

NAMIBIA 2022

Summary of the work undertaken in September 2022, by Drs Mike Hall, Patricia Vickers-Rich, Tom Rich and Mr Peter Swinkels along with staff from the Namibian Geological Survey and locals.

Pokenbank was revisited and the location of the 12-15 m fault that cuts out part of the section was checked. The Aar member just to the south was prospected for fossils, without success, and cross bedding measured in a sandstone unit.

The track from the abandoned Kokerboomkloof homestead to the plateau to the east was navigated, and an almost continuously exposed stratigraphic section was measured from the valley floor to the east, back to the top of the plateau. The Kanies, Mara and Kliphoek members are present, as well as the lower part of the Aar member.

The track to the abandoned Arasab (Theodora) homestead was reconnoitred and outcrops in the hills south of Farm Grens examined at a distance. A section of Kanies member was later examined.

Scattered outcrops of Aar member below prominent Mooifontein Limestone were prospected on Farm Anusi, adjacent to Elbra homestead.

A section was measured in a valley east of the C13 (Aus - Rosh Pinah road) south of Pokenbank homestead, from the top of the Mara to the base of the Aar member. This is referred to as South Pokenbank.

An almost continuously exposed section from the top of the Mara member to the base of the Mooifontein Limestone was measured on Farm Arasab along the track to the communications tower.

Outcrops immediately north of the abandoned Anib homestead were mapped and a section measured through the upper part of the Mara into the lower Aar member. No fossils were found.

A section was measured on Farm Ruspunt from the top of the Mara member to the base of the Mooifontein Limestone and prospected for fossils.

Farms Tsachanabis and Groenboom, along the D446, were reconnoitred for possible sections and areas to prospect for fossils.

Outcrops of Aar member along the main Aus - Keetmanshoop road (B4) were prospected just west of Biltong Plaas, as were similar outcrops along the D435 just west of Goageb.

A stratigraphic section was measured in a valley on Farm Groenboom, west of the D446, from the basal unconformity to the base of the Mooifontein Limestone.

Prospecting was continued along the D446 to its junction with the D727, and then along the DF727 to the C13, and an inlier with a complete Kanies, Mara, Kliphoek, Aar section was located in the gorge area of the D727. A stratigraphic section was later measured here from the basal unconformity to the base of the Mooifontein Limestone.

The Ernietta Hill area on Farm Aar was re-examined as well as sediments around the basement inlier just east of Windy Peak. A thorough search was also conducted for fossils previously discovered at the top of the Kliphoek member, but these appear to have been removed.

Fossils stored on Farm Plateau were examined and prospecting carried out in the Aar member along the track just south of the homestead. Possible stromatolites were located.

Reconnaissance in the valley immediately south of Snake Canyon resulted in the discovery of probable stromatolites in a ginger-coloured limestone in the upper part of the Aar member. Prospecting further south discovered probable Ernietta in the upper part of the Aar member and abundant Pteridinium in a sandstone bed in the middle of the Aar member.

Fossil occurrences at the waterfall locality (Arhausser) were re-examined, as were outcrops in the gorge area and hillsides immediately to the east.

Outcrops of the Aar member forming a prominent hill north of Farm Aar homestead were prospected but no fossils were found.

Stratigraphic Sections

Summary of the main sections examined during all visits to Namibia:

Windy Peak – West Valley

Very thin basal conglomerate and sandstone rest on a slightly irregular unconformity surface. Overlain by sandstone with some thin limestone beds, including one of ankeritic limestone. Then c.30 m of dominantly sandstone (Kliphoek) and typical Aar, c.38 m dominated by shale and very fine sandstone with common, thin limestone beds and a few thin sandstone beds. Total thickness to the base of the Mooifontein Limestone is c.72 m.

South Valley

Section 7 km SSE of Windy Peak. Very thin basal clastics (medium to coarse sandstone) are followed by c.18 m of interbedded fine sandstone with thin limestone beds (Mara), then c.37 m of dominantly fine to very fine sandstone, very coarse and cross bedded in its lower part (Kliphoek). The overlying sandstone and shale with thin limestone beds (Aar) is c.31 m thick. The base of the Mooifontein Limestone is c.86 m above the basal unconformity.

