NEODYMIUM ISOTOPIC COMPOSITION OF ANTARCTIC ORDINARY CHONDRITES.

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Introduction: In order to properly constrain the earliest history of terrestrial differentiation, it is necessary to separate the initial composition of the material that accreted to form the Earth from any signatures of differentiation. Traditionally chondrites have been taken to represent the building blocks of Earth, particularly for elemental abundances [e.g. 1]. The recent developments in analytical techniques have lead to high precision isotopic measurements that have revealed a chondritic reservoir that is very diverse isotopically, calling into question the idea of a chondritic bulk Earth [e.g. 2-5]. To what degree this variability is nebular in origin through heterogeneous mixing of different presolar components or thermal processing of dust in the solar nebula [2-3,5], versus the contribution of thermal metamorphism on the parent body [4], is important in the application of radiogenic chronometers, in particular the short-lived systems. One such chronometer, ^{146}Sm-^{142}Nd ($t_{1/2}$ ~103 Myr) is an important tool for probing early silicate differentiation on planetary bodies [e.g. 6-7] as it is coupled to the much longer lived ^{147}Sm-^{143}Nd ($t_{1/2}$ ~106 Gyr) system. However, its application in understanding the early evolution of planetesimals and planets requires well-constrained initial ^{142}Nd/^{144}Nd and ^{146}Sm/^{144}Sm ratios. There is potential for nucleosynthetic variation in Nd and Sm in the early solar system as different nucleosynthetic pathways (p-process, r-process and s-process) contribute in different fractions to the formation of the various isotopes. In order to provide constraints on the scale and extent of any nucleosynthetic variation we carried out a systematic study of ordinary chondrites of different petrologic grades, as ordinary chondrites have been proposed to represent better the bulk planetary Nd isotopic composition [8].

Method: Antarctic meteorites are valuable resource for such studies as they are particularly well preserved from the effects of terrestrial alteration. Approximately 1.2 g of sample was dissolved using acid digestion with the Nd being separated using ion exchange chromatography including a solvent extraction step to remove Ce. A TIMS was used for the isotopic analysis with Nd analyzed as Nd^+ using a multistatic routine after [9].

Results and Discussion: Our initial data displayed no variation outside of error in ^{142}Nd/^{144}Nd of ordinary chondrites with either class or petrologic grade, with an average μ^{142}Nd= -11±3. This points to a limited role for thermal metamorphism on the parent body affecting the variability of Nd isotopic signatures on the bulk meteorite scale. In common with previous studies [e.g. 8,10] we observed an offset relative to the modern convecting mantle. We also observed resolvable anomalies in ^{145}Nd/^{144}Nd, ^{148}Nd/^{144}Nd, and ^{150}Nd/^{144}Nd, indicating that any variation in ^{142}Nd/^{144}Nd could be nucleosynthetic in origin. This implies that the Earth accreted with a non-chondritic Nd isotopic composition, and removes the need for hidden reservoirs proposed by [10]. This suggests that any effect of collision erosion in the early solar system on differentiated bodies is limited. However, further systematic work on other chondrite groups is necessary to confirm this hypothesis.

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