

Geological map of the Pongola Supergroup in SE South Africa and Swaziland. The various stops on the field trip are numbered and the places of accommodation are shown as follows:

FD – Fugitives Drift                      ML- Mtonjeneni Lodge                      KL- Koubad Lodge  
 IR - Ithala Game Reserve                      DD - Dawn-Till-Dusk Country lodge.

# JGC field trip

## THE PONGOLA SUPERGROUP: EARTH'S OLDEST STABLE CONTINENTAL MARGIN

The c. 2.9 Ga Pongola Supergroup located in the SE Kaapvaal Craton is one of the best preserved Archaean terranes in the world. It is made up of sequences of volcanic and sedimentary rocks that extend as a linear belt in a north-south direction for 270 km in SE South Africa (adjacent map, after Wilson *et al.* (2013)). It is unique amongst supracrustal terrains of this age because its relatively undeformed state affords a rare opportunity to study volcanic and surface processes from rocks in an almost pristine state over a wide geographic extent. The sequence was deposited in a stable continental margin environment with extensive epicratonic volcanism and basin sedimentation. It formed in the period of transition between the general steeply-dipping and highly deformed early Archaean greenstone belts, exemplified by the Barberton Mountain land, to the extensive late Archaean Witwatersrand and Ventersdorp crustal basins.

The purpose of the field trip is to allow participants to view the entire length of the Pongola Supergroup, examining the wide range of rock types from the base to the top of sections, which, at their thickest exceed 9 000 m. An appreciation will be gained of the major variations along the length of the belt including the marked changes in thickness, enabling a reconstruction of the environment of surface processes on the early Earth. The field area is also located in some of the most beautiful and spectacular countryside in South Africa, in an area steeped in history and with superlative accommodation.

The Pongola Supergroup of craton-wide extent developed as two separate basins (Gold, 2006), delineated as the Northern and Southern Domains and into distinct geographic regions: north, central, south, and the Nkandla region in the far south. The north and central regions extend into western Swaziland. In contrast to the northern region, the Nkandla region in

the far south has been folded in three main synclines and block-faulted, causing repetition of the stratigraphy. In the south region of the Northern Domain, and in the Nkandla region, the Pongola successions are exposed as distinct inliers each with specific names.

The type sections for all parts of the Pongola Supergroup are located in the Northern Domain but lithostratigraphic correlations, particularly for the Southern Domain, remain debatable and are constantly evolving with continued studies. The lower, dominantly volcanic succession is called the Nsuze Group (4300 m thick in the type area) overlain by the dominantly sedimentary succession of the Mozaan Group (4 800 m thick) (Gold, 2006). The volcanic rocks range from komatiitic basalt to rhyolite and all will be viewed at various stops during the field trip with textures ranging from pillow lavas, classic pahoehoe-textured flow units, pyroclastic rocks and accretionary lapilli. The sedimentary successions include cross-bedded sandstones, pelites, mixed volcanic ash quartz-arenite deposits, stromatolites, banded iron formation and glacial diamictite. On the economic geology side the site of Stanhope mine will be visited as well as the major shear-hosted gold deposit at Klipwal Mine.

Important side aspects of the trip will be to visit the Isandlwana battle site where the British expeditionary force in Natal was comprehensively defeated by the Zulus on 22<sup>nd</sup> January, 1879. The short tour to the battle site will be conducted by historian Andrew Rattray. One overnight stop will be at the Ithala Game reserve with spectacular views of the Mozaan sedimentary sequence.

The tour starts from King Shaka International Airport and will head through the c. 1000 Ma Natal-Namaqua Metamorphic Province passing through Devonian sandstones of the Natal Group and the lowest stratigraphy of the Karoo Supergroup. The first stop will be at the Mhlatuzi inlier and Stanhope Mine site. Metavolcanic lava units of the Nsuze Group are





*The Buffalo River near Fugitive's Drift showing the steeply dipping quartzite and pyroclastic units unconformably overlain by lower Karoo sediments with the imposing Isandlwana Mountain in the background, site of the famous battle of the same name.*



seen together with the lowest conglomerate member of the Mozaan Group (Sinqeni Formation) exploited for gold at the old Stanhope Mine with workings still visible (Stop 1).

A 60 km drive to the west takes us through the rolling hills of eastern KwaZulu-Natal where traditional Zulu homesteads and villages on steep-sided mountains will be observed. The trip passes by the iconic 'Sphinx-shaped' Karoo sandstone mountain, the site of the great battle of Isandlwana, and then across the Buffalo River to the first evening stop at the world renowned and exclusive Fugitives Drift Lodge. The spectacular view at Fugitives Drift is of the Buffalo River (Stop 2) cutting through steeply dipping units of volcanic and sedimentary units of the Pongola Supergroup in the Buffalo River inlier.

