WETUMPKA'S BAILLIF HILL STRATIGRAPHIC SECTION – MIXED CRYSTALLINE AND SEDIMENTARY MEGABLOCKS AND IMPACT BRECCIA. L. W. Petruny[1], D. T. King, Jr. [1], and R. S. Harris[2]. [1]Geology Office, Auburn University, Auburn, Alabama 36849 [lpetruny@att.net; kingdat@auburn.edu], [2]Geosciences, Georgia State University, Atlanta, Georgia 30302 [rsharris@gsu.edu].

Introduction: The Wetumpka impact structure (Fig. 1) is a Late Cretaceous marine target impact feature located in central Alabama (~ 32 deg 31' N; ~ 86 deg 10' W) [1, 2, 3]. The total structural diameter is ~ 7.6 km, but the inner crystalline rim has a diameter of ~ 5 km. Wetumpka's submarine target formations included (in reverse age order): a few m of lower Mooreville Chalk, the clastic paralic Eutaw Formation, the clastic fluvial Tuscaloosa Formation, and basal weathered crystalline Piedmont metamorphic rocks. The Eutaw and Tuscaloosa sedimentary target units and clastics derived from their disintegration presently form the intra-structure terrain (unit ist in Fig. 2).

Wetumpka impact structure consists of three surficial terrains (Fig. 2), including crystalline rim, interior (intracrater sediments and broken formations), and exterior (structurally disturbed target formations).

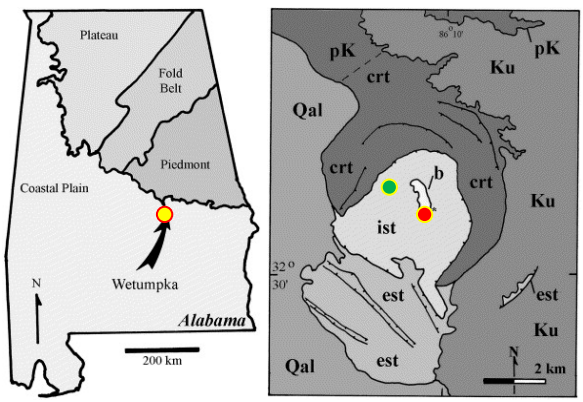

Fig. 1. Location map (left) of the Wetumpka impact structure in Alabama (yellow dot), showing major geological provinces (modified from [2]).

Fig. 2. Geological map of the Wetumpka structure (right), showing location of Baillif Hill outcrop (red dot). Map symbols: crt = crystalline-rim terrain; ist = intra-structure terrain; est = extra-structure terrain; Ku = Upper Cretaceous undeformed units; pK = pre-Cretaceous crystalline units unaffected by the impact structure; b = central impact breccias (modified from [2]). Red dot shows approximate location of Schroeder and Reeves drill-core holes; green dot shows location of Baillif Hill outcrop.

Stratigraphy: In 1998, the Schroeder and Reeves core holes were drilled near the southwestern margin of the central impact breccia outcrop area (labeled b in Fig. 2; see red dot in Fig. 2). The stratigraphy of these centrally located core holes, both ~ 200 m deep, showed a similar sequence of ~ 100 m of mixed crystalline and sedimentary megablocks with polymict impact breccia matrix, which was overlain by ~ 100 m of slumped sedimentary target megablocks (i.e., identifiable megablocks derived from the Eutaw Formation and Tuscaloosa Group) [1, 2].

Stratigraphy of the Baillif Hill outcrop (green dot in Fig. 2) consists of ~ 40 m of mixed crystalline and sedimentary megablocks with polymict impact breccias (Fig. 3, upper part). The stratigraphy of Baillif Hill is similar to the lower ~ 100-m thick unit in the Schroeder and Reeves drill-core holes, as described above. However, at Baillif Hill, this lower unit is at the surface, whereas it is ~ 100 m deep at the Schroeder and Reeves drill-core holes. The top of Baillif Hill is ~ 140 m above sea level, and the spudded level of the Schroeder and Reeves drill-core holes is approximately the same elevation. Thus, the upper ~ 100-m thick unit in the two drill-core holes is entirely missing at Baillif Hill.

Shock effects at Baillif Hill: Shocked quartz as fine sand and silt grains within the matrix of impact breccias has been previously reported at Wetumpka impact structure from the lower breccias of the Schroeder and Reeves wells [2] and from central breccia outcrops [4]. At Baillif Hill, we noted shock effects in quartzite pebbles. These pebbles, which probably derive from quartzite veins in the target basement metamorphic rocks, are found in impact breccias at Baillif Hill. The pebbles have a 1-2 cm, white rind of highly fractured quartz and an interior grey, translucent area (Fig. 3, lower parts). Thin sections of the interior part of these pebbles shows many PDFs, which are strongly related to larger planar fractures in large quartz crystals. These features have been referred to previously as "feather features" [4, 5, 6]. Study of these PDFs from Baillif Hill is ongoing.

