IDENTIFICATION AND CHARACTERIZATION OF A CARBONACEOUS, TITANIUM CONTAINING INTERPLANETARY DUST PARTICLE. **David Blake, SETI Institute, MS 239-4, NASA/Ames Research Center, Moffett Field, CA. 94035, Ronald H. Fleming, Charles Evans and Associates, 301 Chesapeake Dr., Redwood City, CA 94063, and T.E. Bunch, MS 239-4, Planetary Biology Branch, NASA Ames Research Center, Moffett Field, CA 94035.**

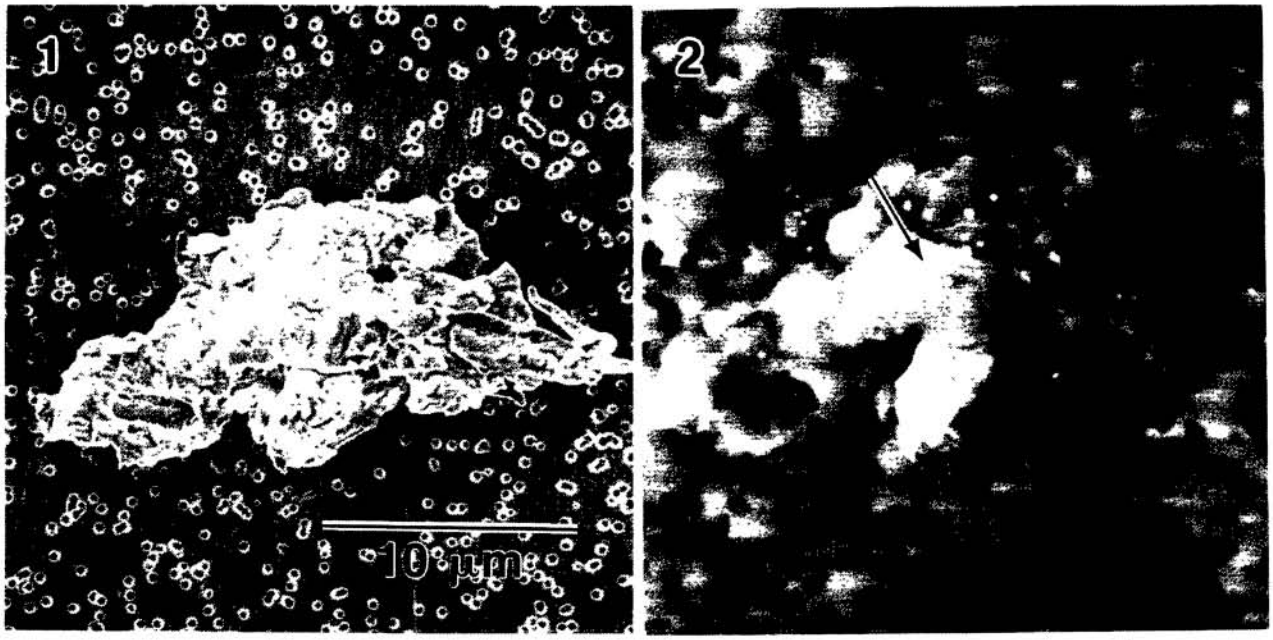
We have recently begun a survey of non-chondritic "low atomic number" IDPs from the Johnson Space Center Collection in order to identify which, if any are potentially of extraterrestrial origin. We define "low atomic number" particles as those which exhibit only minor elemental X-ray peaks above atomic number 10 and which have a high Bremsstrahlung X-ray background.

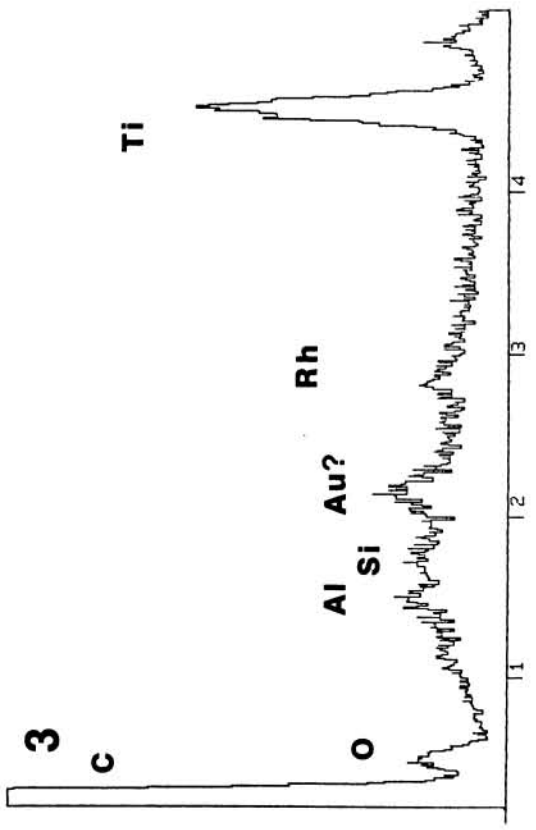
Figure 1 shows a LVSEM image of a low atomic number IDP obtained from a nucleopore filter onto which debris from a JSC collection flag had been washed. The particle has many of the surface morphological characteristics which we have come to associate with IDPs; in particular, a wrinkled, reentrant surface texture. Figure 2 is a Backscattered Electron (BSE) image which shows compositional (average atomic number) differences within the particle. There appear to be sub-μm grains of high average atomic number material (arrowed) scattered throughout the IDP. Qualitative Energy Dispersive X-ray (EDX) spectra recorded while the beam was scanned over the entire IDP show primarily carbon, with minor amounts of O, Al, Si, Au(?), Rh(?) and Ti. Figure 3 is an EDX spectrum recorded with the electron beam in point mode, placed on one of the high atomic number particles imaged in Figure 2. In this configuration, the volume of X-ray excitation would include regions outside the particle, but the X-ray signal from the particle would be enhanced over bulk scans. Titanium is present in much greater abundance within the particle than in the bulk of the IDP. From this, it appears that the particles are primarily Ti, but it is not known whether the particles are oxide, carbide, or metal.

