PETROGRAPHY OF A LENTICULAR QUARTZ BODY INSIDE SHATTER-CONED SCHIST: IMPLICATIONS FOR DISCUSSIONS OF PEAK SHOCK PRESSURES AT THE SANTA FE IMPACT STRUCTURE, NEW MEXICO. R. S. Harris[1], S. P. Wright[2], and S. J. Jaret[3], [1]Department of Space Sciences, Fernbank Science Center, 156 Heaton Park Drive, Atlanta, GA 30307, [2]Planetary Science Institute, 1700 East Fort Lowell, Suite 106, Tucson, AZ 85719-2395, [3]Department of Geosciences, Stony Brook University, Stony Brook, NY 11794-2100; scott.harris@fernbank.edu.

Introduction: The Santa Fe impact structure was recognized by the occurrence of abundant shatter cones that are developed in Paleoproterozoic schists and metagranitoid rocks along New Mexico Highway 475 approximately eight kilometers northeast of Santa Fe [1]. Analyses of basal and high-order Miller index decorated planar deformation features (PDFs) associated with the shatter cones led Fackelman et al. [2] to suggest peak pressures between 5 and 10 GPa. Subsequent studies [3-5] documented detrital zircon and phosphate grains that exhibit planar elements typical of pressures up to about 20 GPa. Source rocks for those grains were not identified.

We collected a conspicuous football-sized lenticular body of vein quartz (Fig. 1) enveloped in shatter-coned biotite schist during the field trip and workshop associated (http://psi.edu/santafe2017) with the 2017 Annual Meeting of the Meteoritical Society. We previously have analyzed similar quartz bodies from schists and augen gneisses at the center of the Wetumpka impact crater where shatter cone-like structures occur with feather-features and basal PDFs in quartz [6]. We proposed that the co-occurrence, partial development, or absence of feather features in this rock might better constrain the shock regime. Preliminary petrography has revealed some unexpected observations that demonstrate that higher peak pressures (>10 GPa) interpreted from detrital grains should be considered with caution.

Results. Although non-planar fluid inclusion trails are abundant and may occur as short "feather-like" projections at the boundaries between the quartz body and schist, neither well-defined planar fractures, PDFs (with one exception noted below), nor feather-features are observed thus far in the quartz. However, biotite and feldspar inclusions in the quartz do exhibit evidence of low-pressure shock deformation (<10 GPa). The micas exhibit well-developed multiple cleavages and kink banding (Fig. 2) similar to detrital Santa Fe grains reported by Colón Lugo and Cavosie [7]. Feldspars contain PDFs and extensive disordering/recrystallization (Fig. 3) like that reported by Harris et al. [8] and Jaret et al. [9] from other impact craters.

The quartz also contains abundant "outlines" of likely zircon and apatite crystals (Fig. 4). The outlines are defined by high-relief fluid inclusions or crystallites, and although we assume the phases are present, they are now in optical continuity with the host quartz. However, the traces of one to four orientations of planar features are obvious inside the "outlines" (Fig 5.)

The observation that the quartz displays extensive blocky mosaicism (Fig. 3) suggests the possibility that most of the host became diaplectic at pressures high enough to form and destroy PDFs. This possibility is supported by the recognition of isolated domains that appear to retain relict decorated planar features (Fig. 6). Taken in context with the anomalous ghost-like zircon, the quartz may have experienced pressures as high as 35-45 GPa [10]. We are investigating this farther using spectroscopic techniques. If that is the case, detached detrital grains that could have originated as inclusions within similar quartz bodies in the schist might show evidence of pressures well above the shatter cone regime. However, we suggest that this is due to amplification across the impedance boundary between the schist and vein quartz and thus is not suitable for accessing peak pressures in the context of determining size and exhumation depth of the structure.

References: [1] McElvain et al. (2007) *Geol. Soc. Am. Abstracts with Programs, 38*, 298. [2] Fackelman et al. (2008) *Earth Planet. Sci. Lett., 270*, 290-299. [3] Lugo Centeno, C.M. and Cavosie, A.J. (2015) *Proc. Lunar Planet. Sci. Conf., 45th*, 1839. [4] Montalvo, P.E. and Cavosie, A.J. (2015) *Proc. Lunar Planet. Sci. Conf., 46th*, 1337. [5] Cavoise A. (2017) *LPI Contrib. No. 1987*, 6106. [6] Harris et al. (2010) *Meteor. Planet. Sci., 45*, A5397. [7] Colón Lugo, D. and Cavosie, A.J. (2015) *Proc. Lunar Planet. Sci. Conf., 45th*, 2033. [8] Harris, R.S. et al. (2010) *AGU Meeting of the Americas*, P41A-03. [9] Jaret, S.J. et al. (2014) *Meteor. Planet. Sci., 49*, 1007-1022. [10] Wittmann, A., *Meteor. Planet. Sci., 41*, 433-454.

