SOLAR WIND ELEMENTAL ABUNDANCES FROM GENESIS COLLECTORS.

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Overview Solar wind elemental abundances are a major Genesis Science Objective. Spacecraft studies have shown that elements with first ionization potential (FIP) > 9 ev are fractionated relative to those with lower FIP compared with the solar photosphere; however, among elements with FIP<9eV (which make up most of the terrestrial planets) there is no evidence of fractionation. A major goal of Genesis is to provide a higher precision test of the lack of fractionation for FIP<9eV.

Bulk solar wind analyses were made by SIMS on Si, Sandia diamond-like-C, and epitaxial Si on sapphire (SoS) using the ASU 6f and UCLA 1270 instruments. Fluences are calculated relative to implant standards.

Preliminary results with discussion: Figure 1 summarizes Fe fluences for 5 different Sandia and SoS samples ordered in order of the date of the SIMS run. Each point represents a separate depth profile. There is more scatter in the calculated Fe fluences than we expect from the precision of our individual SIMS profiles, but the scatter does not appear to be due to inter-sample variations. Indeed, the discrepancy between Mg values in Si vs. Sandia (shown later) suggest an analytical problem with the Sandia. Therefore, it is especially significant that the SoS and Sandia results are consistent. Giving more weight to the SoS result our preliminary Fe fluence is 1.3e12/cm^2 .

Figure 2 shows Mg fluences in Si as a function of the SIMS sensitivity factor (RSF) which is a measure of the implant Mg/Si cps ratio. Use of O_2 flooding during the analysis removes transient sputtering effects which seriously complicate the analysis in the first 250A. The scatter must eventually be dealt with, but giving more weight to the O_2 flood data due to the relative ease of their reduction, the preliminary Mg fluence from Si is 1.54e12/cm^2.

Figure 3 summarizes a large number of Mg fluences for Sandia samples. These data have more scatter than for Mg in Si, but perhaps more significantly, systematically show Mg fluences twice those measured for Si. This difference is not seen for Fe, and cannot be explained by errors in the implant standards. We are investigating a number of possibilities, including local variations in RSF due to spatial variations in microstructure within the amorphous material, and changes in C-bonding in the amorphous carbon catalyzed by hydrogen and radiation damage from the solar wind. Therefore, the Mg discrepancy is unexplained, but the Si analyses are preferred at present.

Figure 4 shows three depth profiles for solar-wind Ca in a Si collector which agree. Unlike other elements there are measurable impurity levels of Ca in Si, and a 10-15% correction is required, but this correction can be accurately measured. More data are obviously needed, but our preliminary Ca fluence is 1.0e11/cm^2.

Figure 5 gives preliminary results for Cr. Counting rates for individual profiles are much lower than other elements and, at least on Si sample 60291, surface contamination is relatively high. Figure 5 shows our two best profiles. The preliminary fluence is 3.0e10/cm^2.

Figure 6 is a snapshot of our progress measuring Na. We can not use Si wafers, as Na is expected to rapidly diffuse. Sandia samples show reasonable profiles and have sufficiently low impurity levels, although we are struggling with the analytical issues mentioned previously. In addition, Na surface contamination is always a major problem for analysis. Figure 6 show a single profile for Na from 60065. Four other profiles are consistent, but two others have excessive surface contamination. Figure 6 shows that the Mg profile in the same sample unexpectedly has a steeper spectrum than Na, and that neither agree with the calculated Mg depth distribution (Olinger) for the measured Mg velocity distribution. Very provisionally, the derived Na fluence is 1.5e11/cm^2.

Summary: Table 1 compares the relative fluences *in the same material* with the equivalent photospheric ratios (1), i.e the Sandia Mg fluence is used for Na. Except for the Na/Fe ratio, agreement is fairly good, although errors are highly uncertain at this point.

