ABSOLUTE AND RELATIVE STABLE MG ISOTOPE COMPOSITIONS OF SOLAR SYSTEM RESERVOIRS.

C. Paton[1], K. Larsen[1], M. Schiller[1], D. Ulfbeck[1] and M. Bizzarro[1]. [1] Centre for Star and Planet Formation, Natural History Museum of Denmark, University of Copenhagen, Copenhagen 1350 Denmark. E-mail: cpaton@snm.ku.dk.

Studying the potential variability of $^{26}Mg/^{24}Mg$ and $^{25}Mg/^{24}Mg$ ratios in solar system solids may be used to infer genetic relationships between early solar system reservoirs and terrestrial planets. Variations in the isotopic composition of Mg can potentially occur in solar system materials through a number of processes including (1) stellar nucleosynthesis, (2) the former presence and decay of the ^{26}Al nuclide (half-life = 0.73 kyr) and (3) mass-dependent isotopic fractionation during high-temperature processes such as partial evaporation/condensation as well as from low-temperature fluid/rock interactions (e.g. aqueous alteration in carbonaceous chondrites).

We have developed a double-spiking method (using a 1:1 mixture of isotopically enriched ^{24}Mg and ^{26}Mg) on the Neptune multi-collector inductively coupled plasma mass spectrometer that allows for the analysis of absolute $^{25}Mg/^{24}Mg$ ratios with an accuracy of <100 ppm. This is the first study of the absolute abundances of Mg isotopes since they were first investigated over 40 years ago using thermal ionisation mass spectrometry [1]. In addition to this method, we have developed protocols allowing for the determination of relative $^{25}Mg/^{24}Mg$ ratios with an external reproducibility of 20 ppm using standard-sample bracketing. The combination of these two approaches provides an unprecedented opportunity to investigate Mg-isotope variability in the solar system.

Absolute Mg isotope compositions were measured for terrestrial standard reference solutions (DSM-3, Cambridge-1), earth's mantle (represented by olivine crystals separated from the J-12 dunite [2]) and north Atlantic seawater. In addition, the absolute compositions of the Ivuna and Alais CI chondrites are presented. These absolute anchor points complement a comprehensive suite of relative Mg isotope analyses on bulk meteorites.

Absolute isotope analyses of the DSM-3 standard show that it is significantly heavier than published values[1] for the SRM-980 metal (which is now known to be heterogeneous), in accord with previous observations [2]. We therefore suggest new absolute Mg isotope ratios for use as reference values based on the earth's mantle, as well as the DSM-3 standard.

Results of the two methods are in excellent agreement, and show that earth's mantle (inferred from the J-12 olivine) is isotopically heavier than the DSM-3 reference standard, with a $\mu^{25}Mg$ of -150 to -200 ppm. Enstatite chondrites, ordinary chondrites and CI chondrites have $\mu^{25}Mg$ stable isotope compositions within 50 ppm of earth's mantle, and are therefore indistinguishable using the absolute method. However, the additional resolution provided by our standard-sample bracketing method does indicate small stable isotope variations (up to several 10's of ppm) between the chondrites, suggesting that subtle fractionation between reservoirs may exist.

References: [1] Catanzaro, E. J. et al. 1966. *Journal of Research of the National Bureau of Standards* 70:453–458. [2] Handler, M. R. et al. 2009. *Earth and Planetary Science Letters* 282:306-313.