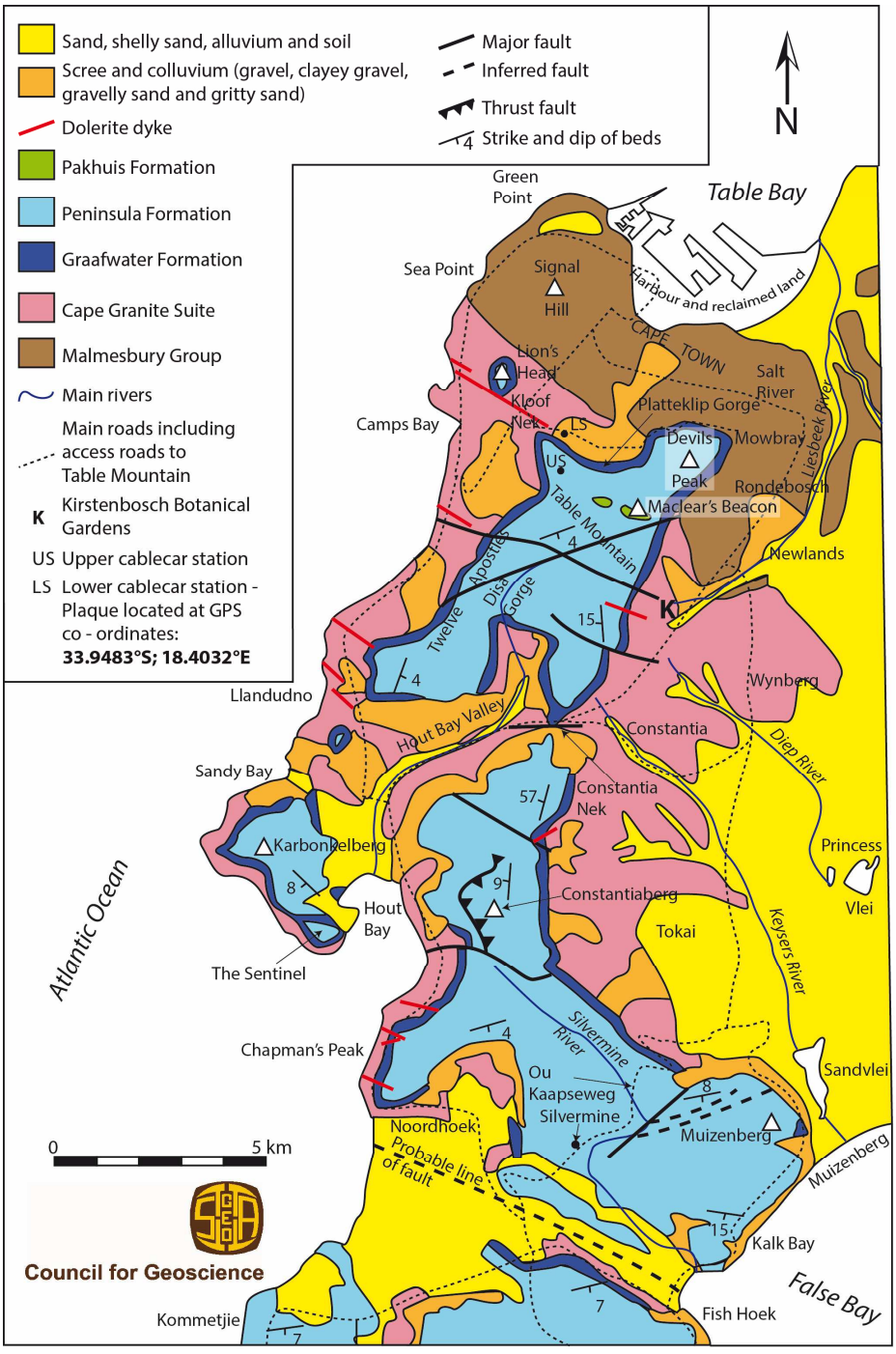

Figure 4: Geological map of the northern part of the Cape Peninsula centred on Table Mountain showing infrastructure, including suburbs and towns, rivers and the upper and lower cable-car stations on Table Mountain.

Figure 5: Dolerite dyke intruding coarse-grained porphyritic granite of the Cape Granite Suite. First Beach, Clifton. 33.93425°S/18.37746°E.