The next morning ( **DAY 2** ) commences with a two hour visit to the Isandlwana Battle Site of 22<sup>nd</sup> January, 1879. The mega-cross beds of the Karoo Vryheid Formation make up the mountain, where the history will be recounted in great detail by expert historians. We will then visit the sediments and volcanic rocks of the Central Syncline (Stops 3 – 5 on map, p 22) with spectacular views of the folded sequence in the Nsuze River. Accommodation that night will be at the luxury Mtonjeleni Lodge close to the town of Melmoth.

The next day (**DAY 3**) will be a walking traverse through the spectacular gorge of the White Mfolozi River (Stops 6 and 7).

We will view the cross-bedded arenites, stromatolites, mafic tuff and diamictite in this section, then the superbly preserved lavas of the Agatha Formation.

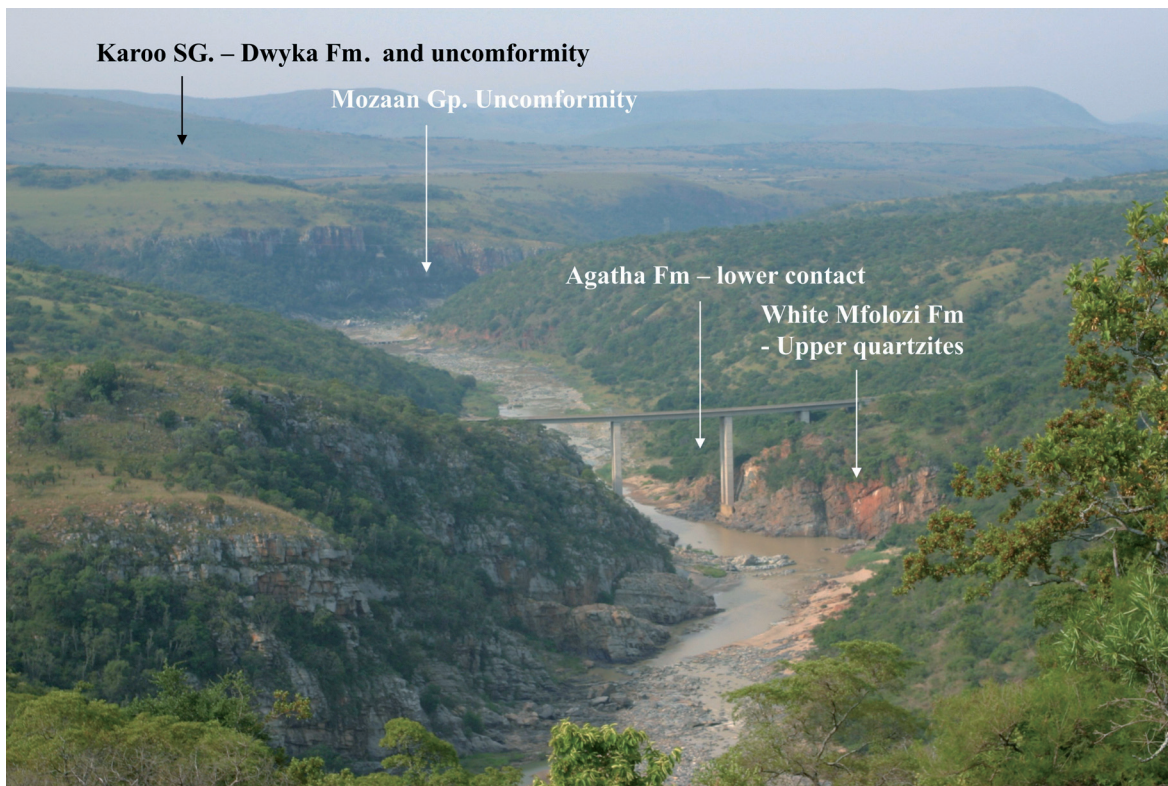


*Columnar stromatolites in the White Mfolozi Formation.*



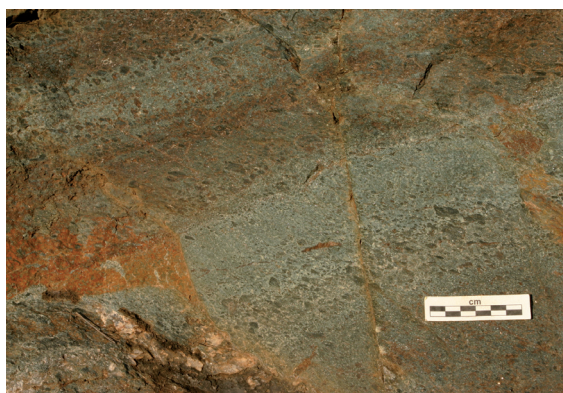
*Ropey lava at the top of perfectly preserved pahoehoe lava flow units in the White Mfolozi valley.*





*View of the White Mfolozi valley with the upper quartzites of the White Mfolozi Formation in the foreground, the lavas of the Agatha Formation in the middle overlain by gently dipping (to the east) sediments of the Mozaan Group.*

The superbly preserved stromatolites provide unique insights into the evolution of the ancient atmosphere (Beukes & Lowe, 1989). The base of the volcanic Agatha Formation will be examined in the road cut of the R34 where a mafic tuff together with accretionary lapilli are seen overlying the quartzites of the White Mfolozi Formation.