References: [1] King D. T. Jr. et al. (2002) *EPSL 202*, 541-549. [2] King D. T. Jr. et al. (2003) *Cratering in marine environments and on ice*, Springer-Verlag, Berlin, 97-113. [3] King D. T. Jr. et al. (2006) *MAPS 41*, 1625-1631. [4] Morrow J. R. and King D. T. Jr. (2007) *GSA Field Forum*. [5] Morrow J. R. and King D. T. Jr. (2007) *Met. Soc. 70*, abstract #5009. [6] Poelchau M. H. and Kenkmann T. (2010) *LPI 41*, abstract #1987.

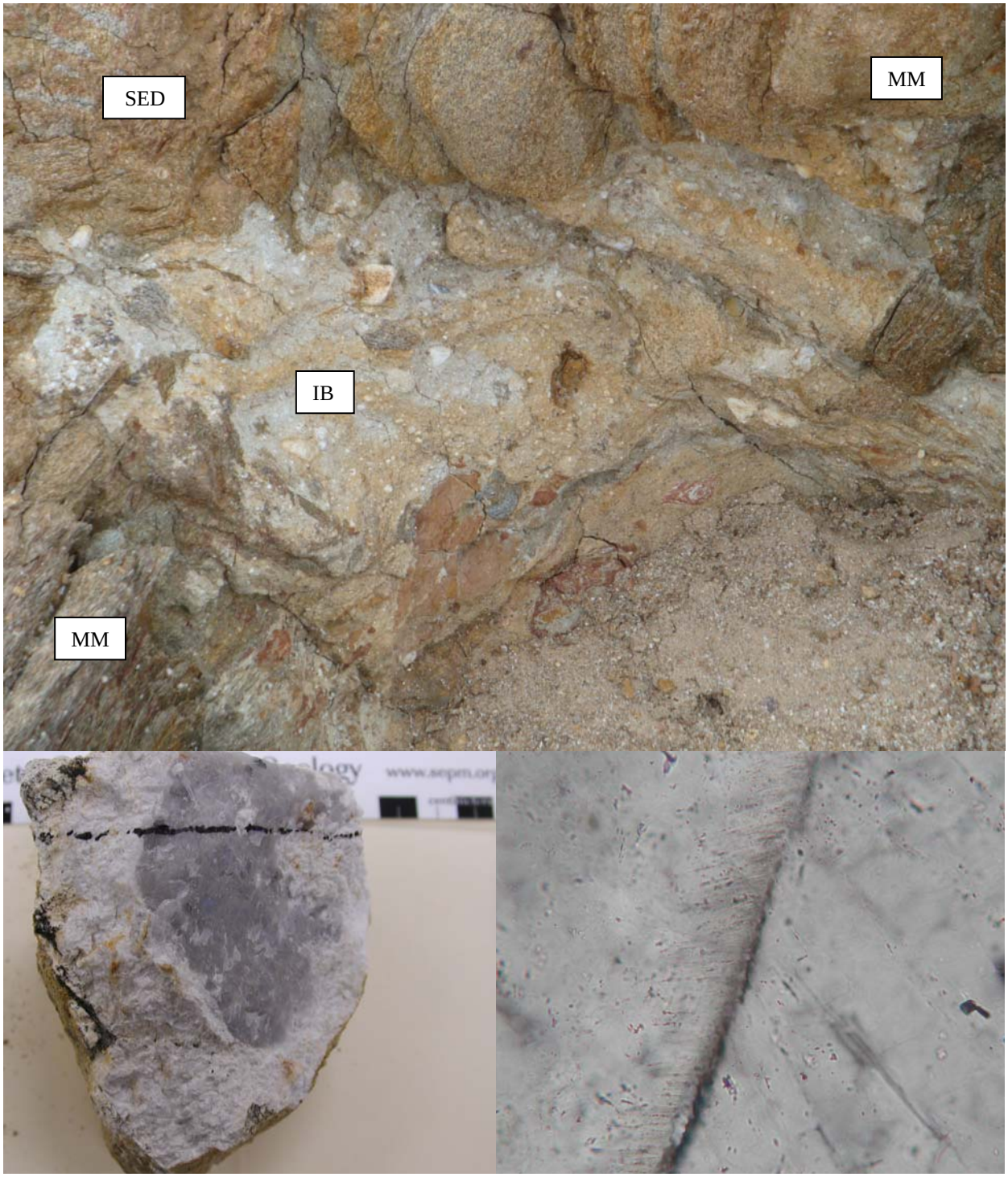

Fig. 3. Upper part – outcrop in gulley at ~ 7 m in Baillif Hill section showing all three of the main lithologies: impact breccia (IB) and sedimentary (SED) and metamorphic (MM) blocks, which are ~ 5 m across. Width of field of view is ~ 50 cm. Lower parts – Left: ~ 8 cm quartizite pebble from impact breccias (like IB above) showing white rim and grey, translucent central area. Scale in upper right is in cm. Right: thin section view of quartz PDFs related to fracture plane forming a "feather structure." Thin section was made from central grey, translucent area of similar quartzite pebble taken from Baillif Hill outcrop. Width of field of view is ~ 50 microns. Crossed polars.

Acknowledgement: Work was supported in part by NASA grant NNX09AD90G.