THE RELATIONSHIP BETWEEN IIE IRONS AND H CHONDRITES: PETROLOGIC AND OXYGEN ISOTOPE CONSTRAINTS.

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Introduction: Silicate inclusions have been observed in about half of all currently identified IIE irons (21 specimens) [1]. Based mainly on their similar oxygen isotope compositions, a genetic relationship between the IIE irons and H chondrites had been proposed [2,3]. However, this relationship was subsequently questioned due to the limited overlap between laser fluorination data for equilibrated H chondrites and the earlier IIE silicate data [4,5]. We are undertaking a detailed oxygen isotope and geochemical study of both the IIE silicate inclusions and H chondrites, with the aim of investigating further the relationship between the two groups.

Analytical techniques: Oxygen isotope analysis of both mineral separates and bulk silicate inclusions from 9 IIE irons, as well as a suite of 12 H chondrite samples, was undertaken by infrared laser-assisted fluorination [6]. Textural and quantitative analysis of IIE silicate inclusions was carried out using a Cameca SX-100 Electron Microprobe and a FEI Quanta 200 FIB-ASEM.

Petrographical results: Detailed petrographic study of the chondritic IIE-an Netschaevo, (Fa_{14}, excluding Fa_{25} secondary olivines) reveals that it not only contains well-developed chondrule relicts, but also extensive evidence of partial melting. The more primitive IIE silicates have olivine compositions that fall within the H chondrite range, i.e. Techado (Fa_{16}) and Watson 001 (Fa_{20}), both of which have also experienced melting.

Oxygen isotopic compositions: Oxygen isotopes in the IIEs show a range of $\Delta^{17}O$ values from 0.58‰ to 0.90‰, with a mean of 0.72 ± 0.11‰ (2σ). $\delta^{18}O$ for the 9 samples studied also show a considerable range from 3.06‰ to 6.25‰, the mean $\delta^{18}O$ value is 4.69 ± 0.59‰ (2σ). The wide range in $\delta^{18}O$ values reflects the fact that some of the IIE silicate inclusions are highly differentiated (Kodaikanal and Colomera), as discussed by [5]. For comparison, the oxygen isotope analyses of the 12 equilibrated H chondrites examined gave a mean $\delta^{18}O$ value of 4.11±0.56‰ (2σ) and $\Delta^{17}O$ value of 0.71±0.12‰ (2σ).

Discussion: The presence of relict chondrules in Netschaevo suggests that the group as a whole may be derived from a chondritic parent body. The nearly identical mean $\Delta^{17}O$ values for the IIE irons and H chondrites support the possibility of a genetic link between these two groups. In addition, the substantial variation in $\Delta^{17}O$ seen in both groups suggests that they were derived from parent bodies with similar levels of primary isotopic heterogeneity. The wide variation in $\delta^{18}O$ values seen in some IIE silicate indicates that they underwent significant degrees of differentiation. In conclusion, our new laser fluorination data show that the H chondrites and IIEs could both have originated on the same unequilibrated H chondrite parent body.

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