

Geochemistry of Paleozoic Carbonates in the Yunnan Tethyan Belt: Coupling of the Neo-Tethyan Ocean Opening and Crustal Weathering

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The opening process of the Neo-Tethyan Ocean and its associated crustal evolution mechanism remain further to be understood. Marine chemical composition records can offer a distinctive window into the coupling between tectonic activities and continental weathering. In this study, we present geochemical data, including elemental and Sr-Nd isotopic compositions of carbonate rocks from the Baoshan block, western Yunnan Tethyan belt, China, to reconstruct ancient seawater chemistry and investigate long-term effects of continental weathering and hydrothermal activity of mid-ocean ridge on paleo-ocean chemistry from the Devonian to Permian.

Sr isotopic compositions of Paleozoic marine carbonates collected from the Baoshan block exhibit a variation tendency consistent with the global oceanic record. A decline in $^{87}\text{Sr}/^{86}\text{Sr}$ values of the carbonates suggests a significant increase of juvenile crustal material contributing to the Neo-Tethyan Ocean basin. Analytical results further reveal a pronounced shift in initial ϵ_{Nd} values (from -9.6 to -3.1) and Ce/Ce^* and Eu/Eu^* ratios in marine carbonates. These variations imply intensified hydrothermal activity along the rapidly expanding mid-ocean ridges, which released large amounts of mantle-derived juvenile materials into the oceanic basin. Basaltic magmas forming in intense submarine volcanic activities interacted extensively with seawater and resulted pronounced release of juvenile materials with depleted Sr and Nd isotopic composition. Modeling calculation of integrating geochemical proxies demonstrates an interplay between continental weathering, magmatic activity, and hydrothermal process on oceanic chemistry of the Neo-Tethyan Ocean. These results highlight an importance of the coupling of tectonic-weathering process and ocean system to the Earth's surface evolution and provide evidence for geodynamic changes of oceanic chemistry in Late Paleozoic.