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The Composition of Meteoroids Impacting LDEF- D.E. Brownlee[1], F.Horz[2], M. Laurance[1], R.P. Bernhard[2], J. Warren[2], and J.P. Bradley[3]. 1-Dept. of Astronomy, Univ. of Washington, Seattle, WA, 2-NASA Johnson Space Center, Houston, TX, 3-McCrone Associates, Westmont Ill

The Long Duration Exposure Facility (LDEF), recovered from a nearly 6 year exposure in low Earth orbit, has provided an unprecedentedly large number of meteoroid impact craters that can be studied in the laboratory to determine the composition of sub-millimeter meteoroids. We are currently analyzing the elemental composition of meteoroid residue found lining the interiors of craters in the high purity Al and Au exposure surfaces of the A-187-1 experiment. Although hypervelocity micrometeoroids impacting solid metal targets are usually severely altered during capture, space collection of this type provides unique information that cannot be obtained from more pristine particles collected in and below the atmosphere. One major advantage is that without bias all meteoroids produce craters that can be examined to detect meteoroid types that either do not survive atmospheric entry or are not recognized in atmospheric collections. For example, pure Halley CHON material would be difficult to distinguish from contaminants in stratospheric collections but could clearly be found in orbital collections. Another value of LDEF collections is that the spacecraft's fixed attitude relative to its velocity vector provides an important means of statistically distinguishing low velocity particles such as orbital debris and asteroid dust from high velocity cometary dust. Low velocity particles are highly concentrated on the leading edge while higher velocity particles produce a more even distribution on the leading and trailing edges. CI matrix and stratospheric IDPs of probable asteroidal origin often have large Ca depletions relative to bulk CI and we plan to test the hypothesis that Ca depletion is a common property of asteroidal dust by examining the relative abundance of chondritic composition impacts with abnormally low Ca meteoroids on the front and back of LDEF.

So far we have completed an initial SEM survey of craters in the 100μm to 1mm size range and done some quantitative analysis. Typical craters have only small amounts of residue and with variable matrix/residue geometry it is difficult to do more than semi-quanitative analysis. In these "typical" craters the residue appears to be a mixture of glass and FeNi and sulfide beads with an overall chondritic elemental compositon. In less than 10% of the craters there is a substantial amount of meteoroid debris that also contains unmelted mineral grains. The relatively high abundance of forsterite and enstatite among these irregular grains suggests that high melting point probably plays a role in surviving impact without melting. Some irregular sulfides up to several microns in size have also survived without melting. Unmelted olivine grains extracted from one crater contain faint linear defects consistent with their being solar flare tracks at a density similar to that commonly observed in stratospheric IDPs.

The initial EDX analyses of LDEF metal craters has shown that the composition of crater residues can provide valuable information on the meteoroid complex although it has also shown that impact velocity and projectile melting point provide bias in obtaining craters with abundant residue for analysis.