MEASUREMENTS OF XENON FROM THE SOLAR WIND IN GENESIS SILICON COLLECTOR TARGETS.

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Introduction: Determining the elemental and isotopic noble gas composition of present-day solar wind is one of the major objectives of the NASA Genesis mission [1]. The Genesis bulk solar wind collector targets were exposed to the solar wind for 853 days. The concentrations of implanted noble gases are very low (~ 3×10^6 atoms ^{132}Xe / cm^2 [1]) and the most sensitive techniques and instruments must be used to make precise and accurate measurements of the solar wind noble gas composition.

Experimental: We have measured the concentration and composition of Xe implanted in CZ-Si targets from the bulk collector, using the RELAX mass spectrometer in Manchester [2, 3]. Gas is extracted from the silicon targets by uv laser ablation. An unfocused laser beam with a uniform beam profile across the central ~ 6mm is wide enough to ablate the whole surface of square samples ~ 3-4 mm in dimension, without the need to raster over the surface. Investigations into the laser pulse energy and number of laser shots have shown that multiple low energy laser shots are preferable to individual high energy shots. Also, it is desirable to release the implanted solar wind in as few extractions as possible, to minimize contributions from the spectrometer blank. Therefore, our protocol involves analysis of gas released by a single initial laser shot (to remove any surface adsorbed component), followed by analysis of gas extracted by 30 consecutive laser shots. Our experiments demonstrate that this ensures all implanted solar wind xenon is released.

Results: A number of flight and non-flight CZ-Si samples have been analysed. The blank Xe intrinsic to the collector material, as measured in the non-flight samples, is isotopically identical to air. However variations up to a factor of 5 are observed in the concentration of this component from sample to sample. Variations in Xe concentration are also observed in the flight samples. These are consistent with mixing between a uniform concentration component, implanted from the solar wind, mixing with the variable concentration Xe component identified in non-flight samples.

Relative to air, Xe extracted from the flight samples is enriched in the lighter isotopes and depleted in the heavier isotopes. The extent of deviation from the air composition is inversely proportional to the concentration of xenon, as expected for a uniform-concentration implanted component mixing with a variable concentration intrinsic component. The trends are consistent with an implanted component with the isotopic composition of the young lunar regolith [4, 5], implanted with the surface concentrations of xenon expected for the Genesis collectors.

References: [1] Burnett, D. S. et al., 2003 *Space Science Reviews*, 105, 509-534. [2] Gilmour, J. D. et al., 1994 *Review of Scientific Instruments*, 65, 617-625. [3] Crowther, S. A. et al., 2008 *Journal of Analytical Atomic Spectrometry*, 23, 938-947. [4] Wieler, R. and Baur, H., 1994 *Meteoritics*, 29, 570-580. [5] Pepin, R. O. et al., 1995 *Geochimica Et Cosmochimica Acta*, 59, 4997-5022.