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A Cenozoic-Style Scenario for the End-Ordovician Glaciation

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The end-Ordovician (Hirnantian) was an enigmatic interval in the Phanerozoic, known for massive glaciation potentially at elevated CO_2 levels, biogeochemical cycle disruptions recorded as large isotope anomalies and a devastating extinction event. Such linkage of eustatic, biological and isotopic records to the climatically forced development of an ice sheet can only be contemplated within a framework of high-resolution sequence stratigraphy that integrates allo-, chemo- or biostratigraphic markers. We develop sequence stratigraphic correlations for two superbly exposed and exceptionally well-developed latest Ordovician successions, the Anti-Atlas of Morocco and Anticosti Island in Canada. Both offer sections, on a 100-km scale, from the basin edge to the axis of active sedimentary depocentres. Relative to the end-Ordovician ice-sheet centre (present-day north-central Africa), they provide a near-field (Anti-Atlas, siliciclastic platform) and a far-field (Anticosti Island, mixed carbonate and siliciclastic) stratigraphic records. These two successions, up to 300 and 100m thick, respectively, were deposited in basins with notable subsidence rates and significant (ca. 100 m) initial water depths, enabling the development of comprehensive archives of the latest Ordovician glaciation. This framework, driven by glacio-eustatic cycles tied to the evolution of polar continental-scale ice sheets over west Gondwana, enables the correlation of eustatic cycles at a level that is beyond the resolution capability of most absolute dating methods and of biozones, the latter typically of Myr duration. A proposed Cenozoic-style scenario including three main glacial cycles and higher-order phenomena necessitates the revision of the end-Ordovician, glaciation-related sequence of events.