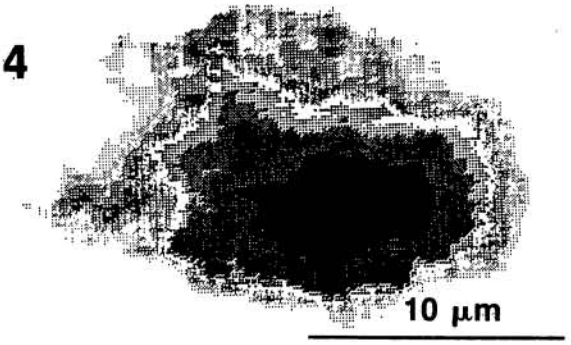
The IDP was transferred onto a polished aluminum stub for analysis by Secondary Ion Mass Spectroscopy (SIMS). Deuterium/Hydrogen (D/H) isotope ratio images were recorded in a Cameca 4F SIMS using a Cs^+ source. Raw hydrogen and deuterium images were obtained by rastering the ion beam over a rectangular area slightly larger than the particle. Hydrogen images with a resolution of 0.5-1.0 μm were recorded in a matter of a few seconds; deuterium images were recorded over 1-2 hour periods due to the low counting rates. The resulting D/H values were not corrected for instrumental mass fractionation; however, D/H values for terrestrial materials such as epoxy in microtome thin sections were found to be isotopically "normal" and within 100 per mil of SMOW. The results from the IDP are shown in Figure 4. The IDP has a positive D/H deviation overall, and exhibits a region of at least +800 per mil enrichment. On the basis of the SIMS data, we tentatively identify this IDP as being extraterrestrial in origin.

Zolensky et al. (1) and Rietmeijer and Mackinnon (2) describe occurrences of Ti in IDPs in which the Ti appears to be a high temperature condensation product either from the solar nebula or from a supernova event. In Zolensky et al. (ibid.), the Ti is present as Magneli phases and in one instance as Titanium Carbide in a volume of material which appears to contain excess carbon. However, the host phase for the Magneli phases is kaolinite, presumably the devritification product of an aluminum-rich glass. We believe that the present study represents the first instance of a titanium phase contained within a carbonaceous IDP. The titanium phase may represent either remnant interstellar grains, or high temperature products of the solar nebula which were later enclosed within the carbonaceous phase. We hope to obtain phase information from microtome thin sections which will elucidate the mechanism of formation and processing history of these particles.

1). Zolensky, M.E., A. Pun and K.L. Thomas (1988). Proc. **19th** LPSC (in press).
2). Reitmeijer, F.J.M. and I.D.R. Mackinnon (1987). Nature **326**, 162-165.







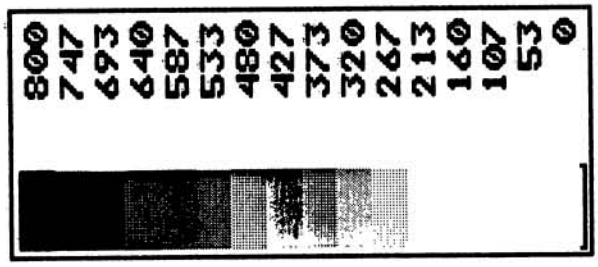


Fig. 1. LVSEM micrograph of carbonaceous IDP (SE image) showing morphology and surface structure. Fig. 2. SEM micrograph (BSE image) showing sub-μm high atomic number grains (arrowed) within low atomic number matrix. Fig. 3. Energy-dispersive X-ray spectrum from high atomic number grain within the IDP. Bulk spectra from the IDP are identical except for much reduced Ti peak. The IDP is carbonaceous, with minor amounts of the elements labelled in the figure, and titanium-containing grains. Fig. 4. D/H ratio image, showing excess Deuterium in IDP. Maximum D/H values in IDP approach 800 per mil relative to terrestrial values. The deuterium excess could not be identified with any obvious morphological features of the IDP.