THE IIIAB –PALLASITE RELATIONSHIP REVISITED: THE OXYGEN ISOTOPE PERSPECTIVE

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Introduction: The relationship between the IIIAB iron meteorites and the main group pallasites (MGPs) has been debated for many years. The metal composition of the MGPs is consistent with originating from IIIAB metal after 80% fractional crystallisation [1]. On the other hand differing cooling rates argue for separate parent bodies [2]. Previous O-isotope analyses of oxygen containing inclusions in IIIABs indicate a potential relationship with the silicates in MGPs [3], albeit in a crowded portion of the O-isotope diagram. However, Wasson and Choi [1] argued that there remained a significant difference in the O-isotope signatures.

Samples and Methods: We have measured the O-isotope composition of chromites from 5 different IIIAB irons (17 analyses) using high precision laser fluorination to better constrain the O-isotopic signature of the IIIABs. Chromites are notoriously difficult to analyse [e.g. 4], and therefore we used a more focused laser at higher power than normal to improve yield and isotopic reproducibility. Tests with terrestrial standards showed yields approaching 100% and analytical precision comparable to that for silicates [5]. While some of the meteorite chromites displayed greater variability in $\delta^{18}O$ than expected, O yields approached expected values and generally lacked systematic correlation with $\delta^{18}O$. Therefore, some of the variation may be intrinisic to the samples. In any case, such effects would be mass dependent and therefore not affect $\Delta^{17}O$.

Results and Discussion: Four of the 5 IIIABs analysed display a very restricted range in linearized $\Delta^{17}O$ with a mean value of -0.18‰, and a 2σ scatter of ±0.02‰ that is similar to the variation observed from bodies believed to have experieinced extensive homogenisation. Most $\delta^{18}O$ values ranged from -1.3 to -3.8‰. The mean $\Delta^{17}O$ value of these four IIIABs is identical to that of the MGPs (-0.18 ± 0.02) [6], arguing strongly for a common origin for the IIIABs and the MGPs. The fifth sample analysed, Cape York, has a $\Delta^{17}O$ value of -0.27‰. As Cape York appears to be a typical IIIAB it may be that multiple sources of chromites exist in the IIIAB parent body (e.g. those precipitated directly from solid metal and those found in troilite nodules). Alternatively, the IIIAB parent body had a more complex structure than previously considered, or even that Cape York originated from a distinct parent body. Further analyses are planned to explore the variation in the IIIABs to resolve this anomaly.

References: [1] Wasson J. T. and Choi B.–G. (2003) *Geochimica et Cosmochimica Acta* 67:3079-3096. [2] Yang J. et al. (2012) *Geochimica et Cosmochimica Acta* 74:4471-4492. [3] Clayton R. N. and Mayeda T. K. (1996) *Geochimica et Cosmochimica Acta* 60:1999-2017. [4] Heck P. R. et al. (2010) *Geochimica et Cosmochimica Acta* 74:497-509. [5] Miller M. F. et al. (1999) *Rapid Communications in Mass Spectrometry* 13:1211-1217. [6] Greenwood R. C. et al. (2006) *Science* 313:1763-1765