HSE and $^{187}Os/^{188}Os$ isotopic systematics in mantle wedge peridotite xenoliths from the Canadian Cordillera

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The Highly Siderophile Elements (HSE: Os, Ir, Ru, Pt, Pd, Re, Au) and $^{187}Os/^{188}Os$ ratios are considered powerful tracers of Earth's accretion history and metal-silicate differentiation. They also provide key insights into the complex petrological history (partial melting, melt and/or fluid percolation) experienced by the mantle peridotites, insights complementary to those offered by the lithophile element geochemistry. Most existing studies have focused on the HSE and $^{187}Os/^{188}Os$ systematics of Archean cratonic peridotite xenoliths, post-Archean peridotite massifs (e.g., orogenic) and peridotite xenoliths associated with intraplate volcanism. Peridotite xenoliths associated with arc volcanism have been largely ignored.

12 mantle wedge peridotite xenoliths from the Canadian Cordillera investigated here reveal a huge range of whole-rock HSE concentrations and fractionations. All the lherzolites and the Alligator Lake (AL) harzburgites show either CI-chondrite normalized HSE patterns similar to the primitive upper mantle (PUM) or similar to those known in intraplate peridotite xenoliths characterised by depletions (0.02-0.8 x PUM) in all HSE that become stronger for the incompatible Pd and Re. The Llangorse (XLG) harzburgites display unique signatures characterised by extreme depletions in all HSE (as low as 0.001 x PUM) combined with positive Ru and Re anomalies (e.g., Ru_N/Ir_N=8.3-15.6). Additionally, all these mantle wedge peridotites, except the XLG lherzolites, show sub-chondritic Os_N/Ir_N-ratios (0.2-0.9). $^{187}Os/^{188}Os$ ratios vary from 0.1152 to 0.1339, clustering mainly between 0.1203 to 0.1293, and do not covary with HSE systematics.

The HSE and $^{187}Os/^{188}Os$ systematics of the AL lherzolites and harzburgites and the XLG lherzolites suggest that these mantle wedge peridotites experienced melt-rock reactions at both low and high melt/rock ratios, while the HSE signatures of the XLG harzburgites may reflect processes mainly associated with subduction zones such as fluid overprinting or destabilisation of sulfides into sulfates.