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Late Eocene stable isotope stratigraphy of North Atlantic IODP Site U1411: Orbitally paced climatic heartbeat at the close of the Eocene greenhouse

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Integrated Ocean Drilling Program (IODP) Expedition 342 drilled sediment drifts on the Newfoundland margin to recover high-resolution records of North Atlantic ocean-climate history and track the evolution of the modern climate system through the Late Cretaceous and Early Cenozoic. An early Paleogene deep-sea benthic stable isotope composite record from multiple Exp. 342 sites is currently in development and will provide a key reference section for investigations of Atlantic and global climate dynamics. This study presents initial results for the late Eocene slice of the composite from Site U1411, located at mid depth (∼2850m Eocene paleodepth) on the Southeast Newfoundland Ridge. Stable oxygen (δ^{18}O) and carbon (δ^{13}C) isotope ratios were measured on 640 samples hosting exceptionally well-preserved epifaunal benthic foraminifera obtained from the microfossil-rich uppermost Eocene clays at 4cm spacing. Sedimentation rates average 2-3 cm/kyr through the late Eocene, such that our sampling resolution is sufficient to capture the dominant Milankovitch frequencies. Late Eocene Site U1411 benthic δ^{18}O values (1.4 to 0.5‰ VPDB) are comparable to the Pacific and elsewhere in the Atlantic at similar depths; however, δ^{13}C is lower by ∼0.5 ‰ with values intermediate between those of the Southern Labrador Sea to the north (-1 to 0 ‰) and mid latitude/South Atlantic (0.5 to 1.5 ‰) to the south, suggesting poorly ventilated bottom waters in the late Eocene North Atlantic and limited production of North Atlantic deep water. Applying the initial shipboard magneto-biostratigraphic age framework, the Site U1411 benthic δ^{13}C and δ^{18}O records display clear cyclicity on orbital timescales. Spectral analysis of the raw unfiltered datasets identifies eccentricity (400 and 100 kyr), obliquity (40 kyr) and precession (∼20 kyr) signals imprinted on our time series, revealing distinct climatic heart beats in the late Eocene prior to the transition into the ‘ice house’.