WOODBURY ASTROBLEME: FURTHER EVIDENCE FOR A LATE PROTEROZOIC IMPACT STRUCTURE IN WEST-CENTRAL GEORGIA, USA. E. F. Albin[1] and R. S. Harris[1], [1]Department of Space Science, Fernbank Science Center, 156 Heaton Park Drive, Atlanta, Georgia 30307 (ed.albin@fernbank.edu)

Introduction: We first used the term "Woodbury structure" to refer to a prominent raised circular depression centered at 32.92ºN, 84.54ºW within the Pine Mountain terrane of west-central Georgia [1]. Approximately 7 km wide and more than 120 m deep, "The Cove" (as the feature is called locally) is situated between the towns of Woodbury on the north and Manchester on the southwest. It is rimmed by Late Paleozoic quartzites (Hollis Quartzite) and floored by Mesoproterozoic schists and gneisses (Sparks Schist and Woodland Gneiss) (Fig. 1). The quartzites dip radially away from the center of the structure between 20 and 50 degrees, although some beds observed in the eastern rim climb vertically and slightly overturn.

Previous workers [2] first recognized the "peculiar" feature as an anticlinal dome, and some interpreted the Cove Dome as a flexural interference fold. It has been described as a "structural dome postdating development of regional metamorphic foliation."

More recently, we proposed that the Cove Dome might be the eroded remains of an asteroid impact crater [3]. Subsequent investigations identified mineralogical evidence suggesting that some rocks in the floor of the structure have been subjected to ultra-high strain rate deformation typically associated with hypervelocity collisions. We reported evidence of shock metamorphism in quartz and plagioclase inclusions in charnockitic melt rocks that crop out several kilometers south of the Dome. Consequently, they proposed that the Wacoochee Group charnockite suite formed by large-scale melting of Grenvillian basement rocks during a late Proterozoic to early Paleozoic impact. Such an event would have been much larger than the collision required to produce a 7 km-wide bowl (Fig. 1).

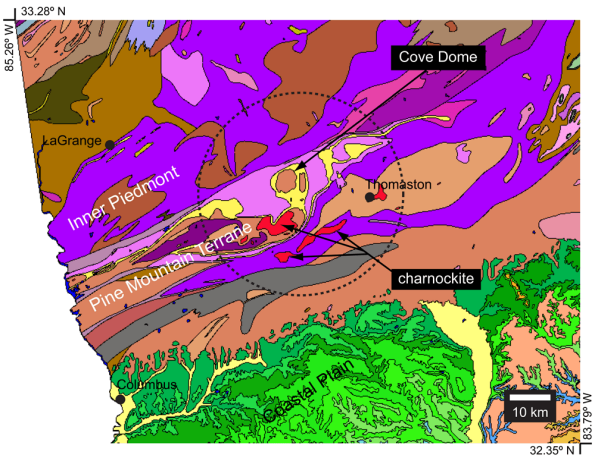

Figure 1. Geologic map of west-central Georgia showing the location of The Cove, charnockites, and the approximate dimensions of the original proposed Woodbury impact structure before Alleghanian deformation.

Evidence for Shock- Metamorphism: The most compelling evidence for shock metamorphism inside the Cove Dome comes from a 2 to 3 m-thick breccia dike that cuts across the eastern floor of the depression. The dike is composed of large quartzite clasts set in a relatively thick fine-grained polymict matrix containing small fragments of schists, gneiss, quartzite, and possibly some carbonates. Some of the quartzite clasts in the matrix contain shocked zircon inclusions, which occur with the ultra-high pressure silica polymorph, coesite.

Evidence for an Impact Melt Sheet: Approximately 63 km^2 of charnockitic rocks (quartz norites to hyperstene-bearing granites) occur in a belt of detached lobate bodies that crop out south, east, and west of the Cove Dome. Charnockitic melt rocks, which form an annulus around the southern side of the Cove Dome, contain shocked quartz and feldspar derived from granitic basement rocks. A large block of Jeff Davis Granite immersed in the charnockite contains cone-shaped strcuture that we interpret as a shatter cone in these materials. Trace element data show that the charnockites can be reasonably modeled as complete melts of Woodland Gneiss or Jeff Davis Granite [3]. They cannot be modeled easily as deep crustal partial melts. Consequently, we propose that the charnockites are the remains of a melt sheet that once surrounded the Cove Dome ring.

