Evidence for Os isotopic homogeneity in the solar nebula from CV-CK carbonaceous chondrites. S. Goderis[1,2,3], A. D. Brandon[3], B. Mayer[4] and M. Humayun[4], [1]Earth System Science, Vrije Universiteit Brussel, B-1050 Brussels, Belgium, [2]Dept. of Analytical Chemistry, Ghent University, B-9000, Ghent, Belgium, [3]Dept of Earth and Atmospheric Sciences, University of Houston, Houston, TX 77204, USA, [4]National High Magnetic Field Laboratory and Dept. of Earth, Ocean & Atmospheric Science, Florida State University, Tallahassee, FL 32310, USA.

Introduction:

Deficits in Os nuclide abundances with large contributions from the s-process (^{186}Os, ^{188}Os, ^{190}Os) relative to those dominated by r-process were first identified in chondrites of lower metamorphic grades [1]. These isotopic anomalies were interpreted as the result of variable amounts of acid-resistant presolar grains composed of diamond, graphite, or most likely SiC [1-4]. To further examine the variation of time-integrated Pt/Os and Re/Os in bulk chondrites and asteroidal achondrites [1,5-9], twelve CV-CK clan carbonaceous chondrites across a range of metamorphic grades (CV3/CK3-CK6) were characterized for their high-precision Os isotopic compositions and corresponding highly siderophile element (HSE) contents.

Results and discussion:

CK4-6 chondrites are the only carbonaceous chondrites that have seen significant aqueous alteration and thermal metamorphism (petrologic grades > 3.5) under strongly oxidizing conditions. This has resulted in fairly fractionated HSE patterns with increasing depletion of the more volatile elements but also Re, resulting in extremely low Re/Os and often in HSE ratios deviating from average chondrite (e.g., Pt/Os varies from 1.2-2.1). This demonstrates the need to determine precise Pt/Os ratios via isotope dilution on the sample aliquots analyzed for high precision Os isotope ratios. Terrestrial weathering also appears to have played a significant role in the case of particular samples (e.g., NWA 1559 and Y 82191). No refractory presolar grains enriched in s-process Os (e.g., SiC) appear to have survived in any of the CK4-6 samples analyzed during this analytical campaign at the U of H. None of the CK samples analyzed show resolvable nucleosynthetic anomalies, confirming the importance of parent body processes in this context [10]. The μ186i (H-type OC-normalized ^{186}Os/^{189}Os ratios corrected to the initial at 4.567 Ga using measured Pt/Os for each sample) for nine CK4-6 carbonaceous chondrites is equal to -13±31 (±2 s.d.), not resolvable from equilibrated enstatite [7] and ordinary chondrites [e.g., 1-5] or from the solar system initial. The widespread absence of anomalies in non-primitive meteorites with a history of metamorphism and thermal processing, together with the observed isotopic anomalies of similar magnitude in low-grade unequilibrated meteorites from all studied chondrite clans [1-7], confirms similar proportions of s- to r-process Os nucleosynthetic components for all major chondrite group feeding zones.

References:

[1] Brandon et al. (2005) *Science* 309, 1233-1236. [2] Yokoyama et al. (2007) *EPSL* 259, 567-580. [3] Reisberg et al. (2009) *EPSL* 277, 334-344. [4] Yokoyama et al. (2010) *EPSL* 291, 48-59. [5] Brandon et al. (2006) *GCA* 70, 2093-2103. [6] Humayun and Brandon (2007) *Astrophys J* 644, L59-L62. [7] van Acken et al. (2011) *GCA* 75, 4020-4036. [8] van Acken et al. (2012) *MAPS* 47, 1606-1623. [9] Wittig et al. (2013) *EPSL* 361, 152-161. [10] Yokoyama et al. (2011) *EPSL* 305, 115-123.