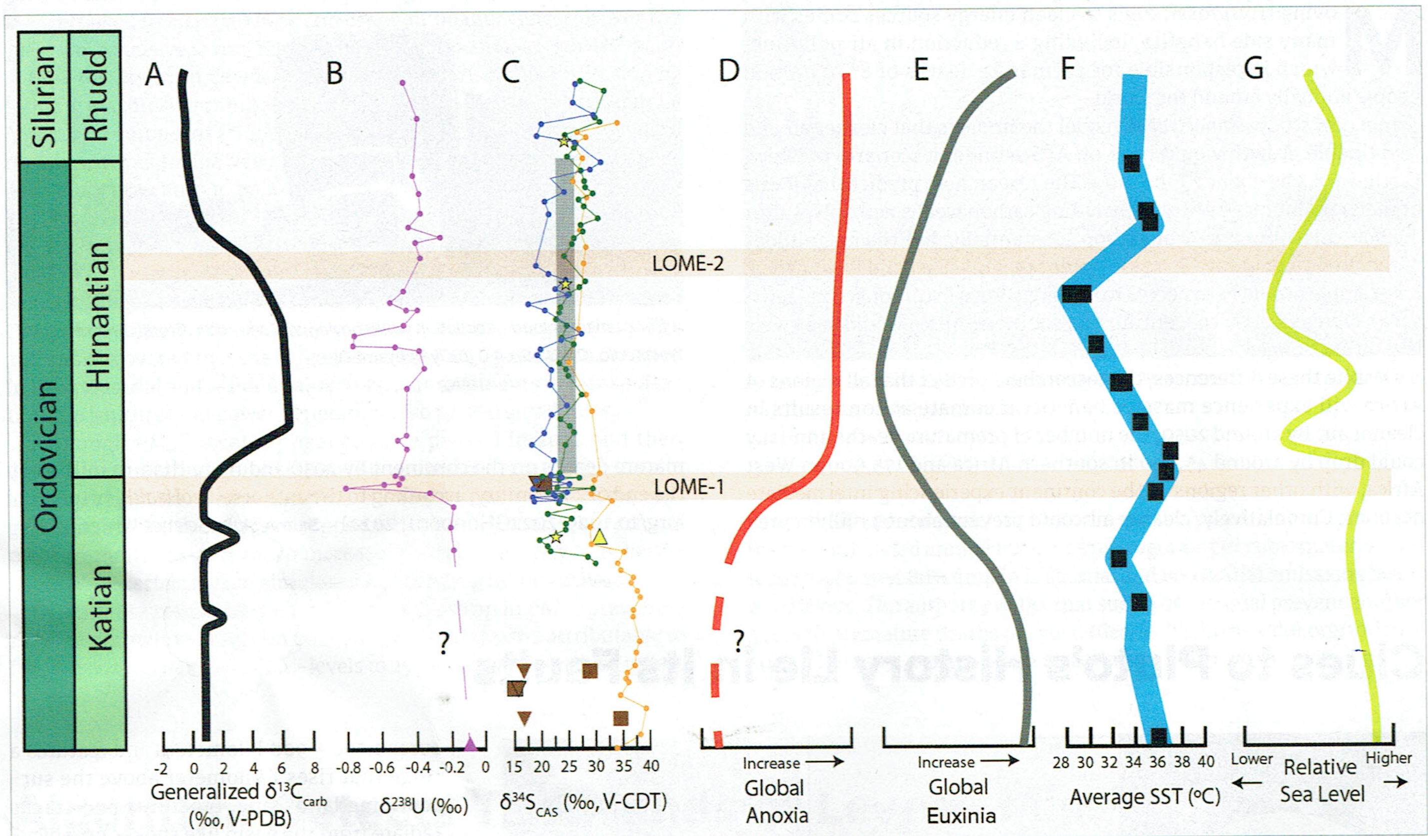
What Conditions Accompanied the Late Ordovician Mass Extinction?



Trends in geochemical and climate proxies seen in carbonates in this and previous studies—including (curve A) carbon isotopic ratios (δ13C) used with biostratigraphic markers to correlate records in time, (curve B) uranium isotopic ratios (δ238U) recording nonsulfidic anoxia, and (curve C) sulfur isotopic ratios (δ34S)—indicate Late Ordovician–early Silurian conditions and their relationship to two Late Ordovician mass extinction (LOME) pulses (horizontal bars). Generalized changes in the extent of (curve D) global marine anoxia and (curve E) euxinia are inferred from these proxies. The two rightmost curves show (F) inferred average sea surface temperatures (SST) and (G) eustatic sea level over this period. Credit: Kozik et al., with data from various sources

The second most severe mass extinction in Earth's history occurred in the Late Ordovician, specifically during the Hirnantian Age about 445 million years ago. At that time, 85% of marine species were eliminated in two pulses, comprising the only major mass extinction associated with icehouse conditions. However, the exact causes of the extinction, especially the potential role of marine oxygenation, remain uncertain. *Kozik et al.* present paired iodine concentrations and sulfur isotope data from three sites hosting Late Ordovician carbonate rocks to constrain both local and global marine oxygenation surrounding the extinction. Their results indicate that during the two extinction pulses, anoxia in local shelf environments (indicated by iodine-to-calcium ratios) persisted against a backdrop of waning and then waxing global euxinia—anoxia plus sulfidic water columns—as shown by variations in sulfur isotopic ratios ($\delta^{34}S$) in the carbonates. Using geochemical models, the researchers found that the mass extinction was strongly associated with expansions of nonsulfidic anoxia on shelves combined with glacioeustatic sea level change and climatic cooling. This study provides new details about paleoredox conditions in Late Ordovician oceans and places them into the context of coincident changes in climate, eustatic sea level, and the biosphere. (https://doi.org/10.1029/2021AV000563) **—Susan Trumbore**