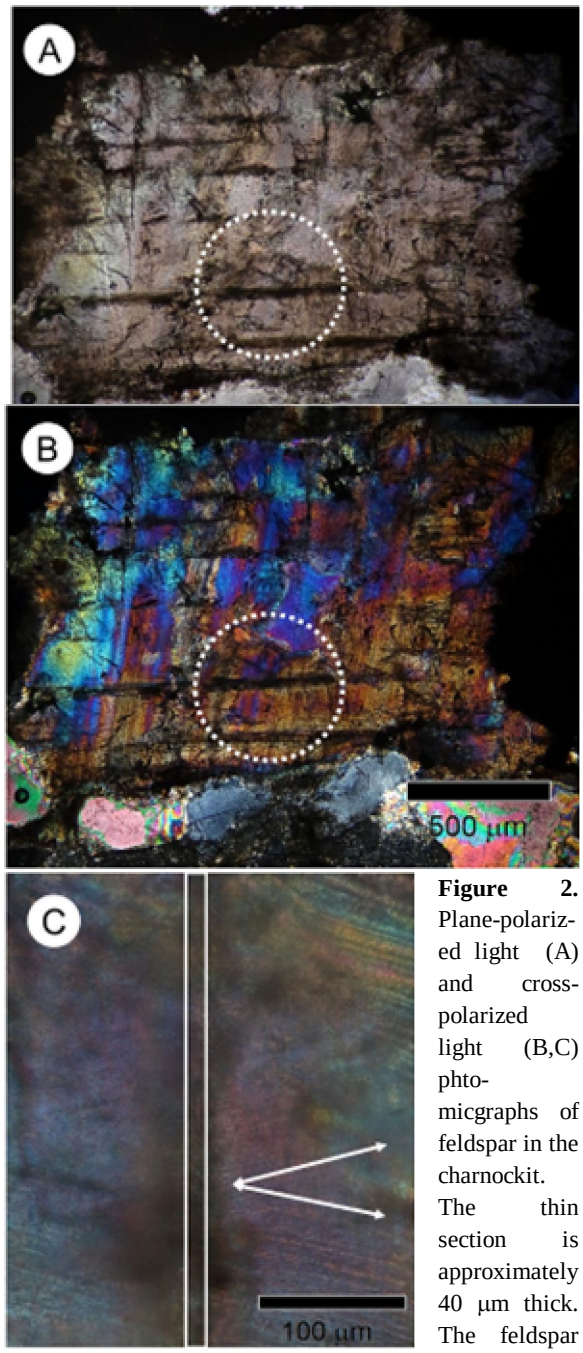

Figure 2. Plane-polarized light (A) and cross-polarized light (B,C) phto-micgraphs of feldspar in the charnockit. The thin section is approximately 40 μm thick. The feldspar exhibits mosaicism not observed in neighboring grains. A section of the crystal (dashed circled) has been broken and rotated. A close-up (C) shows at least two sets (arrows) of PDFs. The narrow dark regions between albite twins (box) appear to be compressed twins that contain their own set of short planar features stacked at low angles to the composition planes.

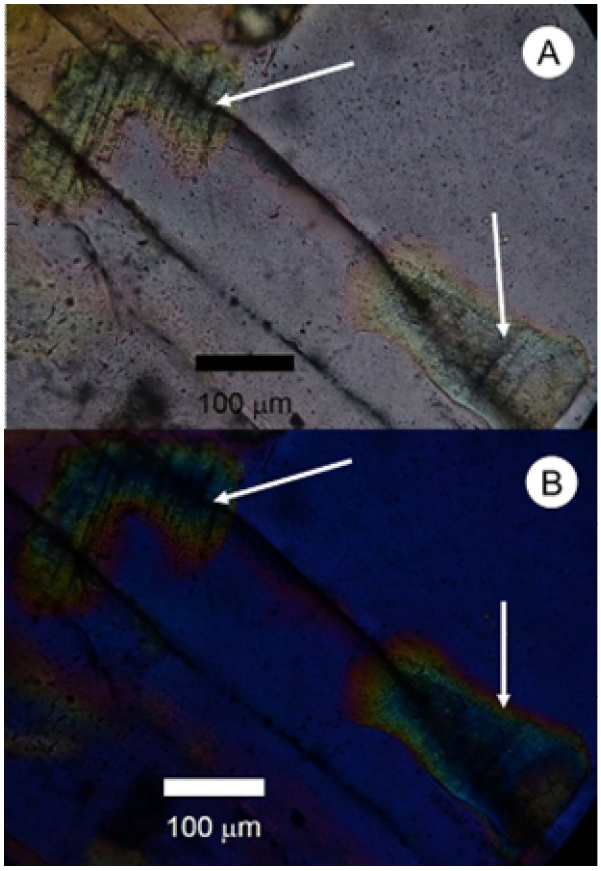

Figure 3. Plane-polarized (A) and cross-polarized light (B) photomicrographs of quartz in the charnockite. The quartz appears to be epitaxial to two relict grains that contain decorated planar features. All grains are at extinction. Note that the thin section is approximately 60 μm thick.

Discussion and Conclusions: Further petrographic investigation of the charnockite continue to illustrate that it contains a population of relict mineral that show evidence of deformation characteristic of impact shock metamorphism (Fig. 2,3).

We consider the Cove Dome to be a deeply eroded peak ring that formed at the center of a 35 to 40 km diameter impact structure. Much of the original structure would have been deformed and removed by Paleozoic tectonism as the Pine Mountain terrane docked and uplifted along the North American margin. Thus the resulting feature and the geology it has affected should be referred to as the *Woodbury astrobleme*.

References: [1] Albin E. F. et al. (2006) *LPSC, 40,* 2544. [2] Hewett D. F. and Crickmay G. W. (1937) U.S. Geological Survey Water-Supply Paper, 819, 49 p. [3] Harris R. S. (2011) Georgia Geological Society Guidebook, Volume 31, pages 29-41.