

**MEASUREMENTS OF NITROGEN IN THE GENESIS CONCENTRATOR TARGET MATERIALS: SOURCES OF CONTAMINATION N.** A. B. Verchovsky and I. A. Franchi. Planetary and Space Sciences Research Institute, Open University, Walton Hall, Milton Keynes MK7 6AA, Bucks, U. K.

**Introduction:** Measurement of N isotopic composition in the Genesis samples has turned out to be a tricky business. The results obtained so far in two laboratories are different by 700‰ (from -400 [1] to +300‰ [2])! The laboratories used different extraction methods and target materials: amalgamation of gold on sapphire [2] and UV laser ablation of gold plated stainless steel [1]. Both techniques are proven to be efficient enough and have been checked using artificially N-implanted target samples. However, the dramatic discrepancy between the obtained results clearly suggests that there is something wrong with one of the two, or perhaps both measurements. And though no obvious mistakes in the measurements have been found yet both of them suffered from some problems. In the case of amalgamation a potential problem is underestimation of the CO contribution at masses 28 and 29. In the case of laser extraction the main problem is with a high level (90% and more) of contamination of the gold layer with terrestrial N. Therefore, the solar wind (SW)  $\delta^{15}\text{N}$  value has been obtained in this case by a very long extrapolation. A more detailed look at the data obtained by [3] has revealed some puzzling observations regarding the origin of the contamination N in the gold samples

At the OU we have developed an alternative technique for analysis of SW N which utilises stepped oxidation of the Diamond-Like-Carbon (DLC) on Si (DoS) Genesis targets.

**Analysis of the data obtained by Nancy group:** This level of terrestrial N contamination of the gold cross of the concentrator target is a factor of 3.5 higher than in the duplicate non-flight samples. The reasons for this are not absolutely clear, although the authors made a suggestion that it is rather associated with the technology of the material production and therefore supposed to be a volume-correlated component. The most perplexing observation is a correlation between N and SW Ne release during stepped ablation. The authors mention that this can in principal be regarded as a result of implantation of the contamination N but believe that in fact this is not the case. They explained such an intimate release of N and SW Ne as a result of correlation with number of laser pulses used in the stepped extraction that, in combination with uneven surface of the samples, eliminates the original difference in the distribution of these two components in the gold layer. However, the yield correlation (Fig. 1) is almost perfect. In contrast, the correlation of the N release with number of laser pulses (Fig. 2) is much worse making the yield correlation difficult to under-

stand how it came about. Moreover, there is a correlation between bulk (sum of all pulses for a given area) N and SW Ne release (Fig. 3). Since SW

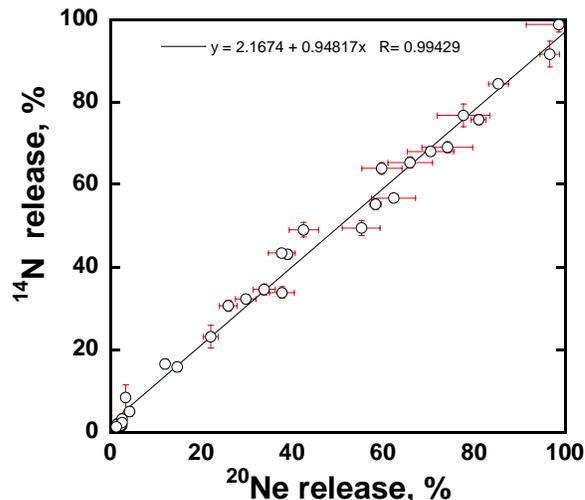


Figure 1. Correlation between percentages of N and Ne release in stepped ablation. For each ablation area the total release is normalized to 100%. Source - data from [3].

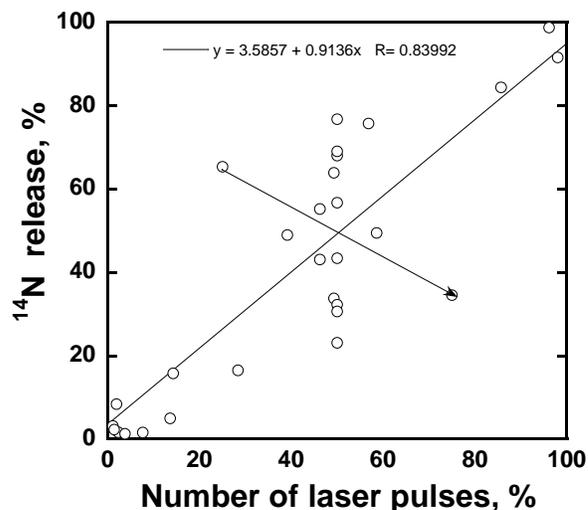


Figure 2. Correlation between release of N and number of laser pulses. For each ablation area the total release and number of pulses normalized to 100%. Source - data from [3].

Ne concentration depends on the radial position on the concentrator due to a certain discrimination factor of the ion concentration mechanism, we have to assume that N concentration is also somehow dependant on

this factor. Thus, it is impossible to exclude that the contamination N is also an implanted component and, therefore, the correlation between  $\delta^{15}\text{N}$  and N/Ne ratio may be not a mixing line but a fractionation line. If this is true then the isotopic composition of N in the SW remains uncertain.

