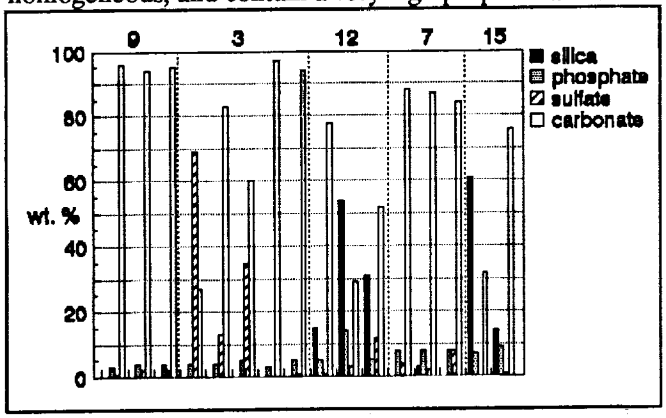
N92-12921

MICROPROBE STUDIES OF MICROTOMED PARTICLES OF "WHITE DRUSE" SALTS IN SHERGOTTITE EETA 79001; D. J. Lindstrom, Code SN2, NASA/JSC, Houston, TX 77058.

The "white druse" material in Antarctic shergottite EETA 79001 [1,2] has attracted much attention as a possible sample of Martian aqueous deposits [3,4]. Instrumental Neutron Activation Analysis (INAA) has been used to determine trace element analyses of small particles of this material (0.03-2.9 ug) obtained by hand-picking of likely grains from broken surfaces of the meteorite [5]. Unfortunately, the analyses show quite clearly that the "druse" samples actually contained substantial amounts of igneous phases (mostly pyroxene), and that the druse material itself is essentially barren of trace elements; with the exception of Na, Br, and Zn, all analyzed elements fall on mixing lines on two-element plots between zero and typical matrix values [5].

INAA is a nondestructive technique, apparently even for these rather thermally fragile samples, so after INAA, they were mounted in epoxy and partially sliced with a diamond knife microtome. The intent was to analyze the microtome slices in the transmission electron microscope, but the quality of the sections obtained was very poor due to the friability of the material and the large size of the particles compared with the cosmic dust particles for which the microtoming procedures have been developed. After partial slicing, the material remaining in the epoxy (the "potted butt") had a good surface, so electron microprobe work was attempted on areas as large as about 150x120 um. Backscattered electron images show a few mineral grains as large as 10 um, which are invariably pyroxenes. The surrounding druse is extremely fine-grained, below the resolution obtainable under normal microprobe conditions. Nonetheless, backscattered electron images show considerable variations in brightness (different average atomic numbers), and botryoidal structures have been observed. Recognizing that the surfaces were likely to be uneven, we rastered the beam at magnifications of 20-80kX (areas about 6 to 1.5 um square) during microprobe analysis. Analyses showed considerable variability, both within single particles and between different particles. In order to interpret these analyses, normative abundances of minerals observed in the druse [3,4] have been calculated. After the usual simplifications (e.g., grouping of minor Mn, Ni, and Fe with Mg), the calculations assumed: 1) all P is present as $Mg_3(PO4)_2$, 2) remaining Mg and Si are dominantly in pyroxene, with any excess Si appearing as silica, 3) all S is as $CaSO_4$, and 4) remaining Ca (plus any remaining Mg, alkalies, etc.) is present as carbonates. Analytical totals based on these calculations range from 96-108%. Data shown on the figure are renormalized after subtraction of the pyroxene, which is considered to be igneous meteorite material. Some particles (9 and 7) are quite homogeneous, and contain a very high proportion of carbonates. Separate regions in the other particles vary widely, e.g. sulfate in particle 3 ranges from less than 1% to nearly 70%. Silica contents are also quite variable, silica being present in major amounts in some analyses of particles 12 and 15, but not at all in particle 3. Phosphate abundances display a much narrower range, all but one analysis falling between 3-8 %.



Microtomed surfaces of small selected particles have been shown to be very useful in obtaining information on the texture and composition of rare lithologies like the white druse of EETA 79001. This material is clearly heterogeneous on all distance scales, so a large number of further analyses will be required to characterize it. Further characterization of these sections is in progress.

References: [1] Martinez R. and Gooding J. L. (1986) Antarctic Meteorite Newsletter 9(1), 23-29. [2] Gooding J. L. (1990) Antarctic Meteorite Newsletter 13(2), 4. [3] Gooding J. L., Wentworth S. J., and Zolensky M. E. (1988) Geochim. Cosmochim. Acta 52, 909-915. [4] Gooding J. L. and Wentworth S. J. (1991) Lunar Planet. Sci. XXII 461-2. [5] Lindstrom D. J. and Martinez R. R. (1991) Lunar Planet. Sci. XXII, 813-4.