HIGH RESOLUTION SCANNING AUGER ELECTRON IMAGING OF MICROTOMED SECTIONS OF MURCHISON MATRIX; F. Radicati di Brozolo, I.C. Ivanov and C. L. Anderson, Charles Evans & Associates, Redwood City, CA 94063.

The use of microtomy techniques in the preparation of rare meteoritical and interplanetary dust particles (IDP) samples for analysis by microbeam techniques has recently found increased acceptance. (1) The use of microtomed thin sections allows the analysis of dielectric materials by charged particle beam techniques (AES, SIMS). In addition, using sequences of adjacent thin sections one can identify elemental variations as a function of depth, and provide three-dimensional maps of the sample. The application of microtomy is of particular interest in the case of IDP, given the small size and the uniqueness of these samples.

At CHARLES EVANS & ASSOCIATES we are developing under NASA contract various techniques for the characterization of IDP, with emphasis on analytical methods to determine the distribution of light elements and organic molecular species. The Auger electron spectroscopy (AES) technique is particularly suited for high resolution mapping of the distribution of light elements, that are difficult to analyze by the X-ray based methods. (2) We report here on preliminary results obtained by employing AES imaging on small fragments of the Murchison (CM) carbonaceous chondrite matrix. The Murchison matrix was selected because it exhibits a porous texture which is similar to certain IDP. Fragments of matrix were selected and embedded in LR White resin, which is a standard embedding medium. Thin sections (~5000 Å) were cut using a microtome (Model MT-7, RMC Corporation, Tucson, Arizona) equipped with a diamond knife. Figure 1 shows in false colors a sequence of several well preserved adjacent thin sections after they were deposited on a silicon wafer square.

The samples were analyzed in a Perkin-Elmer PHI 660 AES instrument at CHARLES EVANS & ASSOCIATES. Figure 2 is an SEM map of the region analyzed. Five spots within the region were analyzed and are identified with numbers. A composite Auger electron energy spectrum for the five sampling locations is shown in Figure 3. The elements detected are C, O, Mg, Al, Si and Fe.

Figure 4 is a multi-element map of the region shown in the SEM photograph. Mg and Fe are concentrated in the area to the left, while Si predominates on the right. Quantitative analysis for major and minor elements on a submicron scale becomes possible after relative sensitivity factors have been determined from appropriate standards. Figure 5 is the Al elemental map showing elevated Al levels in area 2.

In conclusion, the use of microtomed thin sections is shown to be a viable approach to the analysis of small terrestrial or extraterrestrial samples such as IDP. An additional advantage is that the preparation of sequential thin sections allows the application of multiple characterization techniques to very small samples.

REFERENCES AND ACKNOWLEDGMENT: (1) J.P. Bradley and D.E. Brownlee, Science, 231, 1542 (1986); (2) G.P. Meeker, Meteoritics, 21 (4), 452 (1986). Supported by NASA SBIR Phase II contract NAS2-13178.

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