Paleomagnetism of Maieberg Cap Carbonates, Namibia. Low Latitude Glaciations and Supracontinental Scale Remagnetization Events.

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Abstract

The Neoproterozoic Era was one of the periods of greatest variation in Earth's external and internal environments in the Planet's history. Lithological and geochemical data show that there were several extreme climatic variations in this period, with a possible advance of the polar ice caps to equatorial latitudes. The position of continental masses and mountain ranges is an important factor in climate regulation, and, therefore, has been considered as a conditioning element of Cryogenian panglaciations. Thus, the precise definition of the location of the continents during this period is of great importance in paleoclimatic models. However, relatively few high quality paleomagnetic data exist for key geological units between 900 – 500 Ma, producing many ambiguities, with equally valid but very different models. Another complicating factor has been the observation, by several authors, that the Neoproterozoic geomagnetic field presented a particularly anomalous behavior in the Earth's history. In this research we investigated the Maieberg Formation (Namibia), belonging to the Otavi Group, which contains carbonate rocks deposited within the continental carbonate shelf southwest of the Congo craton, and covers glaciogenic rocks of the Ghaub Formation, generated during the Marinoan glaciation (*ca.* 635 Ma). Our study aimed to characterize the magnetic mineralogy and the physical processes of remanence acquisition, obtain robust paleomagnetic data in the light of modern analysis techniques and search for implications of these data for the paleoclimate and tectonics of the period. Thermal demagnetizations made it possible to discretize two magnetization components, one relatively noisy which we called C_1 (pole at 312.09°E and 45.37°S, A95: 7.28°) and another, stable, which we called C_2 (pole at 358°E and 34.32°N, A95: 4.3°). Rock magnetism experiments such as hysteresis cycles, IRM and FORCs lead to the conclusion that the main magnetic mineral responsible for the remanence in these rocks is magnetite. In addition, careful analysis allowed us to distinguish two populations, with different coercivities and magnetic domain structures. To confirm this hypothesis, we performed backscattered and secondary electron analysis via SEM, and verified this distinction in grain's imaging. The population of less coercive magnetites was associated with the C_1 component, which was interpreted as a primary detrital magnetization (DRM). The most coercive grain population was associated with the C_2 component, which was interpreted as a remagnetization of thermochemical (TCRM) origin due to the conversion of iron-rich smectite to illite during diagenesis/anquimetamorphism. These hypotheses were partially confirmed in stability tests with the components. X-ray diffraction showed that there is a close relationship between remagnetized carbonates and the presence of illite/mica. The position of the C_1 pole is close to that of other glaciogenic units and, if indeed a primary component, provides a depositional paleolatitude of 33.3° for the Maieberg carbonates, and by extension to the Ghaub glacier, confirming the advance of polar ice caps to low latitudes (Snowball Earth hypothesis). In turn, the C_2 component falls on a set of poles of Cambrian remagnetizations (*ca*. 525 – 520 Ma) observed in different cratons (now including Congo), suggesting a supracontinental scale event.