

Platinum group element geochemistry of large igneous provinces

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The platinum group element geochemistry of basaltic magmas from large igneous provinces (LIPs) can be used to help evaluate source components and melting/differentiation histories of LIP magmatism, to place empirical constraints on element partitioning, and to test for sulfide liquid segregation and mineralization potential. To this end, a global PGE database (Ir, Ru, Rh, Pt, Pd + Au) for LIPs, consisting of ~400 samples (MgO = 4-27 wt%), has been compiled. LIPs represented are: Siberia (Noril'sk), Emeishan, Ontong Java, Kerguelen, Deccan, North Atlantic (Greenland/Iceland), and Hawaii, with comparative reference values for MORB included. New results are also available for 78 samples of the Triassic Wrangellia LIP, an accreted oceanic plateau exposed over 2300 km in the Pacific Northwest of North America (Vancouver Island, Yukon, Alaska).

For sulfide-undersaturated, high-MgO ($\text{TiO}_2 < 1.5$ wt%) basalts and picrites derived by high extents of melting (>20%), Pd/Pt is relatively constant at 0.5-1.5 (Pd = 2-12 ppb; Pt = 3-10 ppb) and the absolute variations in [Pt] and [Pd] between different LIPs appear to be strongly controlled by concentration differences in the peridotite source. In sulfide-undersaturated, high- TiO_2 (>1.5 wt%) tholeiitic basalts, Pd/Pt increases sharply (2-13; Pd = 10-25 ppb; Pt = 2-6 ppb) in volcanic rocks with MgO < 8 wt% (e.g. Wrangellia, Deccan, East Greenland), which is consistent with Pt compatibility in clinopyroxene during fractionation of gabbroic cumulates. Ir and Ru are positively correlated with MgO in the dataset and are likely hosted within spinel inclusions in olivine phenocrysts. Estimated magmatic S contents are 800-1200 ppm in the low Pd/Pt, high-MgO basalts and 1300-2000 ppm in the fractionated, high Pd/Pt, high-Ti tholeiitic basalts; LIP-related basaltic magmas are closest to saturation in a sulfide melt at relatively low MgO contents of ~7-8 wt%.

Finally, because average oceanic crust is characterized by extremely low PGE abundances (ppt levels for Pd and Pt), the PGE systematics of LIPs appear to limit the role of a eclogitic source component (recycled oceanic crust) in their genesis.

Neodymium isotopic reconstruction of past North Atlantic surface and deep water compositions

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Comparing isotopic measurements of oceanic substrates that preserve deep (e.g. authigenic Fe-Mn oxides) or surface water (e.g. sedimentary planktonic foraminifera) Nd isotopic signatures offers the potential for reconstruction of past water mass interactions [1, 2]. A difficulty inherent in measuring both substrates from the same sample is extraction of Nd while avoiding admixture. North Atlantic sediments present the additional hurdle of ubiquitous, easily leached volcanogenic material; such material has presented analytical difficulties where previously encountered [3]. Through a series of novel cleaning and dissolution protocols isotopically distinct surface and deep water Nd isotope compositions were isolated from North Atlantic sediment samples.

Initial data indicate that sedimentary planktonic foraminifera and authigenic Fe-Mn oxides preserve isotopically distinct Nd: e.g. Eirik Drift surface ocean ϵ_{Nd} is 2.5 ± 0.4 ϵ_{Nd} units more positive than bottom waters; Gardar Drift surface ocean ϵ_{Nd} is 1.5 ± 0.3 ϵ_{Nd} units more negative than bottom waters. These data clearly illustrate the feasibility of this approach. Methods which cannot fully separate the Nd from authigenic Fe-Mn oxides and surface ocean carbonates (i.e. sedimentary planktonic foraminifera) most likely combine signals from the surface and deep water.

- [1] Piotrowski, A.M. *et al.* (2004) *Earth Planet. Sci. Lett.* **225**, 205-220, doi,10.1016/j.epsl.2004.06.002. [2] Scrivner, A.E. *et al.* (2004) *Geology* **32**, 565-568, doi,10.1130/G20419.1. [3] Vance, D. *et al.* (2004) *Paleoceanography* **19**, PA2009, doi,10.1029/2003PA000957