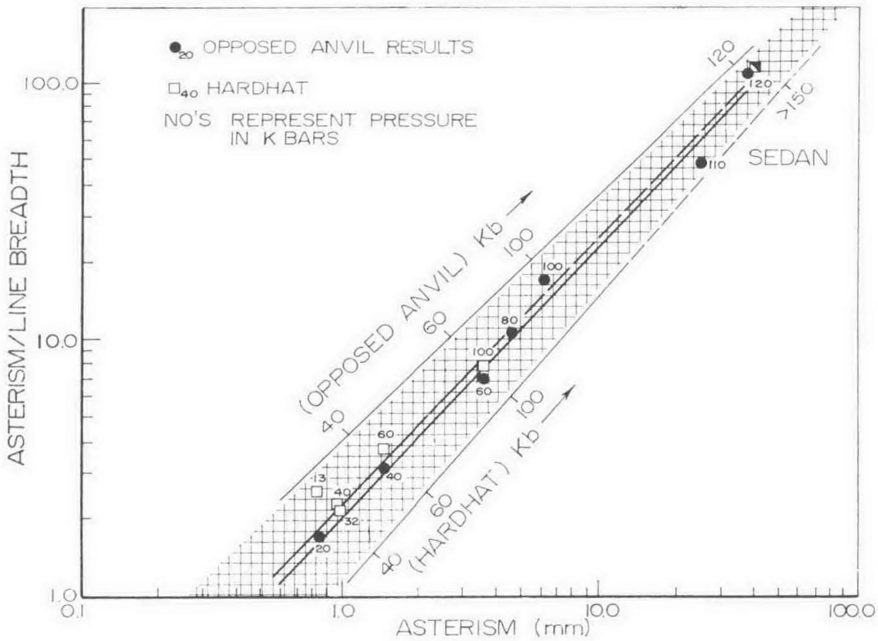

Fig. 12. Approximate but qualitatively useful relations between applied pressure and resultant asterism observed in quartz in "quasi-shock" studies with an opposed-anvil apparatus and in shock experiments.

formation) from the Handcar nuclear event. When undisturbed reference samples are not available, asterism values above 2.5 mm for single crystals of quartz should serve as an alert to the possibility that the rock has been subjected to impact. Numerous readings above this value would be highly indicative of a shock history unless obvious facts to the contrary are known.

OPTIC AXIS MEASUREMENTS IN THIN SECTION

Previously, we described how x-ray diffraction was used to demonstrate and evaluate the degree of scattering of plane normals of submicroscopic blocks which now compose crystals that have been subjected to deformation processes. In this section are discussed observations on a microscopic scale first reported by Dachille, Fauth and Vand (1964), of the scatter of optic axes of fragments or of distorted portions of single quartz crystals.

The optic axis measurements were made on standard thin sections, using a petrographic microscope with a four-axis universal stage. Initial measurements were made on specimens of typical unshocked and shocked Coconino sandstone from Meteor Crater, Arizona (the latter material, courtesy of E. M. Shoemaker). Results warranted extension of the study to other sandstones, to gneisses and quartzites from metamorphic terranes, and to material from other probable or actual meteorite impact areas.

For comparison, 25 grains obtained by selecting 5 grains along each of 5 equally-spaced traverses were measured in each sample. Optic axis orientations of only those grains whose diameter *exceeded 0.5 mm* were measured, in order to minimize the effects of uncertainties in readings, and to avoid small crystals in heterogeneous rocks which may have been shielded from pressure effects. Three measurements were made on crystals exhibiting continuous undulose extinction: as the extinction "wave" entered, passed the center, and left, the grain. On segmented crystals or on crystals with discontinuous undulose extinction (patchy extinction), the axis orientation of each segment or patch was determined.

