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Synglaciogenic Late Ediacaran Cap carbonate of Hormuz Formation (southern Iran)

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The formation of Neoproterozoic cap carbonate is linked to the "Snowball Earth" hypothesis, which suggests that the Earth was covered by ice during two or more prolonged glaciations. The melting of the glaciers led to a rapid rise in sea level and the subsequent deposition of carbonate-rich sediments. The presence of dolomite in the Hormuz Formation deposited in the Proto-Tethys Ocean provides important insights into the geology, chemistry, and biology of the Ocean. The two forms of dolomite found in the Hormuz Formation, laminated-organogenic and hydrothermal-metasomatically recrystallized. The laminated-organogenic dolomite formed through precipitation of calcium and magnesium ions in a shallow marine environment associated with microbial mats, indicating a thriving microbial ecosystem. The recrystallized dolomite formed through alteration by hydrothermal fluids, indicating the presence of geothermal activity. The formation of laminated dolomite occurred penecontemporaneously with the deposition of banded iron formation (BIF), and the primary dolomite is silicified. In addition, dropstones are present in this facies association. The hydrothermal-metasomatic dolomite is highly recrystallized, consisting of microspar and spar cement, as well as saddle fabrics. Trace minerals such as pyrite, and sphalerite, among others, are early diagenetic in origin. Later-stage calcitic veins frequently cross-cut through both micritic and microspar cemented lithologies. The δ13C (V-PDB) values of dolomite range from -7.0 to +2.7 ‰, indicating that seawater was the principal source of reactants for dolomite precipitation. The negative δ13C values of laminar dolomite may relate to CO2 decreases linked to worldwide icehouse intervals. The δ18O values of dolomite range from -0.55 to -13.13 ‰ (V-PDB), reflecting a temperature fractionation effect. The carbonate formation temperatures of the Hormuz Formation were determined using the Δ47 (paleo)thermometer in dolomite. Δ47 values range between 0.5875 ± 0.0114 and 0.2869 ± 0.0152 (‰ ± 95 %), indicating predominant diagenetic closure temperatures of between 27.2 ± 3.9 and 271.2 ± 32.5 (°C ± 95 %). The laminar dolomite contains samples with the wider range of δ13C values and lower diagenetic closure temperatures. The results suggest that dolomite comprises a mineral initially precipitated in a retro-arc rifted basin behind the Cadomian magmatic arc in the Tethyanmargin of Gondwana.