**Analysis of a small flight sample at OU:** The stepped combustion technique developed for analyses of SW N in DoS samples is briefly described in [4]. We applied the technique for analyses of a small ( $0.12\text{ cm}^2$ ) DLC sample (60736) from the concentrator target. The size of the sample does not suppose to have sufficient SW N for a precise measurement, but rather to check again the experimental technique with a real flight sample. As with the other measurements, contamination with terrestrial N is the most significant problem for the DLC analysis. However, we believe that, in contrast to the gold cross, most of contamination N in the DLC target is associated with a local laboratory source and concentrated on the sample surface. This is confirmed by the analyses of the blank (non-flight) DLC samples. In the gold cross the contamination N seems to be distributed very similar to that for SW Ne.

The level of contamination of the DLC samples is comparable with that observed in the gold cross. Most (>90%) of the DLC contamination N can be removed by removing a very thin (<20 nm) DLC layer before analysis of the layers (20-70 nm) where SW N is expected to be located. Thus, if there is an implanted contamination N component in the DLC samples then it is significantly less abundant than in the case of the gold cross (Fig 4). The reasons for that are not clear at the moment, but it could be attributed to the difference in the physical properties of the surfaces (electric conductivity etc).

The original position of flight chip 60736 in the DLC quadrant of the concentrator is uncertain following the crash landing of the Genesis spacecraft. However, the SW Ne concentration and isotopic composition when compared to the gold cross data [5] indicate that the original position was 22 mm from the centre of the concentrator target. Based on the Ne data the amount of SW N expected in the sample is  $\sim 0.03\text{ ng}$  or 2% of the total N released from 20-70 nm DLC layer extraction steps. The measured isotopic composition of the N was found to be within the range for the blank DLC samples and therefore did not allow to estimate the pure SW N signature.

Further analyses of a larger ( $\sim 1\text{ cm}^2$ ) sample of the DLC quadrant will provide a much better precession measurement of the SW N (Fig. 4).

**References:** [1] B. Marty et al. (2009) *LPSC XL*, abstr. #1857; [2] R. Pepin et al. *Ibid.*, abstr. #2103; [3]

B. Marty et al. (2010) *GCA* 74, 340-355; [4] A. B. Verchovsky et al. (2009) *MAPS* 44, Supplement, A211; [5] V. S. Heber et al. (2009), *LPSC XV*, abstr. #1485.

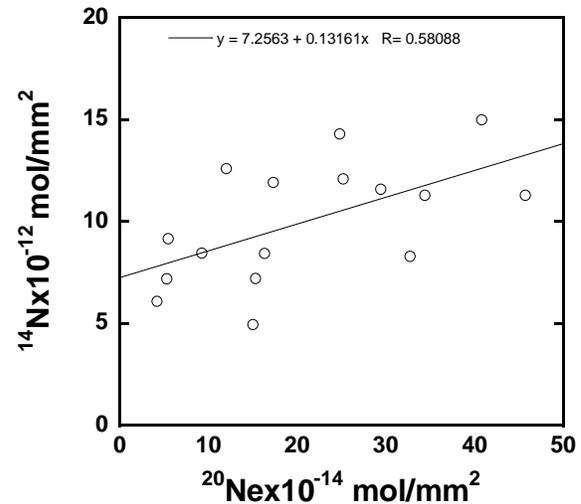


Figure 3. Correlation between total N and SW Ne concentrations extracted from the gold cross targets. Source - data from [3].

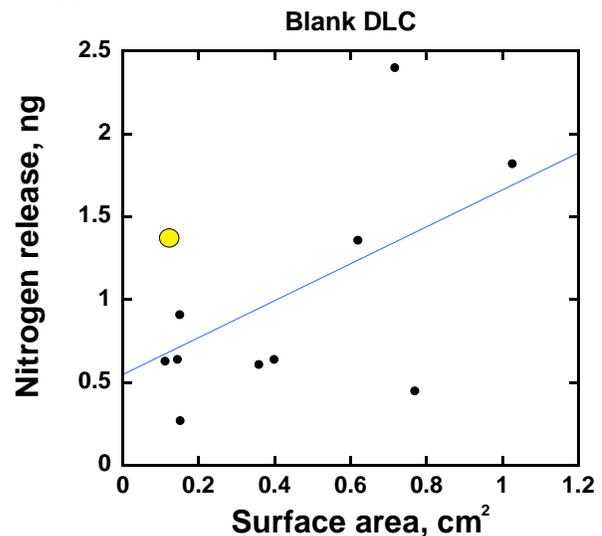


Figure 4. Correlation between N release and the surface area of the DLC samples after removing most of the surface contamination. Open circles - blank DLC, large circle - sample 60736. About 1.5 ng of contamination N is expected in  $1\text{ cm}^2$  of the DLC concentrator target which provides SW N/contamination N ratio of 1 or higher, depending on the radial position of the sample in the quadrant. Contamination level of  $1\text{ cm}^2$  of the gold cross sample corresponds to 7-20 ng of N [3].