Measurements were plotted on the lower hemisphere of a 20 cm diameter equal area net. Points plotted for each grain were enclosed by

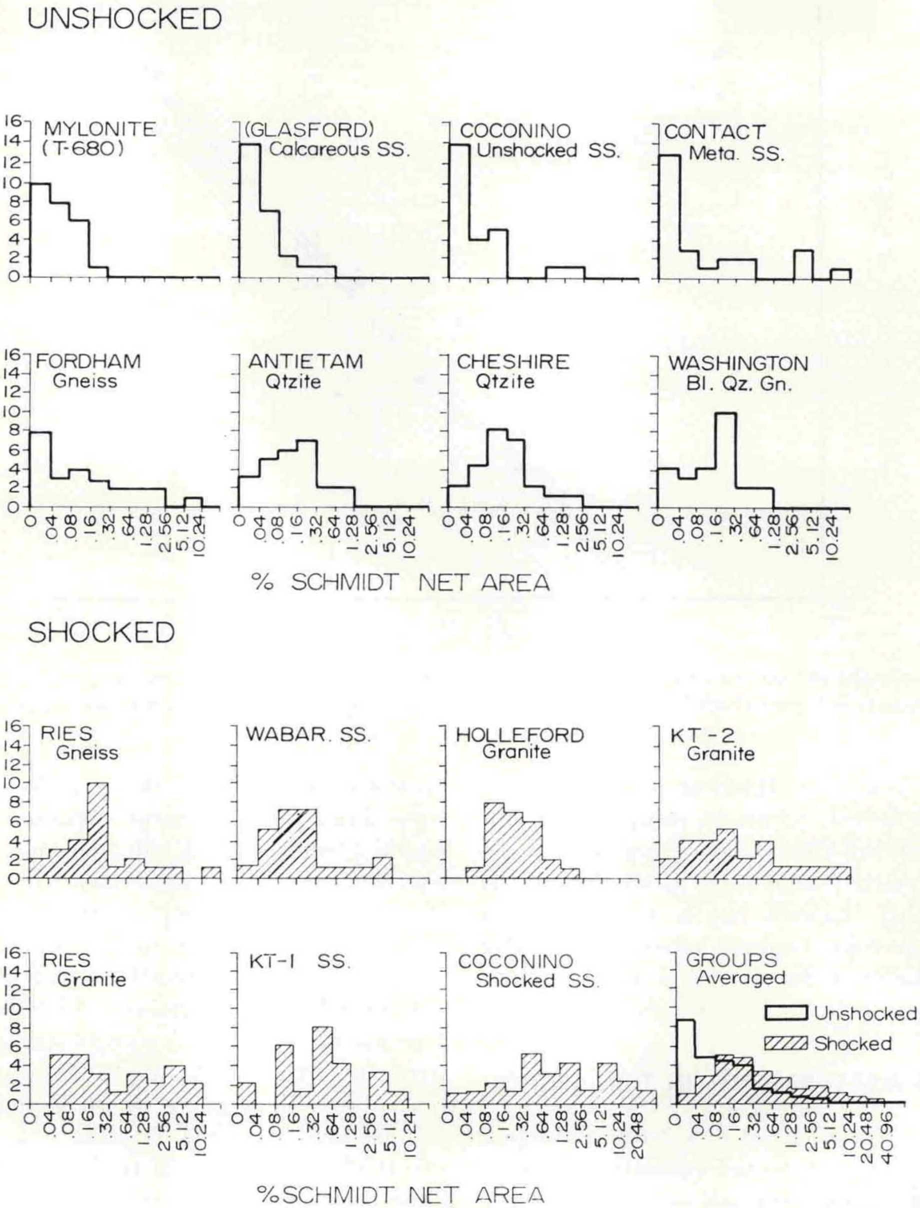

Fig. 13. Histograms which indicate some basic differences in distribution of areas of optic axis dispersal polygons of quartz crystals from both unshocked and shocked rocks. The size classes, in terms of percent of Schmidt net area, start with 0.04 to absorb basic errors of measurement. The averaged histograms in the last diagram emphasize the differences and show the smoothing to be expected from measuring a larger number of grains.

the smallest possible polygon, whose area is thus a measure of the dispersion of the optic axes produced by strain or fragmentation of the original grain. Of course, readings of grains exhibiting straight extinction plot as single points and therefore yield zero areas. For comparison of the shapes of the "dispersal" polygons, the center of each was rotated to the center of the net, but an analysis of these comparisons is not pursued in this report.