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Shallow-water hydrothermal venting in the North Atlantic during the Paleocene Eocene Thermal Maximum

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The Paleocene Eocene Thermal Maximum (PETM, ~56 Ma) was a rapid global warming of 5-6 °C resulting from massive (>2000 Gigatons) carbon emissions. A potential release mechanism is thermogenic gas from contact metamorphism of carbon-bearing sediments due to magma intrusions into sedimentary basins. Here, we present seismic data and borehole information from the North Atlantic Igneous Province. They show that even in the center of the rift system, water depths were sufficiently shallow to allow most gas released from hydrothermal vent systems to bypass the water column. The shape of the vent craters and stratified infill suggest vigorous explosive gas release during the initial phase of vent formation and rapid shallow marine and largely undisturbed infill thereafter. The recorded negative carbon isotope excursion and occurrence of the index taxon *Apectodinium augustum* in the crater-infill support assignment to a latest Paleocene to earliest Eocene vent formation. The data support a scenario where magmatic sill emplacement and resulting hydrothermal activity rapidly injected thermogenic greenhouse gas into the atmosphere.

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