A metamorphic aureole is present adjacent to the granite between Sea Point and Kirstenbosch where the Malmesbury Group rocks have been metamorphosed into hornfels. This aureole is between 0.5 and 1.8 km wide and was exploited for stone aggregate and building stone in several now-abandoned quarries on the lower slopes of Signal Hill and in the vicinity of De Waal Drive. The granite was also exploited from two quarries southeast of Lion's Head in the late 1800s and early 1900s, primarily for building stone, including the construction of Rhodes Memorial and the numerous kerbstones in central Cape Town. The Malmesbury Group rocks have decomposed to clay in a zone outboard of the metamorphic aureole that is between 0.5 and 1.7 km wide and pinches out west of Signal Hill and south of Mowbray. This alteration is thought to have been initiated by metasomatism (fluid flow) associated with intrusion of the granite at temperatures between 300 and 400°C, prior to residual weathering during the Cenozoic Period. This clay was exploited for brick-making from at least seven pits between the late 1800s and 1982, the last one to close being Rochester Brickworks at the southern end of Brickfield Road in Salt River.

Figure 6: Abandoned Higgo Quarry with Lion's Head in the background. The quarry exploited granite of the Cape Granite Suite between approximately 1855 and 1930 for building stone and kerbstone in Cape Town, one example being the Mandela-Rhodes Building. 33.94250°S/18.40106°E.

The almost horizontal base of the Table Mountain Group is clearly exposed in numerous natural as well as man-made cuttings. It lies at about 450 metres elevation in the north, falling to 200 metres at Constantia Nek and to sea level at Muizenberg. This plane, upon which the lowermost Table Mountain Group beds were deposited, represents a major erosional interval of some 50 million years (Ma) in the Cape Peninsula. The lowermost unit, the 25-65 m thick Graafwater Formation, comprises beds of red to purple sandstone, siltstone and shale. It is magnificently exposed in road cuts along Chapman's Peak Drive. The dominant stratigraphic feature of Table Mountain is the uniform, well-bedded, light grey sandstone of the Peninsula Formation, 500 m thick in the sheer face overlooking the city. The rock commonly carries scattered pebbles of white vein quartz and locally grades into conglomerate. Except for thin layers of micaceous shale, the sandstone stands up well to weathering and erosion, breaking off mainly along open joints into blocks of all sizes.

Figure 7: Sandstone of the Graafwater Formation resting non-conformably on weathered coarse-grained granite of the Cape Granite Suite. Road-cut west of Constantia Nek. 34.01198°S/18.40001°E.

Figure 8: Light grey sandstone of the Peninsula Formation overlying red to purple shale, siltstone and sparse sandstone of the Graafwater Formation. Lower part of Western Table promontory above lower cable-car station, Table Mountain. 33.94884 °S/18.40187°E.

Figure 9: Cross-bedded, gritty sandstone of the Peninsula Formation beside the chains near the top of Platteklip Gorge. 33.96153°S/18.40756°E.

Thin remnants of the glacially deposited Pakhuis Formation are preserved along the summit between Maclear's Beacon and Platteklip Gorge. The unbedded pebbly sandstone, only a few metres thick, contains faceted and scratched fragments of chert, quartz and quartzite in a clay-bearing matrix, and shows various permafrost effects. The same glacial unit, elsewhere in the Western Cape mountains, is overlain by soft marine shales of the Cedarberg Formation. By inference, the level top of Table Mountain has resulted from the removal of these shales and the superior resistance to erosion of the underlying sandstone.

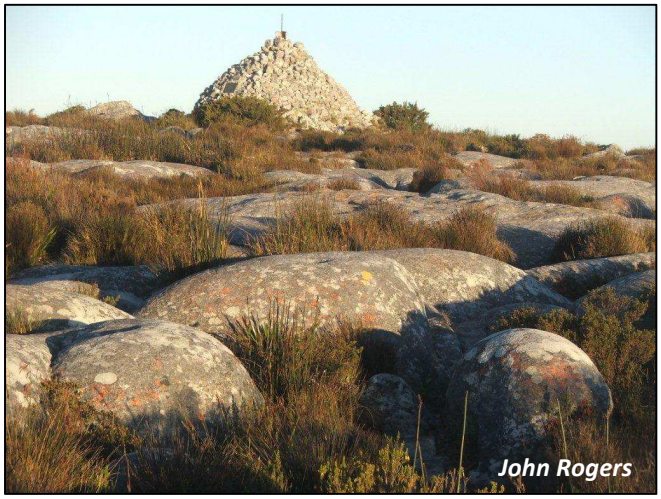

Figure 10: Hummocky outcrop of the homogeneous Pakhuis Formation diamictite (tillite), which forms an outlier at Maclear's Beacon. 33.96685°S/18.42553°E.