Kubub

This section, 5 km SW of South Valley, was measured on the western side of the plateau. Very thin basal conglomerate and sandstone (< 1 m) is overlain by c.18 m of interbedded sandstone and limestone, 26-27 m dominated by sandstone (Kliphoek), and c.40 m of interbedded fine to very fine sandstone and limestone (Aar). The base of the Mooifontein Limestone is c.85 m above the basal unconformity.

North Tower

This section, on a very prominent hill 8 km SSW of Kubub, was measured along the upper part of the steep access track to a communications tower. It is almost continuously exposed, except for the c.17 m above the top of the Mara. The inferred Kliphoek is c.28 m thick, contains some very thin limestone beds and has an upper part comprising interbedded fine sandstone and shale. The overlying Aar is 44-45 m thick and dominated by interbedded shale, fine sandstone, and limestone. Total thickness from the top of the Mara to the base of the Mooifontein is c.72 m.

Arasab (Theodora)

The section, 5 km SE of North Tower, was measured on a hill slope immediately east of Arasab homestead. Very thin (1.5 m) basal sandstone and fine conglomerate is overlain by c.34 m of limestone and interbedded sandstone (Mara), then c.33 m of sandstone, medium to very coarse at the base and becoming finer upwards (Kliphoek). The Aar is taken from the base of the first limestone above the sandstone and comprises at least 41 m of mainly fine to very fine sandstone and interbedded limestone.

North Kokerboomkloof

This exceptionally well exposed section, 14 km SW of Arasab, was measured from the valley floor up the eastern side of the plateau, through several washouts along an old track. The basal clastics (Kanies) up to c.7 m of coarse sandstone, grit and fine conglomerate, include a lower dark grey portion and an upper pale brown-beige portion, both of which stand out prominently on the surrounding cliff faces. The overlying 42-43 m (Mara) is dominated by limestone, which forms five distinct benches, interbedded with shale. The overlying Kliphoek, c.36 m thick, is dominated by thinly interbedded shale and medium to very fine sandstone in its lower part and fine sandstone in its upper part. Two thin limestone beds occur in the middle of the member. The Aar is represented by <11 m of interbedded limestone, shale and sandstone. The section does not extend to the base of the Mooifontein Limestone.

Pokenbank

Section 18 km SSW of Kokerboomkloof. Because of a 12-15 m normal fault at Pokenbank main, sections were measured at north Pokenbank and Pokenbank main, up to and west of the fault in order to get a complete section. The basal clastics (Kanies) are up to c.41 m thick, medium sandstone to fine conglomerate in the lower part, fine sandstone in the upper part, and dominated by planar, flaggy bedding. This is overlain by c.45 m of limestone with minor interbedded very fine sandstone and shale (Mara). The uppermost limestone bed, c.4-5 m thick, is a prominent dark grey to black unit and conspicuous stratigraphic marker in the surrounding area, and colloquially referred to as the "Top Black". The overlying Kliphoek, c.37 m thick, is dominated by sandstone and minor shale, but also includes some limestone beds up to 1.5 m thick. The Aar is at least 50 m thick, commences with a 3.5 m thick limestone bed, and consists dominantly of fine to very fine sandstone, some cross bedded, with common, thin limestone beds. A sandstone bed, c.14 m above the base, contains *Pteridinium*. The transition into the Mooifontein Limestone is exceptionally well exposed, and displays thinly interbedded limestone and fine to very fine sandstone in which the limestone beds become thicker upwards over 15-20 m.

Anib

This section, 7 km S of Pokenbank, was mapped and measured on outcrops immediate north of Anib homestead. The Mara, lowest unit observed, is at least 42 m thick and comprises limestone with interbedded sandstone, some very coarse. This is abruptly overlain by c.25 m of sandstone (Kliphoek), very coarse to grit at the base, fines upwards into fine to very fine sandstone with minor shale. Only the basal limestone of the Aar is present.

