LOW GERMANIUM ISOTOPIC COMPOSITION OF IIG IRON METORITES : RELATIONSHIP WITH IIAB IRONS AND INFLUENCE OF SULFUR AND PHOSPHORUS.

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Introduction: The newly identified IIG group of magmatic iron meteorites is defined by 5 members which have the lowest Ni contents (4.1-4.6‰) of any iron meteorites [1]. On several compositional diagrams they plot near an extrapolation of trends in the magmatic IIAB irons. The IIG irons have very high P and very low S contents, and Wasson and Choe [1] proposed that liquid immiscibility had occurred in the IIAB core and that the IIG irons formed in the P-rich lower layer. The Ge isotopic composition of the (high-Au, low-Ir) IIB irons are well constrained ($\delta^{74}Ge_{NIST3120a}$ =+0.94±0.14‰, 2σ); curiously, those for IIA irons are appreciably higher ($\delta^{74}Ge_{NIST3120a}$ = +1.40±0.18‰, 2σ) [2,3]. We therefore selected a set of IIB and IIG irons to test the isotopic relationships between these two groups.

We also investigated additional questions regarding the extent of Ge isotopic fractionation between metal and phosphide phase (schreibersite $(FeNi)_3P$), which occur as irregular coarse inclusions in these irons.

Samples and methods: Selected iron meteorites with large troilite and/or schreibersite inclusions, such as Santa Luzia (IIB), Twannberg (IIG) and Tombigbee River (IIG) have been studied for their Ge contents and Ge isotopic compositions. Metal was cut into mm-size pieces using a diamond-coated wire saw, and schreibersite was extracted using a Micromill device. These fractions were chemically processed, and Ge contents and isotopic compositions measured using the Neptune*Plus* MC-ICPMS (CRPG-Nancy) relative to NIST3120a Ge standard, and with a 2σ SD better than 0.26‰ [2,3].

Results - Discussion: These new Ge isotopic data show δ^{74}Ge values in IIG metal (δ^{74}Ge = +0.93±0.15‰) that are essentially the same as those in IIB metal (δ^{74}Ge = +0.97±0.16‰). These support the view that the IIG irons were formed in the IIAB parent core.

Schreibersite has very low Ge contents and strongly δ^{74}Ge negative values, from 0.6-0.9 ppm Ge and δ^{74}Ge values of -1.59, -2.47‰ in Santa Luzia, to 1.3 ppm Ge and δ^{74}Ge = -3.4‰ in Tombigbee River. We can calculate a partition coefficient $D\ Ge_{\text{metal-schreibersite}}$ ranging from 52 to 137, and a Ge fractionation factor $(\Delta^{74}Ge)_{\text{metal-schreibersite}}$ from 2.62 to 4.28, i.e., a very low degree of Ge partitioning in the phosphide phase, with a preferential partitioning of light Ge in the schreibersite phase.

These results strongly support the proposal that the IIG irons formed as the final products of the IIAB core. We found further evidence that IIA and IIB irons have distinct isotopic compositions. The reason is not clear; it seems possible that some parts of the core intermediate between IIA and IIB have not been sampled by the Earth.

References: [1] Wasson J. and Choe W. 2009. *Geochimica Cosmochimica Acta* 73: 4879-4890. [2] Luais B. 2012. *Chemical Geology 334:* 295-311. [3] Luais B. 2007. *Earth Planetary Science Letters 262:* 21-36.