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Magnesium and Uranium isotope composition of the Sturtian Jacoca Formation cap dolomite, Brazil

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The Early Cryogenian period is marked by the Sturtian glaciation episode (ca. 720-660 Ma) that triggered a global perturbation to ocean chemistry and to the surface cycles of many elements. However, reconstructing variations in seawater chemistry during the Early Cryogenian remains a challenge. The magnesium and uranium isotope composition of seawater ($\delta^{26}Mg$ and $\delta^{238}U$) have recently been shown to be good tools to reconstruct key Earth-surface processes, such as weathering rates, carbonate precipitation, and seawater anoxia. Dolomite has been suggested as a promising archive for $\delta^{26}Mg$ and $\delta^{238}U$ values of past seawater, but the fact that, in many cases, dolomite forms in sediment-buffered conditions complicates the interpretation of its isotopic signature. Here, we study the Sturtian Jacoca Formation cap dolomite member (~ 1.5 m-thickness), underlain by the Jacarecica Formation diamictite. The goals of this study are: (1) to identify the factors determining the $\delta^{26}Mg$ and $\delta^{238}U$ values of this cap dolomite; and (2) to assess if these isotope values can be used to reconstruct the $\delta^{26}Mg$ and $\delta^{238}U$ of Early Cryogenian seawater. To this end, we measure Mg and U isotope compositions of dolomites sampled from 3 profiles (ca. 1 m apart), as well as different generations of dolomite within single samples. These measurements are supplemented by chemical composition, mineralogical (XRD), and petrographic analyses. The samples exhibit a narrow range of Mg/Ca molar ratios (0.84 − 1.04), which along with XRD and petrographic analysis, indicate a dolomite-dominated carbonate mineralogy. The $\delta^{26}Mg$ values of the cap dolomite samples range between -1.77‰ and -0.91‰. Through the basal 6 cm above the contact with the underlying diamictite, the $\delta^{26}Mg$ increases from -1.66‰to -0.91‰. This may suggest a local ^{26}Mg-enrichment within the precipitating solution. Above this, the $\delta^{26}Mg$ value decreases back to ~ -1.7‰ and remains similar up to the highest sample taken (100 cm). This may suggest that the system was more seawater-buffered for the upper part of the unit relative to the basal part. Such seawater-buffered dolomite $\delta^{26}Mg$ may be used for reconstructing Early Cryogenian seawater $\delta^{26}Mg$.