West Road

This section, 4 km SE of Anib, includes a very thin basal conglomerate and c.53 m of laminated, planar bedded, dominantly medium to fine sandstone (Kanies), overlain by almost c.49 m of limestone with interbedded sandstone in its upper portion (Mara). The overlying Kliphoek begins abruptly and is over 30 m thick, but incomplete. It includes thin limestone beds, most only a few cms thick. The sandstone at the top of the section is medium to very coarse and cross bedded.

South Pokenbank

The lower part of his section, 6.5 km SE of West Road, comprises at least 36 m of limestone (Mara) overlain by c.27 m of poorly exposed, medium to fine sandstone with some thin

limestone beds (Kliphoek). Possible Aar at the top of the section includes a lower 5 m thick limestone bed overlain by c.12 m of medium to fine sandstone.

Ruspunt

A largely rubble covered section c. 50 m thick, 16 km E of Pokenbank, was measured from near the top of the Mara to the base of the Mooifontein Limestone. Some c.29 m of laminated, fine to medium sandstone (Kliphoek) is overlain by just over 10 m of possible sandstone and shale with two thin limestone beds (Aar).

Groenboom

This section, 21.5 km ENE of Arasab and c.78 m thick, includes a thin basal grit – fine conglomerate overlain by c.12 m of mainly medium to coarse sandstone, with common cross bedding in its lower part and planar bedding in its upper part (Kanies). The overlying, poorly exposed c.13 m includes three thin limestone beds and some sandstone (Mara). This is followed by c. 16 m of dominantly fine sandstone, cross bedded at the base (Kliphoek), then a poorly exposed c. 31 m with some thin beds of fine sandstone and a very thin limestone bed in its lower part.

D727

This reasonably well exposed section, 21.5 km SE of Ruspunt and 24.5 km E of South Pokenbank, is c.170 m thick and was measured in an inlier along a gorge-like section of the D727, where it is surrounded by younger sediments. A very thin (<1 m) pebble conglomerate is overlain by c.43 m of continuous sandstone that includes three prominent members (Kanies). The overlying c.42-43 m is dominantly limestone with interbedded minor sandstone (Mara), and is followed by 33-34 m, but probably 52-53 m, of sandstone that includes three coarse to very coarse portions (Kliphoek). The inferred Aar, c.30 m thick but very poorly exposed, contains two prominent sandstone beds but no obvious limestone.

Comments

In a number of the sections described it is somewhat arbitrary where the boundary between the different members is placed, partly because of facies changes and poor, rubble-covered outcrops. For example, the base of the Aar is easy to pick in the north on Farm Aar where the Kliphoek is abruptly overlain by shale. However, in less well-exposed sections further south the base is taken at the base of the first prominent limestone bed above obvious Kliphoek sandstone.

From a regional perspective it is obvious that the Kanies thickens markedly south of Kokerboomkloof. It is very thin in the north and, in the absence of (very thin) Mara, disappears or becomes the basal part of the Kliphoek.

The Mara also thickens southwards, but more regularly, and gradually loses its clastic component. In the north (West Valley) it represented by c.5 m of ankeritic limestone, and in Waterfall Valley, east of Arhausser, by only c.10 cm of similar limestone. However, there is no evidence of continuity between these two outcrops.

