Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30382

Barium isotopes track the environmental dynamics across the Ordovician-Silurian transition

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The Ordovician-Silurian transition is a critical period in Earth's history that was characterized by mass extinctions, rapid climate changes, and global carbon cycle perturbations. However, the driving forces of these ecological and environmental fluctuations remain highly debated. Barium isotope compositions (δ^{138}Ba) of marine sediments have emerged as a promising proxy for understanding Ba cycling that is potentially related to primary productivity. In this study, we present δ^{138}Ba data of two sections that are individually dominated by shallow-water carbonates and deep-water shales spanning the Ordovician-Silurian boundary. For the carbonate section, the δ^{138}Ba values slightly fluctuate around ~1.0‰ in the latest Ordovician, and then drop to relatively low values (~0.7 ‰) in the earliest Silurian. While the shale section is characterized by a positive δ^{138}Ba excursion (up to 1.65 ‰) in the Hirnantian Age. In combination with previously published organic carbon isotope, lithium isotope, and uranium isotope data for the same successions, our δ^{138}Ba variations in contemporaneous shallow and deep waters support that elevated nutrient inputs corresponding to enhanced continental weathering before and after the Hirnantian glaciation would have increased primary productivity, ultimately leading to deeper water anoxia. While the δ^{138}Ba variations were more likely controlled by deep-ocean sulfate increase during the Hirnantian Age. Overall, our δ^{138}Ba data provide new insight into the Ba cycle across the Ordovician-Silurian transition, and indicate distinct δ^{138}Ba characteristics in response to changes of primary productivity and ocean redox conditions.