Radiogenic isotope and precious metal compositions of orangeite dykes intersecting the Bushveld Complex

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The Western Limb of the Bushveld Complex hosts a recently documented swarm of orangeite dykes [1] that are significantly younger (177-132 Ma; [2]) than the c. 2.06 Ga Bushveld lithologies they intrude. Orangeite dykes are thought to form from very low-degree partial melting deep within the lithosphere. In this ongoing study, we marry geochemistry, bulk platinum-group element (PGE) and Au analysis, detailed mineralogical investigations, and radiogenic isotopic geochemistry (Sr, Nd and Hf compositions) of South African orangeite, lamprophyre, and kimberlite dykes from the last 2-3 Ga.

The dykes vary in compositions and textures. Olivine macrocrysts (2–10 mm) are variably serpentinised, and phlogopite forms euhedral (micro)phenocryst laths (generally < 1mm, but up to 10 mm) as well as a main groundmass constituent. The Al_2O_3, TiO_2 and FeO concentrations of phlogopite (micro)phenocrysts are largely consistent with the global orangeite variability.

The dykes have whole-rock Mg# between 64 and 88 atomic percent, which is within the range of regional ultramafic lamprophyres and orangeites. They have bulk PGE contents of 1.1 – 8.3 ppb but vary in IPGE:PPGE (e.g. (Pd/Ir)N values of 0.7 – 27.9, mean = 8.1), and Pt/Pd (0.8 to 3.1, mean = 1.8) suggesting that they may have formed in an inhomogeneous, variably enriched lithospheric mantle source.

In this contribution we present the first radiogenic isotopic data of these newly documented dykes in conjunction with geochronology and geochemistry.

[1] Hughes, H.S.R. et al. 2016. Applied Earth Science **125(2)**, 85-86. [2] Hughes, H.S.R. et al. (in prep). A major swarm of orangeite dykes exposed in platinum mines across the Western Bushveld Complex, South Africa.