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Fresh and warm Arctic Ocean Surface Waters during Eocene Thermal Maximum 2

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Eocene Thermal Maximum 2, at ∼53.5 Ma (further referred to as the Elmo phase), was a short-lived (∼50 kyr) episode of widespread deep-sea carbonate dissolution and warming. Documentation of the Elmo phase is limited, hampering evaluation of the global nature and pattern of global change. Here we present micropaleontological (dinoflagellate cyst), organic geochemical (TEX_{86}, BIT, stable carbon isotopes of bulk organics and n-alkanes) and inorganic geochemical (XRF) data from the Elmo section recovered from the Lomonosov Ridge, Arctic Ocean, during IODP Expedition 302 (ACEX). The stable carbon isotope record on total organic carbon (TOC) shows a ∼3.5 ‰ negative carbon isotope excursion at the onset of the Elmo, ∼1 – 1.5 ‰ smaller than that usually recorded in TOC for the PETM. Dinocyst assemblages show a freshening of Arctic Ocean surface waters. TEX_{86}-derived sea surface temperatures and MBT-derived atmospheric temperatures show a ∼3 ˚C rise starting from already warm conditions of ∼19 ˚C, reaching temperatures similar to those recorded for the PETM in the Arctic. Moreover, laminated sediments and the absence of organic foraminiferal linings suggest that anoxia developed at the sediment-water interface. Biomarker analyses also indicate euxinic conditions in the photic zone. All trends, including those recorded using XRF core scanning techniques, mimic those

observed during the PETM but generally exhibit a slightly smaller magnitude. Our findings, together with the scant published data, corroborate the notion that the Elmo was indeed a true global warming phase, associated with the rapid injection of light carbon.