Source heterogeneities deduced from spatial and temporal geochemical patterns in continental basalts

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Deciphering the mantle source(s) of basaltic magmas erupted in continental settings is challenging due to the potential geochemical and isotopic overprints imparted by continental lithosphere. In addition, both lithospheric and sub-lithospheric mantle reservoirs are variously implicated in continental basalt generation. As a result, intracontinental locations with extensive exposures of time-transgressive basalt flows can be extremely important for unraveling the relative contributions of these reservoirs.

In this context, we describe the spatial, temporal, chemical, and isotopic characteristics of basaltic volcanism on the Owyhee Plateau, USA. The Owyhee Plateau (OP) lies at the intersection of the Snake River Plain-Yellowstone and Oregon High Lava Plains magmatic trends; a region affected by the initial upwelling of the Yellowstone hotspot ~17 million years ago. It is the only location in the Pacific Northwest directly affected by Yellowstone-hotspot related volcanism that also contains a continuous record of basaltic volcanism over the past ~17 Ma [1]. OP basalt compositions include primitive to fractionated tholeiitic and mildly alkaline varieties with incompatible trace element and Sr, Nd, and Pb isotope ratios that are decoupled from the bulk chemistries, and that are time dependent [1,2].

The OP basalt suite reveals how mantle sources of intracontinental mafic magmas can vary as a function of time and lithospheric structure in a geographically restricted location. In this region, the heterogeneous mantle sources result from location along a distinct continental lithosphere transition, a major episode of sublithospheric mantle upwelling, and prolonged regional subduction leading to geochemical modifications of the lithosphere-asthenosphere boundary region that influence the nature of subsequent magmatism. Recent geophysical and geodynamic modeling results support these geochemical-based interpretations [3].

[1] Shoemaker & Hart (2002) *Idaho Geol. Surv. Bull.* **30**, 313-328. [2] Hart (1985) *Geochim. Cosmochim. Acta* **49**, 131-144. [3] Long *et al* (2012) *Geochem. Geophys. Geosys.* **13**, doi: 10.1029/2012GC004189.

Melt injections and metasomatism in the continental mantle lithosphere beneath southern Africa

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A wide spectrum of melt-related phenomena have been identified in mantle xenoliths and xenocrysts from southern African xenoliths. At one end of this spectrum are the megacrysts of the Cr-poor megacryst suite, which appear to be direct crystallisation products from a melt body. At the other end of the spectrum are peridotite xenoliths with no megascopic signs of melt injection, but showing trace element evidence of metasomatism by melt percolation. In between these extremes are xenoliths showing apparently intrusive sheets and injected veins, as seen in the MARID suite of the Kimberley area (South Africa) and the IRPS suite of Matsoku (Lesotho). Evidence of melt intrusion, disruption and metasomatism is also shown by the polymict peridotite suite.

Close major-minor element compositional links exist between megacryst suite minerals, some Fe-Ti-rich high-temperature deformed xenoliths, and the metasomatised peridotite host rocks to intrusive IRPS-rich sheets. The major-minor element compositions of minerals in the Matsoku IRPS suite show close similarities to the matrix minerals of polymict peridotites. Estimates of the trace element compositions of melts percolating through Jagersfontein peridotite xenoliths evolve from compositions close to those estimated for megacryst magmas to those estimated for kimberlites. It appears that many phenomena show evidence of a lineage going back to similar Cr-poor megacryst magmas interacting over thicknesses of ca 100km with a diverse mantle lithosphere.

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