Table 1	**Fe/Mg**	**Ca/Mg**	**Cr/Mg**	**Na/Mg**	**Na/Fe**
Genesis	**0.84**	**0.050**	**0.015**	**0.045**	**0.11**
Photosphere [1]	**0.83**	**0.060**	**0.013**	**0.044**	**0.052**

References:

[1] Asplund M. et al. (2005), in *Cosmic Abundances as records of stellar evolution and nucleosynthesis*, FN Bash and TG Barnes, eds., Proc. Astr. Soc. Pacif. Conf., Austin TX June 17-19 2004

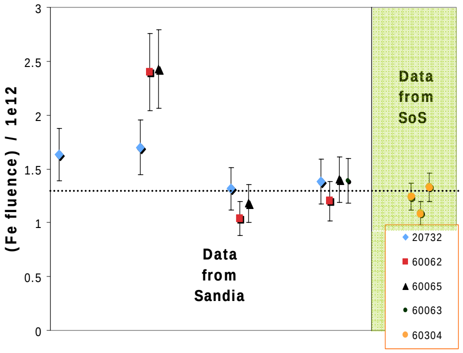

Figure 1. Fe-fluences calculated from individua. depth profiles: 5 samples, multiple analytical dates

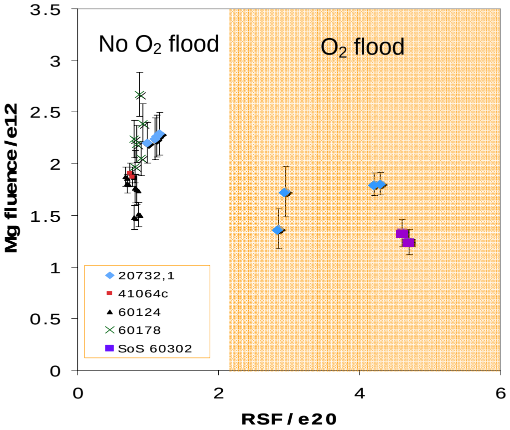

Figure 2. Mg-fluences calculated from individual depth profiles: 5 samples, multiple analytical dates, with and without O2 flood.

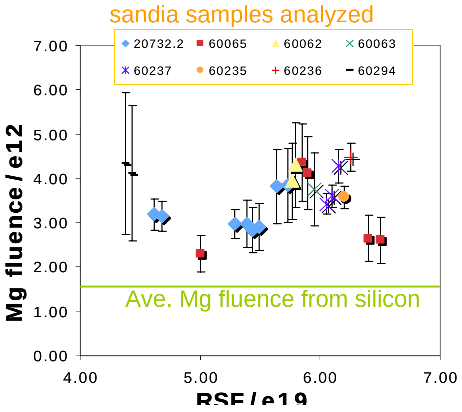

Figure 3. Mg-fluences calculated from individual Sandia depth profiles vs. the average from silicon. Scatter is greater than analytical precision

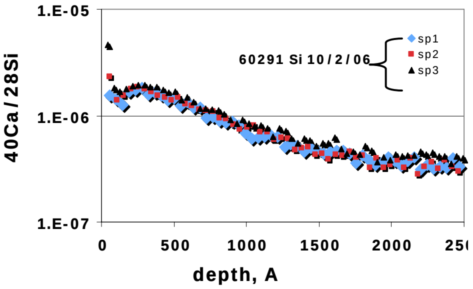

Figure 4. Three depth profiles for Ca in Genesis-flown sample 60291

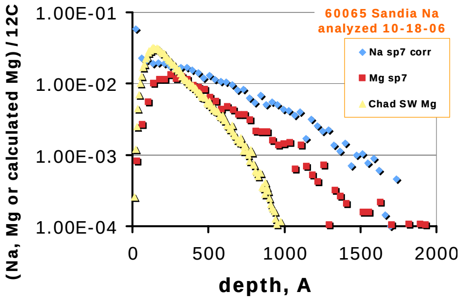

Figure 6. Measured Na, Mg and calculated Mg profiles in Sandia diamond-like carbon (sample 60065). Although the measure-ments are precise and show appropriate trends, there are still internal discrepancies.

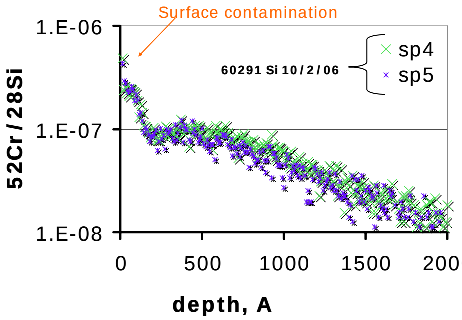

Figure 5. Two depth profiles for Cr in Genesis-flown sample 60291. This is first real attempt at Cr analyses; no special cleaning has been tried for the removal of surface Cr contamination.