Geochemistry of carbonate formations of the Neoproterozoic Marwar Supergroup, western India

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The Neoproterozoic–Early Cambrian Marwar Supergroup of Rajasthan is one of the important Proterozoic sedimentary successions of India. We carried out a C-O-Sr isotopic study of the carbonate formations of the supergroup, all part of a single group called the Bilara, in an attempt to assess the influence of facies variation on primary $\delta^{13}C$ and find evidence of any Neoproterozoic global events in the basin. The bottommost carbonate formation, the Dhanapa, exhibits $\delta^{13}C_{PDB}$ in the range of -7.1‰ to +2.0‰, whereas the that of the overlying Gotan and Pondlo formations varies between -8.4‰ and +2.1‰, and -5.1‰ and +1.6‰, respectively. Samples analysed for $\delta^{13}C$ deemed to be the least altered components from various chemical tests (e.g., Mn/Sr < 10; $\delta^{18}O_{PDB}$< -10‰). Carbon isotope stratigraphy reveals a $\delta^{13}C$ negative excursion in the Gotan limestone formation where the $\delta^{13}C_{PDB}$ values plunge to near mantle values of ~ -5 ‰. This excursion can be correlated throughout the basin and most likely represent a temporal change in the global climate. We suspect this basin-wide excursion to be the chemical signal of the globally synchronous Gaskiers glaciation. However, apart from the basin-wide $\delta^{13}C$ excursion, there are a few $\delta^{13}C$ negative excursions in the Gotan Formation which can be associated with the change in depositional facies suggesting that the local depositional environments do affect the $\delta^{13}C$ of carbonates. Interestingly, the mode of $\delta^{13}C_{PDB}$ of all the three carbonate formations of the Bilara Group is ~0‰, which is different from the elevated $\delta^{13}C$ values reported globally for terminal Neoproterozoic oceans. This probably suggests a spatial heterogeneity in the carbon isotopic record.