*Cyclical banded tuffs and accretionary lapilli at the base of the volcanic Agatha Formation.*

The high Mg, Cr and Ni contents of the fragments attest to an ultramafic magma which was never preserved as flow units.



*Contact of the lowermost sandstones of the Mozaan Group in contact with sheared pahoehoe lavas of the Nsuze Group.*





The second day (**DAY 4**) at the White Mfolozi section will examine the lowermost succession of the Mozaan Formation (Sinqeni Formation). The basal portion of the Sinqeni Formation is most commonly defined by a fluvial conglomeratic succession (Denny Dalton Member), which has its type area at the Denny Dalton Gold Mine, in the White Mfolozi Inlier which will be visited at Stops 8 and 9. The Denny Dalton Member comprises a succession of laterally impersistent gold-bearing conglomerates, granulestones and quartz arenites and is overlain by a succession of mature, coarse-grained quartz arenites. Higher in the succession of the Sinqeni Formation is a spectacular exposure of the sandstones overlying sheared lavas of the Agatha Formation.

The lowest of the jaspilitic banded iron formation units of the Mozaan Group will then be examined.

The day will be concluded by a drive through the picturesque northern Zululand to the Ithala Game Reserve. The cliffs of the Mozaan Group quartzites (Stop 10) will be viewed and an evening game drive will be arranged either that evening or the next morning.

Departing the game reserve the first stop of **DAY 5** will examine closely the basal contact of the lowest unit of the Pongola Supergroup (the Mantonga Formation) in the vicinity of Paulpietersburg (Stop 11). This feature shows the world's oldest clearly established palaeosaprolite

in which coarse-grained sandstone to gritstone overlie weathered early Archaean granodiorite (Matthews & Scharrer, 1968).

Ultramafic fragments contained within the basement granitoid and close to the contact of the Pongola

*The lowermost contact of sandstones of the Mantonga Formation overlying the palaeosaprolite formed by subaerial weathering of the Archaean basement granodiorite.*



*Banded iron formation and ferruginous shale units of the Sinqeni Formation in the White Mfolozi valley.*







*Lava flows of the Pypklipberg Formation in the background incised by the Bivane River at Koubad Lodge*

rocks will be examined. Close to this same area the c.3.3 Ga ultradepleted komatiites of the Comondale greenstone belt will be visited as well as a banded iron formation underlying the komatiites (Stop 12).

On proceeding to the night stop at the beautiful Koubad Lodge, the lowermost unit of Nsuze Group lavas (Pypklipberg Formation) in the Northern Domain will be viewed as well as intrusive gabbros of the extensive Usushwana Complex (see map, p 22) (Stop 13).

**DAY 6** will be spent viewing the Mozaan Group in the type Hartland area (Stops 14 – 16). The structural complexity will be demonstrated on the basis of the three major depositional basins in the area. Strike-slip shear zones separate the basins and have given rise to significant gold showings some of which have been exploited in the Altona and Klipwal gold mines. A major banded iron formation is demonstrated by the Scott's Hill Member. Within the Klipwal Member is an 80-m thick diamictite, arguably the world's oldest clearly recognizable glacial deposit (Young *et al.*, 1998). Higher in the succession the two lava units within the Mozaan Group will be visited (Stops 17 – 19). The Tobolsk Formation has pyroclastic and reworked ash deposits together with pillow lavas and the pyroclastic rocks of the Gabela Formation lavas represent the highest preserved unit of the Mozaan Group. Accommodation will be at the picturesque luxury Dusk-to-Dawn Lodge overlooking the hills of the lower Nsuze Group.

**DAY 7** is the return to Johannesburg and Stop 20 will be at the Piet Retief quarry where the complexly deformed basement tonalite/granodiorite to the

Pongola Supergroup can be viewed. The final stop (Stop 21) will be where the road cuts through the spectacularly exposed quartzite units and interbedded shales of the Sinqeni Formation in the most northerly occurrence of the Pongola Supergroup.

Note: Program may be changed without notice due to unforeseen circumstances

**References**

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