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New constraints on sources of carbon and mercury to environment from large igneous province volcanism

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Large Igneous Province (LIP) eruptions often coincide with severe environmental perturbations in the geological past, such as extinction and oceanic anoxic events. Significant carbon emissions are key to most of the causal cascades proposed to link these massive magmatic episodes to such global-scale changes, however it remains unclear whether magmatic carbon emissions alone are of sufficient scale to account for these fluxes and how the timing of their release might relate to the timescale of the province emplacement as a whole. Additional proposed sources of carbon include those released by the heating of the country-rock surrounding the immense igneous intrusions that typify LIP volcanism. However, constraining the evolving balance between these different carbon sources over the life cycle of a LIP remains challenging. The element mercury (Hg) leaves a fingerprint in the sedimentary record that can, in some cases, be related to episodes of LIP volcanism and used to explore their impacts on the contemporaneous environment and biosphere. Exploring the release characteristics of the Hg, in relation to those of carbon, has the potential to offer new insights into the emission processes and the contributions from different sources. Using data from natural aureole samples, experiments and new drill core material, this presentation will explore how Hg may be used in combination with other proxies in order to understand the different modes of LIP volatile emissions. Data associated with the North Atlantic Igneous Province (NAIP) and the Paleocene-Eocene Thermal Maximum (~56 million years ago) are of particular interest given the range of volcanic styles in operation during this event (submarine versus subaerial, intrusive versus extrusive, magmatic emissions versus thermogenic etc.), detailed work on contemporaneous carbon isotope records and modeling and new material collected from NAIP hydrothermal vent complexes (HTVCs). We will discuss the expression of emplacement style- and source-specific spatial and temporal patterns in sedimentary Hg as well as potential compositional changes of volatile emissions from LIP emplacement phases and, finally, how these characteristics may link to the wide-scale environmental perturbations observed in the geological record.