MARINOAN GLACIAL AND POSTGLACIAL SUCCESSIONS AT THE SOUTHERN RIFTED MARGIN OF THE CONGO CRATON (NEOPROTEROZOIC, NORTHERN NAMIBIA): FACIES, PALAEOGEOGRAPHY AND HYDROCARBON PERSPECTIVE

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In northern Namibia continental rifting occurred at about 750 Ma (Nosib Group). It is followed in the late Neoproterozoic by the deposition of predominantly shallow-water platform carbonates (Otavi Group). These are up to 5000 metres thick, and were deposited on the southern "passive" margin of the Congo craton. The Otavi Group is exposed in a fold belt from the Kaokoveld in the West to the Otavi Mountainland (OML) in the East. Deposition occurred at sub-tropical to tropical latitudes, although at that time climate might have been partly colder in the tropics than today. The Otavi Group is thought to represent a time span of around 200 million years. A complex palaeogeographic setting with small, restricted basins occurred. Frequent submarine mass movements with a wide variety of clasts derived from the underlying Otavi and Nosib Groups, suggest repeated uplift of partly several thousands of metres and deep erosion of the former carbonate platform/ramp.

Two discrete glaciogenic units are known in the Neoproterozoic of northern Namibia. The older one (Chuos Fm.) occurred during the Nosib rifting episode, the younger one (Ghaub Formation, zircon dating of associated tuffs: 635.5 $\pm$ 1.2 Ma) is intercalated in the middle part of the Otavi Group. Ghaub diamictites often reach considerable thickness (>100m) and are restricted to slope settings. Different intervals of diamictite sheddings (from approximately East to West) have been outlined in the central OML. The clasts consist mostly of reworked Otavi and Nosib sediments; only a minor percentage is derived from local crystalline basement. Diamictites seem to be lacking on top of the shallower parts of the carbonate ramp, an argument against "grounded ice". As the assumed glaciers cannot transport the basement clasts for thousands of metres upwards, uplift of large areas that became glaciated is a likely scenario, largely corresponding to the one given by Eyles and Januszczak (2004) (Zipper-Rift-Earth). Most of the diamictites represent debris flows, and no prominent striations occur on the clasts. The only valid argument for glaciations at that time is given by a few dropstones at the base of the overlying postglacial interval.

The post-glacial cap carbonate sequence (Maieberg Fm.) is much more widely developed than the Ghaub Fm. The succession consists of a lower part, up to about ten metres thick of often laminated, micritic Cap Dolomite. As in many other parts of the world, where possibly contemporaneous glacial intervals have been found (e.g. Southwest Namibia, Central Australia, Mackenzie Mts. in Canada, East Greenland and East Svalbard Caledonides) a shaly-marly interval overlies the Cap Dolomites and forms the middle and upper part of the cap carbonate sequence. During this interval, the climate might have distinctly improved.

As in the other areas mentioned, the cap carbonate sequence above the buff coloured Cap Dolomites changes in colour from brown to grey and/or black. It is often rich in pyrite (distributed within the sediment in small aggregates but also filling veins), if the Ghaub diamictite is present in the underlying rocks. This marly-shaly succession is locally more than 200 m thick and contains organic-rich intervals, potential hydrocarbon source rocks. Strong thickness differences indicate, that the shaly succession partly fills the preexisting slope and basin settings. In the central OML, the Maieberg Fm. distinctly increases in thickness westward, from 70 m to 230 m, in line with the westward thickening of the diamictites. Debris flows and turbidite intervals several metres thick are intercalated within the marls.

Two types of organofacies have been found: Type 1 is dominated by strongly degraded acritarchs and is oil prone, typical for lighter, medium grey rocks. Type 2 contains inertinite dominated kerogen with few degraded acritarchs and AOM, typical for dark grey to black rocks. The latter type represents higher anoxic levels. Fluid inclusions and thermoluminescence indicate short lived higher temperatures (150 to 200°C, hydrothermal pulses related with ore emplacements) than the ones indicated by the organic material. The degree of maturation might fluctuate laterally. The described setting shows a potential for hydrocarbons, especially "tight gas" further to the north, in the Owambo Basin.