SULFUR-CONTENT OF THE IIIAB IRON METEORITE GROUP.

N. L. Chabot[1]. [1]Dept. of Geology, 112 A. W. Smith Bldg., Case Western Reserve University, Cleveland, OH, 44106-7216. nlc9@po.cwru.edu.

Introduction: With over 200 members, the IIIAB group is the largest iron meteorite group and is believed to sample the central metallic core of an asteroid-sized parent body [1]. Sulfur is believed to have been an important constituent of the parental IIIAB core, but due to the low solubility of S in solid metal, an initial S-content for the IIIAB group cannot be determined through direct measurements of the IIIAB iron meteorites. Recent work that modeled the crystallization of the IIIAB core and involved trapped melt during the crystallization process suggested that the initial S-content of the IIIAB core was about 2.4 wt% [2]. This recent estimate is lower than previous estimates for the IIIAB core, which have ranged from 6-12 wt% [3-5].

Solid metal-liquid metal partition coefficients have been shown experimentally to be sensitive to the S-content of the metallic liquid [6]. By using the experimental partition coefficients to match the IIIAB fractional crystallization trends, it is possible to gain insight into the initial S-content of the IIIAB core. Here, the most current experimental partitioning data [7], including a re-parameterization of the data as a function of the S-content of the metallic liquid [8], are applied to the crystallization of the IIIAB group to get an estimate of the initial S-content of the parental core.

Results: A simple fractional crystallization model is able to fit the general form of the IIIAB Ga, Ge, and Ir vs. Au trends by using an initial S-content of 12 ±1.5 wt% S. This estimate is a factor of 5 higher than the recent IIIAB S-content estimate from the trapped melt model [2]. The difference between this work and the trapped melt model is the choice of partition coefficients. In the trapped melt model, the partition coefficients used for Ge and Ir are not consistent with the experimental data. When the same partition coefficients that are used in the modeling of this study are applied to the trapped melt model, the trapped melt model is unable to match the IIIAB trends with a S-content of 2.4 wt%.

The simple fractional crystallization model used in this work cannot explain the scatter in the IIIAB trend, the Cape York subtrend, or the high Ir-contents of the latest crystallizing IIIAB members. A process more complex than simple fractional crystallization may be required to explain these second-order features in the IIIAB data. However, the simple model presented here is able to match the first-order shapes of the uniquely curved Ga and Ge IIIAB trends and the three orders of magnitude variation in IIIAB Ir values, suggesting an initial S-content of 12 ±1.5 wt% for the IIIAB group.

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