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Release of greenhouse gases in hydrothermal vent complexes causing global warming

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Hydrothermal vent complexes are pipe-like structures formed by explosive release of liquids and fluids during magmatic sill emplacement in sedimentary basins. We have recently completed an extensive seismic mapping of Paleocene/Eocene sills and hydrothermal vent complexes on the North East Atlantic margins. The extent of the mapped sill complex in the Vøring and Møre basins offshore mid-Norway is >80,000 km^2 with an estimated total volume of 0.9 to 2.5 x 10^4 km^3; and similar structures exist in the Faeroe Shetland Basin. We have further mapped 766 hydrothermal vent complexes connecting the sill intrusions with the paleosurface. Extrapolating between the seismic lines we estimate that just in the two basins of the mid-Norwegian margin at least 2-3000 vent complexes exist. New biostratigraphic dating reveals that most of the sill and vent complexes were formed at the Paleocene/Eocene boundary, almost coeval with the beginning of the initial Eocene thermal maximum (IETM). The magma emplacement caused heating of the surrounding sedimentary strata and production of greenhouse gases. These gases were released through hydrothermal vent complexes. We have calculated that the total methane production potential in metamorphic aureoles in Vøring and Møre basins is in the range of 0.3 to 3.3 x 10^{18} g CH_4 assuming that 0.5 to 2.0 wt. % organic carbon was converted to methane. The methane production potential in the entire NAVP is estimated to be about five times greater. The total volume of methane produced in metamorphic aureoles in NAVP is larger than the volumes required for explaining the IETM and the associated light carbon isotope excursion, provided the greenhouse gases were produced and released in a short time (10^4 years). Although the limited information from the Faeroe Shet-

land Basin suggest that not all the sills were emplaced synchronously, the bulk of the field and seismic data combined with melt modelling support that very voluminous sill complexes were intruded and solidified in a short time span (>1000 years) during the initial phase of volcanic activity. Similar large-volume intrusive complexes are also associated with other global warming and mass extinction events, e.g., the Siberian Traps and the Permian-Triassic boundary.