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Shallow-water hydrothermal venting at the Paleocene-Eocene Thermal Maximum onset

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The Paleocene-Eocene Thermal Maximum (PETM) around 56 Ma was associated with 5-6 °C global warming, resulting from massive carbon release into the ocean–atmosphere system. One potential driver of hyperthermal conditions was the North Atlantic Igneous Province (NAIP), as both volcanic degassing and thermogenic volatile release during contact metamorphism during its emplacement were large potential emitters of carbon. Despite a broad temporal correlation between NAIP activity and the PETM, the exact relationship is obscured by multiple climate forcings, imprecise geochronological data, uncertainties in the timing and magnitude of volatile fluxes from volcanic and thermogenic sources, and limited availability from crucial NAIP localities that could constrain these unknowns. Here we present new seismic and borehole data for the Modgunn hydrothermal vent complex in the Northeast Atlantic (IODP Sites U1567-U1568). Stable carbon isotope stratigraphy and dinoflagellate cyst biostratigraphy reveal a negative carbon isotope excursion coincident with the appearance of *Apectodinium augustum* in the vent crater infill. Modern examples of submarine explosion craters suggest they have filled in within decades to centuries, so the preservation of the PETM onset within the Modgunn vent suggests an extremely close temporal correlation between the crate formation and the onset of hyperthermal conditions. Furthermore, the majority of the craters across the entire NAIP are likely to have vented in very shallow water, implying that the vast majority of emitted CO_2 and CH_4 gases directly entered the atmosphere during eruptions. These findings add considerable weight to the hypothesis that thermogenic degassing aided the initiation of the PETM.