IRON ISOTOPES IN THE METAL PHASE OF IAB IRON METEORITES.

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Introduction: High-precision measurements of non-mass-dependent effects in Fe isotopes in a variety of bulk rock meteorite samples have been reported [1,2,3], and no resolvable anomalies were observed. These previous studies included the metal phase of magmatic irons (IIAB, IIIAB, IVA, IVB), but not samples of non-magmatic irons (IAB). Non-magmatic and magmatic irons had different origins on their respective parent bodies [*e.g.*, 4,5]. In order to investigate whether a difference may exist between magmatic and non-magmatic iron groups, and also to investigate whether the effects of neutron capture reactions induced by galactic cosmic rays (GCR) may affect Fe isotopic compositions, we chose six IAB irons with a range of cosmic-ray exposure ages for high-precision Fe isotope measurements.

Samples and Methods: Iron isotopes were measured in metal samples from non-magmatic (IAB) iron meteorites. We also analyzed four terrestrial Fe-Ni alloys including two naturally-occurring alloys (josephinite and awaruite) and two NIST steels (SRM 361, SRM 126c). The latter was chosen as an external standard and measured repeatedly to determine the external precision. Samples (1.5 to 2.9 g) were cut, polished, leached in cold 2M HCl, and finally digested in 2:1 concentrated HNO_3:HCl. Following digestion, a small aliquot (≈ 3 mg) was taken for Fe isotope analyses. Iron was separated by ion exchange chromatography based on [1,6]. Isotopic measurements were made with the ThermoScientific Neptune Plus MC-ICPMS at ETH Zürich in medium resolution mode. All four Fe isotopes (^{54}Fe, ^{56}Fe, ^{57}Fe, ^{58}Fe), as well as the interference monitors ^{53}Cr and ^{60}Ni, were measured in static mode. Solutions of 10 ppm Fe were introduced using the ThermoScientific Sample Introduction System (SIS) and measured using a 10^{10} Ω resistor for the signal from ^{56}Fe in order to achieve beams ≈ 300 mV on the minor isotope ^{58}Fe.

Results and Discussion: No anomalies were observed in either ^{56}Fe or ^{58}Fe beyond the analytical uncertainties (*i.e.*, precision at the sub-epsilon level). Current parallel studies at ETH of Pd and Pt isotopes on aliquots from the same digestions of these six IAB irons show evidence for neutron capture effects in some samples. Thus, Fe isotopes do not appear to be a reliable neutron monitor in these samples. Predicted neutron capture effects on Fe isotopes from GCR are unknown, and we are currently modelling such effects to determine if our observations are consistent with theoretical calculations. The lack of resolvable variations in the most neutron rich Fe isotope (^{58}Fe) in IAB irons is consistent with previous studies of bulk rock samples [1,2,3] and support a homogeneous distribution of Fe isotopes in the protoplanetary disk.

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