

AGU Abstract – Spring 2004 (Montreal)

Early Archean Osmium in Chromitites from the Beartooth Range, Montana

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Metamorphosed chromitites from the Hellroaring Plateau (Beartooth Mountains, Montana, USA) were analyzed for osmium isotopes and Re and Os contents. The chromitites are exposed at the surface in pit mines above Quad Creek. Euhedral spinels (Mg# 43-44, Cr# 74-76) are set in a matrix of phlogopite and talc. Chromites are free of ferritchromite rims and have only minor exsolution lamellae. Samples were dissolved in carius tubes using aqua regia and analyzed using MC-NTIMS (Os) and MC-ICPMS (Re). Zircons from the Hellroaring Plateau give average Lu-Hf ages of 3.5 Ga (Stevenson and Patchett, 1990). Quartzites (3.1-2.7 Ga depositional age) from this area contain detrital zircons with U-Pb ages up to 4.0 Ga. The main zircon population dates a major crust-forming event at 3.2-3.4 Ga (Mueller et al. 1998). The Main Beartooth Massif area has seen several generations of amphibolite- to granulite-facies metamorphism before the area was uplift during the Laramide orogeny. Sample QC81-19 contains 43 ppb Os with a $^{187}\text{Os}/^{188}\text{Os}$ of 0.1048 (± 0.0001 , 2sigma). Low Re/Os makes correction for ^{187}Os production since the Archean minimal. Assuming an igneous age of 3.2 Ga, the sample formed with an initial $^{187}\text{Os}/^{188}\text{Os}$ of 0.1046, close to the chondritic Re/Os evolution line. A sample aggressively acid leached with still contained considerable osmium of nearly the same $^{187}\text{Os}/^{188}\text{Os}$ as the unleached sample. This suggests that the Os is not hosted by grain boundary sulfides, and that fluid influx and recrystallization was not accompanied by either Re or Os mobility. The present-day $^{187}\text{Os}/^{188}\text{Os}$ of this sample (0.1048) is one of the least radiogenic bulk sample Os ratios reported to date, slightly more radiogenic than the ratios reported (0.1026) for the 3.8 Ga peridotites of SW Greenland (Bennett et al., 2002). Both suggest the upper mantle source had a chondritic Re/Os in the early Archean. Mantle xenoliths from the Highwood mountains on the northern margin of the Wyoming Craton give minimum model ages of 2.9 Ga (Carlson and Irving, 1994), suggesting that this crust is associated with early Archean mantle lithosphere.

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