Hf-Nd ISOTOPE GEOCHEMISTRY OF CHONDRITES: PRELIMINARY RESULTS Martin Bizzarro[1], Joel A. Baker[2] and Henning Haack[1], [1]Geologisk Museum, Øster Voldgade 5-7, 1350 Copenhagen K., Denmark, [2]Danish Lithosphere Centre, Øster Voldgade 10 L, 1350 Copenhagen K., Denmark

Knowledge of the chondritic reference values for isotopic systems such as Sm-Nd and Lu-Hf is essential to model planetary differentiation processes and subsequent secular evolution of the Earth and other planetary bodies. Previous studies of the Lu-Hf geochemistry of chondrites have suggested that the Nd-Hf terrestrial budget is not mass balanced, requiring the presence of a hidden reservoir within the deep Earth [1]. However, to-date, Nd-Hf isotopic ratios have not been rigorously determined on the same meteorites, or even on the sample digestion of an individual meteorite – a critical consideration given the apparent heterogeneity of meteorites as indicated by the large differences observed when the same sample is analyzed in replicate [1].

To this effect, we have re-examined $^{176}Hf/^{177}Hf$, $^{176}Lu/^{177}Hf$ and $^{143}Nd/^{144}Nd$ ratios of three ordinary (OC) and two carbonaceous chondrites (CC). The studied meteorites are Julesburg (L3.6), Belle Plaine (L6), Edmonson (b) (H4), Allende (CV3.2) and Murchison (CM2). In addition, we have analyzed CAI-rich and matrix separates from Allende. Hf and Nd isotopes were measured on the same sample digestion with a multiple-collector inductively coupled plasma mass spectrometer (MC-ICP-MS) coupled to a CETAC Aridus desolvating nebuliser. Samples were processed using a new sample digestion and Lu-Hf separation scheme, involving fusion with a $LiBO_4$ fluxing agent [2]. Typical Hf, Lu and Nd blank/sample ratios were respectively <2, 0.1 and 0.01‰, and are negligible. External reproducibility of the $^{176}Hf/^{177}Hf$ and the $^{143}Nd/^{144}Nd$ ratios was better than 35 and 20 ppm, respectively. Lu/Hf ratios determined by our method reproduced to <0.2%.

In a $^{176}Lu/^{177}Hf$ versus $^{176}Hf/^{177}Hf$ diagram, the three OC plot along the well-established 4.56 Ga eucrite isochron of [3], indicative of derivation from material with initial isotope ratios similar to the eucrite parent body. The $^{176}Lu/^{177}Hf$ and $^{176}Hf/^{177}Hf$ ratios of OC vary respectively from 0.0339 to 0.0362 and 0.28277 to 0.28303, which is systematically higher than presently accepted planetary reference values. In contrast, the CC from this study, including the Allende CAI-rich and matrix separates, lie off the eucrite isochron, with $^{176}Lu/^{177}Hf$ and $^{176}Hf/^{177}Hf$ ratios varying respectively from 0.0326 to 0.0365 and 0.28268 to 0.28287. In an εHf (4.56 Ga) versus $^{176}Lu/^{177}Hf$ diagram, a crude mixing array is defined by the CC with the Allende CAI-rich and matrix concentrates as end members. The measured $^{143}Nd/^{144}Nd$ in both OC and CC varies from 0.51248 to 0.51265, consistently lower than the accepted planetary reference value of 0.512638 [4].

The departure of the CC material from the reference isochron can reflect either disturbance of the Lu-Hf systematic following solidification of the CC parent body or, alternatively, isotopic heterogeneity within the early solar nebula. As such, CC material may not be suitable to define Lu-Hf and, possibly, Sm-Nd terrestrial reference values; our preliminary results indicate that OC material may be a better candidate.

References

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