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Upper Ordovician Astronomical Climate Forcing from the Vauréal Formation, Anticosti Island, East Canada

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The early Paleozoic paleotropical carbonate succession exposed on Anticosti Island in the Gulf of the St. Lawrence, Canada, is one of the most complete, thickest, most richly fossiliferous and diagenetically unaltered carbonate sections in the world across the Ordovician/Silurian boundary. Our cyclostratigraphic study focused on the Katian Vauréal Formation using data from continuously exposed coastal sections and complete stratigraphic drill cores. The high-resolution (dm-scale) proxy data include natural gamma ray profiles, pXRF measurements and bulk carbonate stable isotope values of oxygen (δ18O) and carbon (δ13C). Time-series analysis of the proxy series demonstrates meter-scale periodicities in lithological alternations (carbonate versus clay content), which are hypothesized to result from sea-level variations. Similar periodicity patterns can be seen in the stable isotope data. According to the available age constraints, the observed periodicities could be related to astronomical periods. The working hypothesis is that astronomical changes in insolation were driving sea-level variations by the waxing and waning of the Late Ordovician ice sheets. This hypothesis is also supported by a similar signal in the δ18O record. Our results demonstrate the potential for constructing a high-resolution ($\sim$10^4 yr) age model for the Vauréal Formation as well as for the younger units exposed on Anticosti Island. Such an astronomically based age model and corresponding climatic interpretations should shed more light on the dynamics of the Late Ordovician glaciations and the mass extinction event.