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TITLE: Hydrothermal impacts on trace element and isotope ocean biogeochemistry

AUTHOR: ['Christopher R. German', 'Karen L. Casciotti', 'Jean-Claude Dutay', 'Lars-Éric Heimbürger', 'William J. Jenkins', 'Christopher I. Measures', 'Rachel A. Mills', 'Hajime Obata', 'Reiner Schlitzer', 'Alessandro Tagliabue', 'David R. Turner', 'Hannah Whitby']

ABSTRACT:

Hydrothermal activity occurs in all ocean basins, releasing high concentrations of key trace elements and isotopes (TEIs) into the oceans. Importantly, the calculated rate of entrainment of the entire ocean volume through turbulently mixing buoyant hydrothermal plumes is so vigorous as to be comparable to that of deep-ocean thermohaline circulation. Consequently, biogeochemical processes active within deep-ocean hydrothermal plumes have long been known to have the potential to impact global-scale biogeochemical cycles. More recently, new results from GEOTRACES have revealed that plumes rich in dissolved Fe, an important micronutrient that is limiting to productivity in some areas, are widespread above mid-ocean ridges and extend out into the deep-ocean interior. While Fe is only one element among the full suite of TEIs of interest to GEOTRACES, these preliminary results are important because they illustrate how inputs from seafloor venting might impact the global biogeochemical budgets of many other TEIs. To determine the global impact of seafloor venting, however, requires two key questions to be addressed: (i) What processes are active close to vent sites that regulate the initial high-temperature hydrothermal fluxes for the full suite of TEIs that are dispersed through non-buoyant hydrothermal plumes? (ii) How do those processes vary, globally, in response to changing geologic settings at the seafloor and/or the geochemistry of the overlying ocean water? In this paper, we review key findings from recent work in this realm, highlight a series of key hypotheses arising from that research and propose a series of new GEOTRACES modelling, section and process studies that could be implemented, nationally and internationally, to address these issues.This article is part of the themed issue 'Biological and climatic impacts of ocean trace element chemistry'.

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