SHOCKED CALCITE FROM AN EXPLOSION CRATER - ELECTRON PARAMAGNETIC RESONANCE, C.A. Polanskey and T.J.Ahrens, California Institute of Technology, Pasadena, CA 91125

Electron paramagnetic resonance (EPR) was used to characterize the shock pressure experienced by coral samples taken from OAK crater, a nuclear explosion crater at Eniwetok Atoll. The samples represented both material from the ejecta blanket and from drill cores within the crater. The results of this analysis will be used to relate the distribution of shock pressure to ejection velocity for the ejecta samples, and to determine the depth of the transient cavity of this explosion crater.

The behavior of the EPR spectra of Mn^{2+} in calcite has been studied previously by Vizgirda *et al.*, (1980). They found that the amplitude of the hyperfine splitting measured from second derivative spectra of coral samples from CACTUS crater, another nuclear explosion event, decreased with increasing depth beneath the crater. This effect was also demonstrated in coral samples shocked to known pressures in the laboratory. In this study several samples of Solenhofen limestone were also shocked to known pressure in order to improve upon this previous calibration.

A comparison of the portions of the spectra showing the highest field component of the limestone samples is shown as a function of magnetic field in Figure 1. The reduction in the height and broadening of the right sub-peak is more immediately obvious than the decrease in the spacing between the two sub-peaks. Although the qualitative appearance of these spectra suggests a definite progression with shock pressure, the second derivative spectra is a complex superposition of signals and does not lend itself well to direct analysis. The initial approach to analyzing the spectra was to difference each spectra with a standard spectra of single crystal calcite and then integrate the differences over the range of magnetic field. This provides a estimate of the deviation of the spectra from an unshocked sample. This technique was quite effective for the limestone samples shocked in the laboratory, and similar results are shown for the ejecta samples from OAK crater. There is a correlation of the deviation of spectra with increasing radial distance from the center of the crater as shown in Figure 2. This suggests that the more highly shocked ejecta travels greater distances and thus ejected at higher velocities. Highly shocked samples were also found near the surface of one of the reference drill cores

SHOCKED CALCITE
Polanskey, C.A. and Ahrens, T.J.

located outside the crater, and may represent samples of finer ejecta. A similar plot of integrated spectral deviation verses depth for the samples taken from two drill cores in the vicinity of ground zero show a highly shocked zone approximately 199 ft below the crater floor.

Analytic expressions of second derivative Gaussians were also fit to the laboratory shocked spectra to determine the line positions of the original signals before differentiation. Three Gaussians were fit to the data. Preliminary results show a linear relationship between the decreasing separation of the two outermost Gaussians and increasing shock pressure for the Solenhofen limestone samples.

REFERENCES

Vizgirda, J., T.J. Ahrens, and F. Tsay, Shock-induced effects in calcite from Cactus Crater, *Geochimica et Cosmochimica Acta*, 44, 1059-1069, 1980..

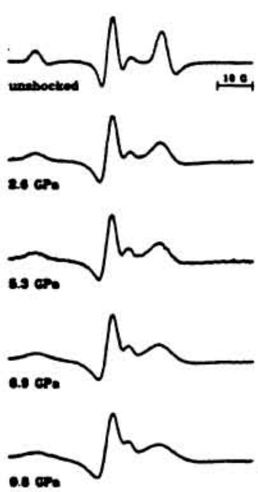

Figure 1.

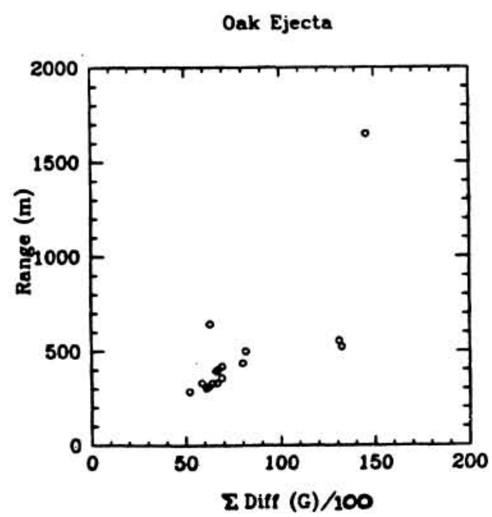

Figure 2.