Acknowledgements: We appreciate the assistance of Horton Newsom (University of New Mexico) for providing additional materials from the Santa Fe impact structure for comparison. We thank the Department of Geology at the University of Georgia for access to sample preparation facilities.

Figure 1. Photograph of lenticular quartz body encased in biotite schist that contains abundant shatter cones. The sample was collected from the roadside of New Mexico Highway 475 northeast of Santa Fe.

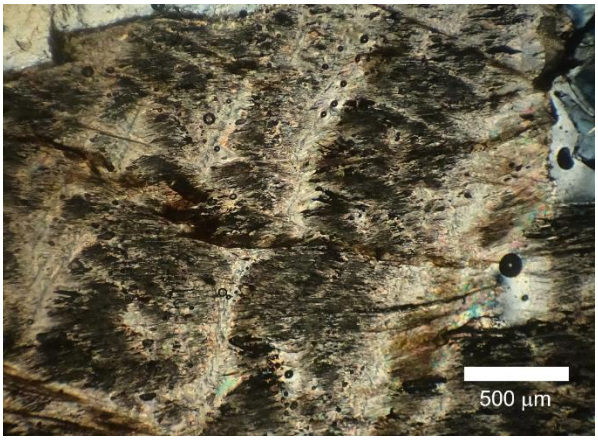

Figure 2. Cross-polarized light (XPL) photomicrograph of biotite inclusion in quartz exhibiting well-developed multiple cleavages, mechanical twinning, and extensive kink-banding.

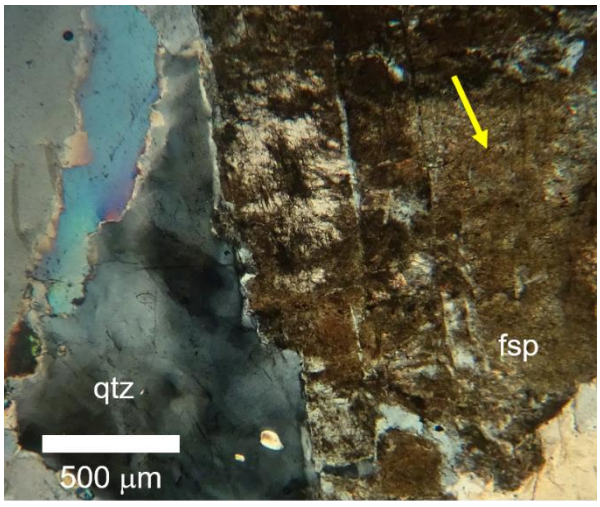

Figure 3. Cross-polarized light (XPL) photomicrograph of feldspar (fsp) inclusion in quartz body showing evidence of extensive disordering and recrystallization. Some domains (arrow) contain relict planar deformation features (PDFs). Note blocky mosaic extinction in some quartz (qtz) domains.

Figure 4. Cross-polarized light (XPL) photomicrograph of quartz containing "outlines" of crystals with zircon-like morphologies.

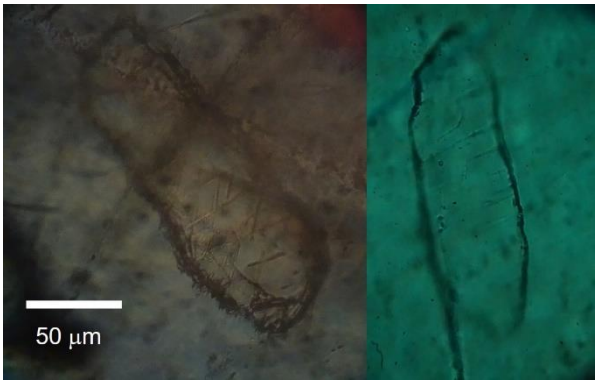

Figure 5. Cross-polarized light (XPL) photomicrographs of zircon "outlines" in quartz showing one to two sets of planar features.

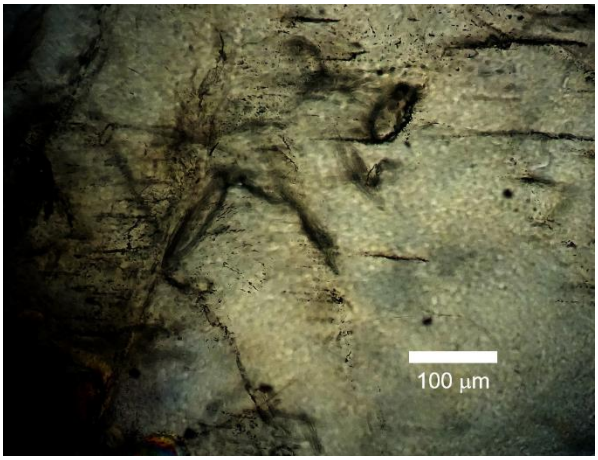

Figure 6. Cross-polarized light (XPL) photomicrograph of quartz showing zircon "outlines" and a set of possible relict decorated PDFs oriented E-W.