Biogeochemistry of Neoproterozoic Low Latitude Glaciations

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The Neoproterozoic (c.a. 1000 Ma–540 Ma) was a time of great change. Eukaryotes radiated through the ocean, while metazoans originated and diversified. The rock record preserves multiple negative excursions of over 15‰ in the carbonate $^{13}C/^{12}C$, at least three of which are associated with global low-latitude glaciations.

Here we describe molecular, isotopic, and petrographic analyses of samples from two Neoproterozoic localities. The first locality contains strata deposited in the Vazante Basin in southeastern Brazil during a low-latitude glaciation at c.a. 700 Ma. The second contains strata deposited in the Nanhua Basin in South China. Samples studied from this interval include rocks deposited both before and immediately after two different glacial events (c.a. 750 Ma and c.a. 630 Ma), during the Wonoka Anomaly (c.a. 570 Ma, when $\delta^{13}C \approx$ -11‰), as well as during the Precambrian/Cambrian transition.

In the Nanhua Basin, the preglacial samples are lean in organic carbon. In contrast, the post-glacial and terminal Neoproterozoic samples are organic-rich, up to 9.8% TOC. The synglacial samples from the Vazante Basin contain organic-rich black shales, up to 3.0% TOC, and organic-poor marls and diamictite. The pre-glacial Chinese samples are dominated by high molecular weight (MW) *n*-alkanes and contain low concentrations of hopanes and steranes. The syn-glacial Brazilian samples are also dominated by high MW *n*-alkanes, while hopanes and steranes are below detection levels. The synglacial black shales from the Vazante Basin and the post-glacial samples from the Nanhua Basin are dominated by low MW *n*-alkanes. They also contain hopanes, steranes, and 2,3,6-trimethylarylisoprenoids. In the Nanhua Basin, the Terminal Neoproterozoic samples resemble the post-glacial samples, although the abundance of high MW *n*-alkanes increases upsection across the Precambrian-Cambrian boundary.

Lithologic and biomarker evidence from sediments deposited before the glaciations indicate low levels of primary production, while the post-glacial samples from China and the synglacial samples from Brazil are consistent with high levels of primary productivity (high TOC), an increase in eukaryotic abundance, and photic zone euxinia, a pattern that persists across the terminal Neoproterozoic.

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