Figure 11: Close-up of diamictite (tillite) of the Pakhuis Formation on the southwestern side of the outlier at Maclear's Beacon. 33.9663°S/18.4241°E.

The picturesque scenery of the Peninsula is greatly enhanced by forested ravines, cut along fractures in the sandstone ranges. The majority of these fractures are nearly vertical and strike slightly west of northwest; some show fault offset and/or are intruded by dykes of dark dolerite of the False Bay Dolerite Suite (Figures 5 and 12). The Twelve Apostles are the result of erosion along such fractures. Kloof Nek and the Suikerbossie nek, east of Llandudno, have each been eroded along a dolerite dyke. The largest fault of this set defines the valley from Fish Hoek to Noordhoek, having caused a relative displacement of up to several hundred metres (Figure 4). Relief features, trending northeast, are fewer and more widely spaced. The imposing Platteklip Gorge, in the face of Table Mountain, is the most visible of these fractures (Figure 13). Disa Gorge, draining the upland plateau, was eroded along a fracture, which can be traced from Maclear's Beacon on the summit of Table Mountain, southwestward to Llandudno. Constantia Nek lies on a west-trending fault and the lower Silvermine Valley along a northeast-trending one.

Figure 12: Normal fault near the East Fort, Chapman's Peak Drive with bedded strata of the Graafwater Formation downthrown to the south (right) against granite of the Cape Granite Suite. 34.05431°S/18.36474°E.

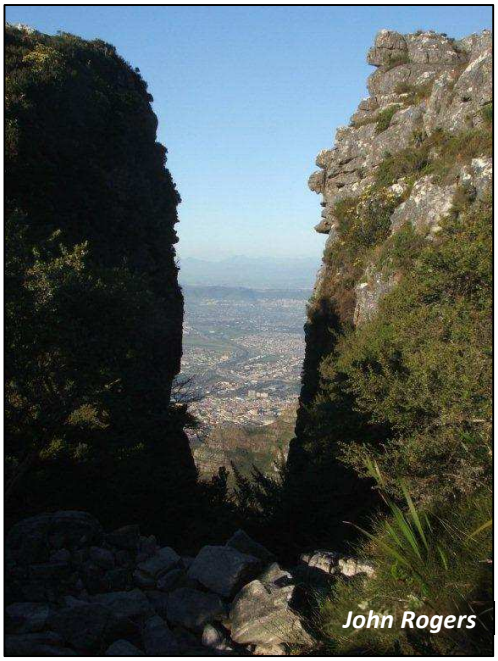

Figure 13: Platteklip Gorge at the top of Table Mountain. The gorge is the result of erosion along a northeast-trending fracture transecting sandstones of the Peninsula Formation. 33.96196°S/18.40768°E.

GEOLOGICAL HISTORY

The history of the geological formations exposed in the Peninsula (Figure 14) begins with the deposition of marine mud and shelf sands in a sea with a coastline similar in shape to that of the present coast, but stretching further inland during Late Precambrian time (approximately 560 Ma ago). These Malmesbury Group sediments became rapidly lithified, were folded into a mountain chain during the Saldanian Orogeny, and intruded at depth by the Cape Granite Suite about 540 Ma ago. This barren mountainland (land plants were still absent) was, over the next 50 Ma, eroded to a low-lying area adjacent to a large intercontinental sea, heralding the onset of a new depositional cycle on the Gondwana supercontinent. Large river systems transported sand and mud southwards, which accumulated on the margins of this sea (Graafwater and Peninsula Formations). In the Late Ordovician Period, about 450 Ma ago, glaciers provided the glacial gravel and sand of the Pakhuis Formation. Thereafter, clay and silt were deposited in calm water from melting ice-sheets (Cedarberg Formation) up until 444 million years ago. Sedimentation probably continued at least

until 280 Ma ago, but these younger formations of the Cape Supergroup and lowermost Karoo Supergroup are not preserved in the Peninsula.

