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SEDIMENTOLOGY AND SEQUENCE STRATIGRAPHY OF THE VININI CREEK SECTION: KEY TO UNDERSTANDING THE LATE ORDOVICIAN GRAPTOLITE MASS EXTINCTION

The Late Ordovician mass extinction was the second greatest of the “Big Five” Phanerozoic mass extinctions, and it is the only one that can be directly linked to rapid climate change including glaciation and associated oceanographic changes. Graptolites, the dominate early Paleozoic zooplankton, suffered near complete extinction contemporaneous with a rapid glacio-eustatic sea-level fall. Several stratigraphic sections worldwide record the graptolite extinction, but a variety of factors limit the ability to investigate the extinction event at these sections. In contrast, the Vinini Creek section in the Roberts Mountains of north-central Nevada, representing a deep-water, continental rise depositional setting, provided a unique opportunity to acquire multiple,varied, integrated data sets because it is expanded, is complete through the extinction interval, includes a distinct sedimentological signal of sea-level change, is abundantly fossiliferous, experienced little post-depositional heating (CAI<1.5), and can be correlated with sections representing outer and inner continental shelf depositional setting. A detailed sedimentological/sequence stratigraphy study by John Cooper, combined with paleontological and geochemical investigations, demonstrated that the graptolite extinction was contemporaneous with the loss of habit in which graptolites flourished. That habit was the margins an extensive oxygen minimum zone that developed beneath surface waters with intense upwelling, high nutrient recycling, and high biological productivity. Changes in oceanic circulation resulting in the dramatic Late Ordovician glacio-eustatic sea-level fall also resulted in the loss of the oxygen minimum zone, possibly through loss of oceanic stratification. In the Vinini Creek section, these changes are represented by a shift from siliceous mudstone with high organic-carbon and high phosphate content and very high graptolite abundance and diversity to lime mudstone with minimal organic-carbon, moderate graptolite abundance, and extremely low graptolite diversity.