CONTAMINATION, MELTING AND SULPHIDE MINERALISATION IN THE BASAL RIVER VALLEY COMPLEX, CANADA

PREVEC[1*], STEPHEN A. AND VILJOEN[1], GREG

[1]Dept of Geology, Rhodes University, P.O. Box 94, Grahamstown, South Africa, 6140, s.prevec@ru.ac.za*

The River Valley Complex (RVC) is a Palaeoproterozoic mafic intrusion lying astride the ca. 1.0 Ga Grenville Front Tectonic Zone (GFTZ). The Complex is the easternmost member of a regionally extensive pod of mafic intrusions, with contemporaneous volcanics and dykes which comprise the Huronian magmatic suite. The RVC is the first member of this suite to show ore-grade prospects for PGE-sulphide mineralisation, as well as the sole instance of ultramafic cumulus rocks. The ores are associated with the Marginal Zone, which is transected by a cross-cutting near-basal unit (the awkwardly named "Inclusion/Autolith-bearing zone") which hosts both autolithic and (more rarely) exotic xenolithic blocks, and has been interpreted [1], on the basis of PGE and HFSE geochemistry, as the product of a late, chemically-boninitic melt, distinct from any other yet reported in this magmatic suite. A xenolithic fragment found in the South Zone of the Dana Lake showing, displaying apparent cumulus layering (only otherwise found higher in the lithostratigraphic sequence), a partial mantle of leucocratic selvage, and sulphide mineralisation, was sampled.

The xenolith is characterised by major and trace element geochemistry comparable to that of a granitoid (e.g., SiO_2 ranging from around 56 wt.% up to nearly 80 wt.%), and features quartz and alkali feldspar prominently. Conversely, the host rock is olivine normative, shows relict cumulus textures, and has REE and other HFSE abundances about an order of magnitude lower than those in the xenolith. Sm-Nd isotopic compositions show a range between $\varepsilon_{Nd}^{2.45}$ of around -1 to -2.3, typical of relatively uncontaminated Palaeoproterozoic mafic rocks regionally. However, the matrix values range between +3.2 and 0, representing the first direct evidence for depleted mantle in the Canadian Palaeoproterozoic. The sulphide mineralogy (po-cpy-py-pn ± sp) varies in mode across the traverse, with fracture-hosted cp-pn dominant in the xenolith, and po-pn-cp in the host rock. Normalised PGE profiles show a PPGE-enriched pattern typical of magmatic sulphide-controlled PGE in both the host rock- and xenolith-hosted sulphides, with the added feature of a negative Ru anomaly. A model involving infiltration metasomatism of fluid-rich crustal (footwall) melt is tentatively proposed to facilitate sulphide liquid precipitation and incorporation.

[1] Jobin-Bevans, L.S. (2004) Platinum-group element mineralisation in Nipissing Gabbro intrusions and the River Valley Intrusion; unpublished Ph.D. thesis, University of Western Ontario, London, Ontario, Canada. 457 pp.

Geochemical Mapping of Mantle Flow between Samoa and the Lau Basin

ALLISON A. PRICE[1*], MATTHEW G. JACKSON[1], PAUL S. HALL[1], JOHN M. SINTON[2], MARK D. KURZ[3]

[1] Boston University, Dept. of Earth Sciences, Boston, MA, 02115 (Price@bu.edu)

[2] University of Hawai'i at Manoa, Dept. of Geology and Geophysics, Honalulu, HI, 96822

[3]Woods Hole Oceanographic Institution, Dept. of Marine Chemistry, Woods Hole, MA, 02543

The juxtaposition of the Samoan plume and the Tonga Trench provides a unique setting for the study of upper mantle flow. The Samoan plume is located only 200 km east of the northern terminus of the Tonga trench. North of the terminus, the Pacific plate "tears," and the resulting tear creates a slab "window" allowing Samoan mantle to flow southward beneath the Vitiaz lineament--which separates the Pacific from the Lau Basin--and into the shallow mantle of the Northern Lau Basin. The presence of high $^3He/^4He$ (up to 28 times atmospheric (R_A)) and latitudinal gradients in trace element and isotopic (Sr-Nd-Pb) enrichment in the N. Lau Basin have been attributed to the southward flow of mantle material from the nearby Samoan hotspot through the slab window. High $^3He/^4He$ ratios (up to 28.1 R_A) have been reported in a swath within the northern Lau Basin but drop rapidly to both the South (~400km south of Peggy ridge) and East (Lupton, 2009.) However, $^3He/^4He$ ratios have not been reported in the region to the West or North of the region of the infiltrating plume, so the geochemical "map" of Samoan plume material in the Lau Basin is incomplete.

We present He, Pb, Sr, and Nd isotopic analyses as well as trace element analyses for glasses in the region just to the west of the location where the highest $^3He/^4He$ ratios were reported. The samples, which span the North Lau and North Fiji Basins, as well as submarine samples from Wallis Island, located just north of the Lau Basin, have $^3He/^4He$ ratios that vary between 6 and 15 R_A. The highest of the new $^3He/^4He$ occur in submarine lavas from Wallis Island, located between the northernmost portion of the Rochambeau Ridge (28.1 R_A) and the Samoan hotspot (up to 35 R_A.) The new data indicate that the Samoan-plume high $^3He/^4He$ mantle does not spread to the west in the Lau Basin, but is confined to a narrow corridor in the Northern Lau Basin that extends from Samoa, through Wallis and into a narrow region of the N. Lau Basin. However, Sr, Nd and Pb isotopic evidence are consistent with low 3He/4He Samoan plume material "leaking" into the N. Fiji basin as far west as Pandora Ridge. This observation places important constraints on changing mantle flow due to the evolving geometry of plume-trench juxtaposition.