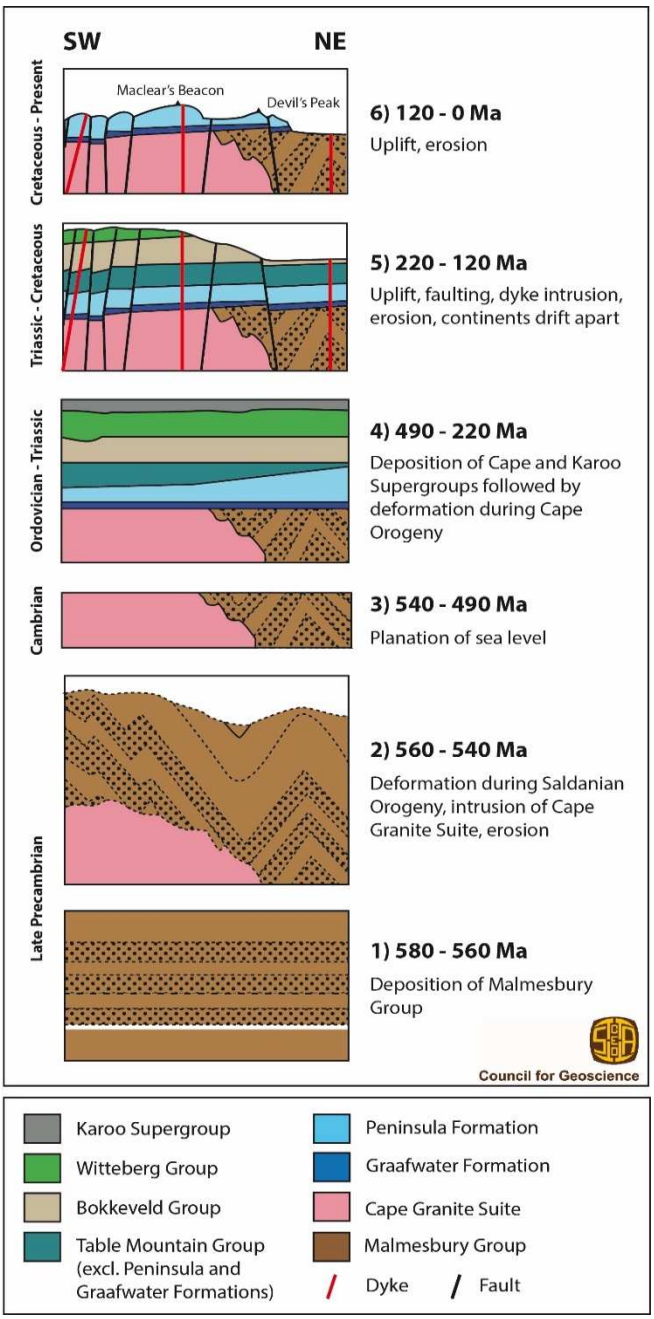

Figure 14: Geological history of Table Mountain.

During the Cape Orogeny (280-220 Ma), the Table Mountain Group of the Peninsula was deformed into open folds and some northeast-trending monoclines (Figure 15), and uplifted progressively with the rest of the Cape Fold Belt. The fragmentation of Gondwana since about 150 Ma ago resulted in the formation of extensive fractures and faults, and was accompanied by the intrusion of many dolerite dykes (these being some 50 Ma younger than those of the Karoo). Prolonged erosion then removed the formations linking Table Mountain with the inland ranges, until the sea finally washed across the Cape Flats during the Tertiary Period. By the mid-Tertiary Period (25 Ma ago) Table Mountain most likely already displayed its present shape, though remnants of Cedarberg Formation shale were probably still present on its crest. The latter has since been stripped off and all the ravines have progressively deepened.

Figure 15: Steeply-dipping sandstones of the Peninsula Formation on the northwestern flank of a northeast-trending monocline at Vlakkenberg, south of Constantia Nek. 34.00896°S/18.40616°E.

CONTACT

Western Cape Branch of the Geological Society of SA: https://www.gssawc.org.za

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