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# The roles of degassing and mixing on volatile-trace element systematics: Implications for global carbon budgets

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Elemental volatility poses problems for quantification of solid-Earth geochemical cycles. Elements such as C, S and H, readily degas from oversaturated magmas at crustal pressures, causing most erupted material to be depleted in volatile elements. Melt inclusions trapped at depth within the crust may offer the best chance of preserving the original volatile characteristics of the melts.

In order to constrain the extent or absence of degassing, volatile elements are often compared to concentrations of the lithophile trace elements. Positive correlations between volatile elements and trace elements in suites of melt inclusions are often taken to mean the elements are behaving identically, i.e. volatile elements have not degassed.

Melt inclusions from three locations along the mid-ocean ridge system (Siqueiros, Equatorial Atlantic and Iceland) appear to have been trapped prior to $CO_2$ degassing. Despite all three eruptions sampling depleted mantle, they record diverse $CO_2$/Ba. Though this observation can be explained a number of ways, we argue that the process of melt mixing can give rise to such variations, even when melts are generated from mantle of uniform composition.

We use simple statistical mixing models to explore how volatiles may behave during mixing and melt evolution. Our results allow us to develop stronger criteria for identifying datasets where degassing has taken place. In addition we outline a new technique for placing constraints on mantle volatile contents from partially degassed datasets, and apply this to new and existing datasets.