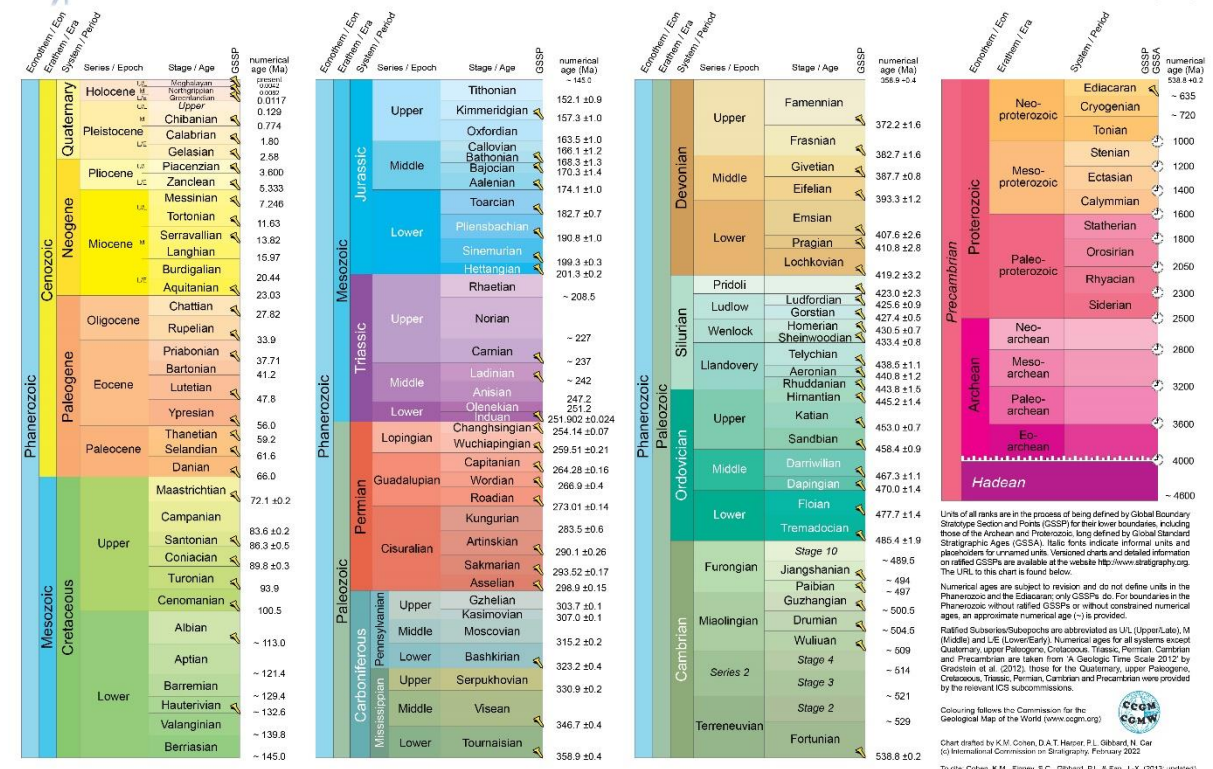
*Comments to be added for:
The Kliphoek.
The Aar.
Paleocurrent directions for each unit*

Mike Hall and team
(Most recent update 1.11.2022)



In addition to all of this it should be noted that our dating of the ash at the top of the Swartpunt in the southern end of our studies was accepted in the 2022 International Geological Time Scale as the boundary date separating the Precambrian and the Phanerozoic – 538.8 +/- 0.2 million years.

INTERNATIONAL CHRONOSTRATIGRAPHIC CHART
 v 2022/02



Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archaean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Italic fonts indicate informal units and paleonyms for unnamed units. Venned charts and detailed information on ratified GSSPs are available at the website <http://www.stratigraphy.org>. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Ediacaran only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (-) is provided.

Ratified Subseries/Subepochs are abbreviated as UL (Upper/Late), M (Middle) and LE (Lower/Early). Numerical ages for all systems except Quaternary, upper Paleogene, Cretaceous, Triassic, Permian, Cambrian and Precambrian are taken from 'A Geological Time Scale 2012' by Gradstein et al. (2012). Those for the Quaternary, upper Paleogene, Cretaceous, Triassic, Permian, Cambrian and Precambrian were provided by the relevant ICS subcommissions.

Colouring follows the Commission for the Geological Map of the World (www.cgmw.org/)

Chart drafted by K.M. Cohen, D.A.T. Heiser, P.L. Gibbard, N. Carr
 © International Commission on Stratigraphy, February 2022

To cite: Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fiala, J.-X. (2022), updated. The ICS International Chronostratigraphic Chart, Episodes 38, 189-204.
 URL: <http://www.stratigraphy.org/ICSChart/ChronostratChart2022-02.pdf>