PRISTINE PRESOLAR SILICON CARBIDE FROM MURCHISON. T. Bernatowicz[1], O. Pravdivtseva[1], S. Messenger[1], and P. Swan[1] , [1]Laboratory for Space Sciences, Washington University, St. Louis MO 63130.

Presolar SiC has been isolated from primitive meteorites for isotopic study primarily using acid dissolution techniques [1, 2], and also has been studied *in situ* in the SEM in meteorite thick-sections polished by Al oxide [3]. Both of these techniques destroy the original grain surfaces, and with them potentially valuable information that might give insight into primary condensation and growth processes, associated minerals normally destroyed by acid dissolution, as well as irradiation, comminution, deposition and processing of volatiles on grain surfaces in the ISM, effects of exposure to the oxidizing solar nebula, and regolith processing on meteorite parent bodies. Because these grains *are* presolar, they *must necessarily* have traversed a wide spectrum of astrophysical environments (namely, stellar atmosphere – ISM – Solar Nebula) before being incorporated into meteorite parent bodies. Any of these environments could have left their mark on grain surfaces, so in principle it is possible to use grain surfaces as probes of these environments.

We developed a simple technique for isolating presolar SiC with such “pristine” surfaces [4]. Small (1-2 g) meteorite samples are first coated with epoxy to fix any terrestrial contaminant SiC, then split open in a clean hood, after which a few tens of mg of matrix material is mined from a fresh surface, ultrasonicated in isopropanol/water for several hours, then centrifuged for size separation. Aliquots of suspended material (~1 – 3 micron) are deposited on graphite planchettes, and grain fields are automatically mapped in Si, Mg, and O X-rays in the SEM to identify SiC. Since the abundance of SiC is so low (a few ppm in Murchison), only one micron-sized SiC grain is located per day, on average, even with continuous mapping. To obtain high resolution images of the SiC grain surfaces, these are examined at low voltages (1 – 3 keV) in a field emission SEM (FESEM).

To date, we have studied 65 pristine SiC grains (0.5–2.5 microns) from the Murchison (CM) meteorite in the FESEM. Three-fourths of the grains have near-unity aspect ratios. More than 80% have at least one identifiable crystal face (20% of all grains are euhedral), indicating lack of severe comminution or chemical weathering in *any* environment since grain formation. In half of the grains, crystal faces are decorated with regular, sub-micron geometrical depressions. Comparison with acid dissolution presolar SiC imaged under the same conditions [4] indicates that these are not etch pits, but preserved primary growth features. The fact that surface growth features are preserved in exquisite detail suggests that the grains bearing them were likely protected by icy/organic mantles during their residence in the ISM. About 20% of the grains are irregular, showing evidence of comminution in the Solar System or ISM, although no clear impact features have been found. A few of the pristine grains have surfaces that are partially rounded (possibly the result of oxidation?). Roughly half (~60%) of the pristine SiC grains are coated with a thin (<100 nm) layer of an amorphous material of unknown composition--O is present in the X-ray spectra, and Si and C are also detected but may simply represent fluorescence of the underlying SiC. We do not know if the coatings are silica from oxidation in the Solar Nebula, and/or carbonaceous residues of volatile condensation and processing on the grain surfaces in the ISM or Solar Nebula. We are now attempting to obtain high resolution TEM images of thin edges of pristine SiC grains, and also to make ultrathin sections of coated grains for TEM analysis, to determine the nature of the coatings and their relation to the underlying SiC. NanoSIMS isotopic measurements of the coatings will also be attempted to help to constrain their origin.

References: [1] see Bernatowicz T. and Zinner E. (1997) *Astrophysical Implications of the Laboratory Study of Presolar Materials*, AIP Conf. Proc. **402**; [2] Amari S., Lewis R. & Anders E. (1994), *GCA*. **58**, 459; [3] Alexander C. et al. (1990) Nature **348**, 715; [4] Bernatowicz T. et al. (2000), *LPS* XXXI, Abstract #1238.