MG ISOTOPIC COMPOSITION OF THE SOLAR WIND BY SIMS ANALYSIS OF GENESIS TARGETS.

V.S. Heber[1], A.J.G. Jurewicz[2], P. Janney[2], M. Wadhwa[2], K.D. McKeegan[1], & D.S. Burnett[3]. [1]Dept. Earth and Space Sciences, UCLA, Los Angeles, CA, USA, heber@ess.ucla.edu; [2]Arizona State University, Tempe, AZ, USA; [3]CalTech, Pasadena, CA, USA.

Introduction: In order to deduce the isotopic compositions in the solar nebula of volatile elements, e.g. noble gases, O, and N, from analyses of the solar wind (SW), we must understand the magnitude of mass-dependent fractionation between the SW and the photosphere. With the exception of evaporation effects in CAI's, mass dependent fractionation of Mg isotopes is small, as evidenced by Mg isotopic compositions of terrestrial igneous and meteoritic samples which agree within ~1‰ [1]. Thus, if we assume that the "terrestrial" Mg isotopic composition is also representative of the solar photosphere, we can use measurements of the SW captured by Genesis to test models of isotopic fractionation in formation of SW. For example, if the inefficient Coulomb-drag model [2] is correct, we would expect that the Mg isotopic composition in the SW is ~10‰ per amu [2] lighter than the terrestrial composition.

Experimental and Results. Fragments of a silicon target from the passive collector, a ^{25,26}Mg implant (Si target) and a terrestrial magnetite (containing low abundance of Mg-bearing inclusions) were measured in depth-profiling mode with the UCLA Cameca ims 1270. 100×100 μm^2 craters were sputtered with a O_2^+ beam in O_2 atmosphere (1.2E-5 torr). 7.5keV impact energy and a field aperture of 40×40 μm^2 were applied to improve depth resolution. Mg isotopes and ^{28}Si were collected simultaneously on electron multipliers (Mg) and a Faraday cup (Si). A mass resolving power of 2100 sufficiently resolved ^{24}MgH from ^{25}Mg. Data are corrected for deadtime, blank and instrumental mass fractionation.

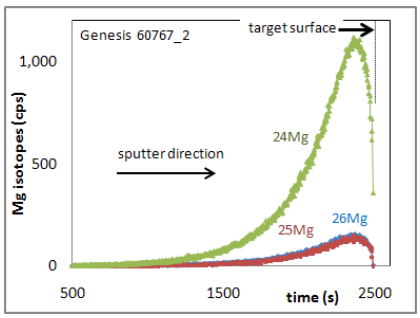

Fig. 1. Backside depth profile of SW Mg isotopes. This mode produces a complete profile, avoiding surface contamination and transient sputter effects otherwise encountered when sputtering from the front side. Isotopic ratios were calculated from the sum of the counting rates over the complete profile.

The ^{25,26}Mg implant standard was homogeneously irradiated (^{25}Mg/^{26}Mg from 3 areas ~5cm apart agree within 3‰). The ^{25}Mg/^{26}Mg ratio was calibrated by solution MC-ICPMS at ASU to be 0.9571±0.0051 (2σ stdev). Uncertainies in the Genesis data are ~5‰ (1σ). Due to unresolved issues with deadtime corrections, we only report δ^{26}Mg/^{25}Mg calibrated against the implant standard: 0.2 ±4.1‰ (4 runs, 1σ stdev). This preliminary result agrees with [3,4]. Thus, at present the isotopic fractionation in SW can neither be confirmed nor excluded. Future analyses that include more standards, a better control on the deadtime and more Genesis analyzes will reduce our uncertainties.

References: [1] Young et al. (2004), Rev. Min. Geochem. 55: 197-230; [2] Bodmer et al. (2000) J. Geophys. Res. 105: 47-60; [3] Rieck et al. (2010) 41st LPSC, #2391; [4] Humayun et al. (2011) 42th LPSC, #1211.