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Metals emissions at arc volcanoes

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Volcanoes emit copious quantities of gases (water, sulfur, carbon) that have shaped our atmosphere over geological time. Volcanoes also emit a range of other trace species, however, which are much less understood, including metals which play important roles in both atmospheric chemistry and in catalyzing microbial activity, and provide constraints on metal partitioning between fluids and melts in arc crust where much of Earth's ore deposits are found. Metal emissions at arcs are both elevated compared to other tectonic settings, and have a distinct compositional fingerprint. The fluxes of some metal species are more than an order of magnitude greater than in ocean island settings. The controls on the flux and composition of the metals in arc gases are poorly understood but probably controlled, on an arc scale, by an interplay between sulfide saturation, vapor saturation and variability in oxidation state, set by the subducting slab. New findings from analyses of melt inclusions from three arc volcanoes (Etna and Stromboli, Italy; and Villarrica, Chile) and recent fieldwork at Villarrica (quantifying metals in the aerosol phase for comparison with melt inclusions) aim to shed new light on these problems through an improved understanding of how metals partition between sulfide, melt and vapor phases.