Sr isotope chemostratigraphy of marbles from the Lutzow Holm Complex, East Antarctica: Implications for Gondwana tectonics

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Dolomite and calcite marbles are common lithologic units in the amphibolite (NE) to ultra-high temperature (SW) metamorphosed Pan-African (530 Ma) Lutzow Holm Complex (LHC), East Antarctica. The marbles occur as layers with varying thickness (up to 100m), conformably interlayered with metapelitic and metapsammitic gneisses and granulites, especially in the SW region of the LHC. The thick metasedimentary supracrustal sequence is believed to have deposited in the Mozambique Ocean that separated east and west Gondwana supercontinents, which amagalmated to from Gondwana during the latest stages of Pan-African orogeny. However, very less is known about Mozambique Ocean, its spatial and temporal extent, because of the absence of unmetamorphosed sediments. Based on the geochemical results, we propose that marbles can preserve pre-metamorphic signatures and are potential candidates to understand the chemostratigraphy of pre-existing oceans.

Strontium, carbon and oxygen isotope geochemistry of the marbles suggest most of the marbles were subjected to extensive alterations after deposition. Some layers exhibit extreme $^{87}Sr/^{86}Sr_{550Ma}$ ratios as high as 0.758 and delta18O values as low as -5permil. These variations indicate multiple stages of fluid-rock interaction processes during diagenesis, prograde to peak and retrograde metamorphic events. Exceptionally, some of the marble layers preserve pre-metamorphic geochemical characteristics, such as low Sr isotope ratios, carbon and oxygen isotopic compositions. Such marble horizons are suitable for chemostratigraphic correlations with their unmetamorphosed equivalents. Least altered $^{87}Sr/^{86}Sr_{550Ma}$ values of 0.70663 and 0.70528 together with high carbon and oxygen isotopic compositions suggest apparent age of deposition around 730-830 Ma. The apparent depositional ages are consistent with the carbonate deposition in the Mozambique Ocean that separated east and west Gondwana. Thus, high-grade marbles, if geochemically unaltered during metamorphism, can provide key information for deciphering the tectonic evolution of supercontinent assembly.