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## Voluminous crustal degassing and immiscible sulfide genesis caused by magma-shale interaction in Large Igneous Provinces

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Large Igneous Province (LIP) activity is hypothesized to impact global volatile cycles causing climate changes and environmental crises deleterious to the biosphere. Recent work suggests that the potential of LIPs to impact climate is magnified where they intrude organic-rich (i.e. shale-bearing) sedimentary basins. However, the chemical and degassing dynamics of magma-shale interaction are not well understood. Here we present the first experimental simulations of disequilibrium interaction between LIP magma and carbonaceous shale during upper crustal sill intrusions in the Canadian High Arctic LIP (HALIP), the latter of which were co-eval with oceanic anoxic event 1a. Experiments show that magma-shale interaction results in intense syn-magmatic degassing and simultaneous precipitation of sulfide droplets at the ablation interface. Magma-shale interaction on a basin-scale can thus generate substantial amounts of climate-active H-C-S volatiles, while the presence of strongly reducing volatiles may also increase the likelihood of magma to segregate a sulfide melt. These findings have fundamental consequences for our understanding of both large-scale Earth outgassing and metal prospectivity in sediment-hosted LIPs.