

ISOTOPIC RATIO AND ORIGIN OF HYDROGEN IN IRON METEORITES.

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Introduction: We generally see Iron meteorites as pieces of differentiated bodies, whether from a totally segregated core or from droplets. Yet, Irons present some inconsistencies with the classically assumed chronology of the solar system. Their parent bodies are thought to come from the differentiation of a chondritic ancestor, but the Hf-W chronometer situates the core segregation in less than a Myr after the CAIs [1]. One way to explore the story of Iron meteorite is to trace the Hydrogen's. Indeed, The D/H ratio being significantly different between the protosolar Hydrogen ($(D/H)_{H_2} = 20 \pm 5 \times 10^{-6}$ [2]) and Hydrogen coming from water reduction during planetesimal differentiation ($(D/H)_{\text{condritic water}} = 150 \times 10^{-6}$ [2]) it can be used as an indicator of the origin of Hydrogen in the Iron Meteorites. Therefore, an analytical technique for measuring the D/H ratio of Iron meteorites using ion microprobe has been developed.

Method: Hydrogen isotopic composition is determined with the CAMECA IMS 3f at the National Museum of Natural History in Paris [3]. Samples are mounted either in epoxy and Au-coated or as polished thin sections and sputtered with a primary positive Cs^+ beam. All slits are kept wide open. Under these conditions, the mass resolution is <300 (note that with the Cs^+ primary beam, the possible mass interference between H_2^+ is D^+ is negligible). To reduce to a minimum the contribution of absorbed water at the surface of the sample, we use a large ion spot (500 μm) combined with a 150 μm aperture field, so that the ions from the center of the "crater" are selectively collected. The intensity of the primary beam varies from 1 nA to 40 nA in order to keep as much as possible a secondary beam around 10^5 cps for H and 10 for D. Data were collected in peak jumping mode, with counting time of 5 and 15 sec. for H^+ and D^+ respectively.

Results: 7 meteorites have been studied as well as a terrestrial metallic sample from Disko Island. D/H have been calibrated with an internal standard of our own, made by rusting a sample with a water whose D/H was precisely known. Corrected from this instrumental fractionation, D/H ratios lie between $92 \pm 5 \times 10^{-6}$ measured in Mont Dieu and $126 \pm 12 \times 10^{-6}$ in Coahuila. H concentrations have been calibrated by comparing the IMS secondary beam responses to those obtained on an H-implanted golden sample. [H] varies from 0.48 ± 0.12 ppb to 119 ± 100 ppb. There is no evident correlation between D/H ratio and [H] between samples. Though, a correlation has been noticed internally for one particular sample. This last observation is thought to be a proof of spallation, which is not noticeable on any other sample. A particular care has been taken to assess terrestrial pollution and minimize any possible source of additional contamination during the measures.

Analyses of additional elements parallel to H showed a correlation between H and O and H and C, which indicates 2 possible carriers of H in Irons, respectively water (terrestrial contamination) and residual organic carbon (?).

References: [1] Kleine T. et al. 2005. *Geochimica and Cosmochimica Acta* 69: 5805 – 5818. [2] Deloule E. and Robert F. 1995. *Geochimica and Cosmochimica Acta* 59: 4695 – 4706. [3] Defouilloy C. et al. 2010. #1340 41th Lunar & Planetary Science Conference.