Controls on komatiite PGE abundances: Evidence from the ~1.9 Ga Winnipegosis Komatiite

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Due to their extremely chalcophile nature, PGEs in high degree melts are thought to be dominantly controlled by interactions with sulphide liquids. Melting beyond sulphide exhaustion in the mantle source produces melts with orders of magnitude higher PGE concentrations than melts produced in equilibrium with residual sulphide. Sulphide control models have successfully reproduced the PGE systematics of Archaean komatiites and modern MORB[1], but are yet to be rigourously tested for igneous rocks produced at intermediate melt fractions between basalts and Archaean komatiites.

We present PGE data and detailed modelling from the ~1.9 Ga Winnipegosis Komatiite, which formed at liquidus temperatures ~100 °C lower than its hottest Archaean counterparts, and at a correspondingly lower degree of melting[2]. PGE variability in these rocks can be explained by low pressure fractionation of the primary igneous phases olivine, chromite, Os-Ir rich nugget phases, and a Ru rich phase such as laurite, $(Ru,Os,Ir)S_2$. Correcting for these fractionations, Winnipegosis Komatiite parental melts contained 7.0 ± 0.8 ppb Pt and 7.2 ± 0.7 ppb Pd.

Sulphide control models predict that after sulphide exhasution, Pt and Pd should behave incompatibly, and be progressively diluted at higher extents of melting. In contrast, Winnipegosis Komatiite parental melts contain lower PPGE concentrations than typical Neoarchaean komatiites[3]. These low PPGE concentrations cannot be explained by differences in source composition. Instead, we suggest that Pt and Pd behave moderately compatibly following sulphide exhaustion at high pressure, and that the residual silicate assemblage exerts an important control on the PGE systematics of high degree melts. This may have important implications for the use of komatiites as a probe of mantle PGE chemistry through time.

[1] Mungall and Brenan (2014) *GCA* **125**, 265 – 289.
[2] Waterton et al (2017) *Lithos* **268–271**, 114–130.
[3] Maier *et al*. (2009) *Nature* **460**, 620 – 623.