CARBON CONTENT OF SILICA AEROGEL: A MATERIAL PROPOSED AS A MEDIUM FOR COLLECTION OF COSMIC DUST GRAINS. J.E. Gibson[1], C.T. Pillinger[1] and E.K. Gibson, Jr.[2]. [1]Planetary Sciences Unit, Department of Earth Sciences, The Open University, Milton Keynes MK7 6AA, England, and [2]SN2, Planetary Sciences Branch, NASA Johnson Space Center, Houston, TX 77058.

Interplanetary dust grains can vary from being virtually pure carbonaceous materials to entirely metallic and all shades of silicates + carbon and/or metal. Our interest in such materials would be the analysis of the carbonaceous phases whether they be organic, elemental or carbidic in nature. Thus, we have a commitment to assisting with the development of methods to capture such grains without compromising their indigenous carbon signatures.

One of the most hopeful substrates for use in interplanetary dust capture cells appears to be silica aerogel which offers a very low density target for decelerating and trapping of grains in near Earth orbit or in dusty regions of the solar system. Efforts have already been made to evaluate the trace element content of such materials to establish whether they would prevent studies to be made on captured grain debris by Proton Induced X-ray Emission and/or Synchrotron X-ray Fluorescence (1) and INAA (2). Laser microprobe/evolved gas analysis studies of volatile compounds have also been carried out (3). Herein, we consider the bulk carbon and carbon isotope content of several different samples of aerogel with different densities and make a preliminary report of its response during stepped combustion analysis.

Table 1 reports bulk carbon contents for five samples of aerogel of differing density from 20 mg/cc to 100-120 mg/cc. There is a substantial difference amongst the materials with most of the samples having a carbon abundance of a few per cent by weight carbon. The highest density specimen, however, had at least an order of magnitude less carbon. The lowest density sample had the greatest carbon abundances and undoubtly reflects the difficulties of extracting the solvents from materials with such high surface areas In most cases, the isotopic composition of the carbon is unusually light and in some samples sufficiently distinct to allow unambiguous recognition from species which might be encountered in interplanetary dust, if analogies with more conventional sized meteorites are appropriate.

The highest density aerogel, which had the smallest concentration of carbon, was analyzed only by stepped combustion at 100^{o}C resolution. In the early steps up to 300^{o}C, the amounts of water given off were large as previously seen in evolved gas studies (3) and separation of CO_2 was difficult. However, at higher temperatures a useful stepped combustion profile was obtained. The bulk of the carbon in the sample is liberated in the temperature regime 600^{o}-800^{o}C, normally associated with elemental forms, rather than at 300^{o}-500^{o}C, the interval commonly found for organic contaminants.

Other samples of aerogel need to be considered by stepped combustion to establish whether this distribution of carbon is general; however, the results might help to explain why baking aerogel samples failed to significantly lower their volatile content (3).

Clearly, the results given here represent only the first steps in characterizing materials appropriate for the collection of interplanetary dust grains. Further investigations of carbon and its associated elements, H and N and their isotopes, are needed particularly as ammonium hydroxide is often used in making aerogel. The aerogels considered were formed in the liquid phase; it would make sense to also investigate similar materials produced in vapor phase reactions (4).

References:
(1) Flynn G. and Sutton S.R. (1990) LPSC XXI, 371-372.
(2) Zolensky M.E. et al. (1990) LPSC XXI, 1381-1382.
(3) Hartmetz C.P. et al. (1990) LPSC XXI, 463-464.
(4) Lushnikov A.A. et al. (1990) Chem. Phys. Letts. 175, 138-142.

TABLE 1

Bulk Carbon Contents and Isotopic Compositions of Various Aerogels

Sample	Density (mg/cc)	Wt. (mg)	Ng C	% Carbon	$\delta^{13}C$
1.	100-120	79.618	1446.5	0.18	-35.59
2.	85	45.175	751.2	1.71	-33.41
3.	40	20.133	701.4	3.5	-45.91
4.	30	20.732	618.4	3.0	-50.28
5.	20	27.613	914.7	3.3	-43.10