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Petrology, Structure and Chemostratigraphic Correlation of Chehmit inlier, Tigrai, Northern Ethiopia

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Chehmit area is one of the four exposed Neoproterozoic inliers in northern Ethiopia, which consists of both Tsaliet and Tambien Group rocks. The metavolcanics, metavolcanoclastics and phyllite rocks exposed in the area represent the Tsaliet Group whereas the mixed clastic-carbonate metasedimentary rocks constitute the Tambien Group deposited ∼800-740Ma ago. An integrated structural, petrological and carbon and oxygen isotope study has been carried out to understand the deformation, metamorphic and Neoproterozoic history of the area. Field structural data demonstrate that there are at least three phases of deformations. Earliest deformation produced minor, steep tight folds and N-S trending, pervasive regional foliation; followed by the formation of major upright folds, and latest brittle structures. Petrographic study of rock samples from the area shows predominantly lower green schist facies metamorphism coeval with the earliest phase of deformation. Stable C and O isotope analysis of the carbonates is also carried out to evaluate chemostratigraphy. The limestone unit contains anomalous C-isotope depositional signature which, together with lithological features, enabled local and global correlations with other Neoproterozoic formations. The δ^{13}C values of the limestone in Chehmit range from -5.79 ‰ to -1.99 ‰ with an average value of -3.80 ‰ whereas the value of δ^{18}O ranges from -7.119 ‰ to -14.164 ‰ with an average value of -11.300 ‰. Although negative carbon isotope excursion in Neoproterozoic era is often related to snowball earth conditions, no glaciation features and erosion surfaces are observed in this unit. Thus the negative C-isotope excursion is, instead, correlated with the Bitter Springs Stage anomaly (found in Australia and Svalbard) which is considered to be the result of inertial interchange true polar wandering. The δ^{13}C values obtained from the Chehmit limestone indicate a match with the top most excursion of the Bitter Springs anomaly. Radiometric dating and paleomagnetic studies of the rocks of the Chehmit area can be useful to further support this hypothesis

Keywords: Tambien Group, chehmit area, carbonates, Neoproterozoic, Bitter spring stage, True polar wondering