CHESAPEAKE BAY IMPACT CRATER: SEISMOSTRATIGRAPHY AND LITHO-STRATIGRAPHY OF DISPLACED SEDIMENTARY MEGABLOCKS. C. Wylie Poag, USGS, Woods Hole, MA 02543, Gregory S. Gohn and David S. Powars, USGS, 12201 Sunrise Valley Drive, Reston, VA 20192.

More than 2000 km of seismic reflection profiles [1,2,3] and two deep coreholes to crystalline basement (634-728 m drill depth) [4,5,6] allow us to document the structure and morphology of the Chesapeake Bay impact crater. Seismic profiles show that kilometer-sized blocks of stratified target sediments (mainly sand, silt, and clay) underlie a thick column of impact breccia in the crater's flat-floored annular trough (Fig. 1). Many of the megablocks display tilted (rotated) stratal reflections, whose geometries indicate physical detachment of the megablocks from the surface of the underlying crystalline basement. Other megablocks with horizontal stratal reflections (no tilting or rotation) appear to have dropped vertically as their bases underwent shock collapse. Seismostratigraphic signatures of distinct reflection packages within the megablocks suggest that Cenozoic target sediments have been stripped from the tops of most megablocks [1; Fig. 1]. As a result, the megablocks appear to be composed almost entirely of Cretaceous (mainly Lower Cretaceous) sediments.

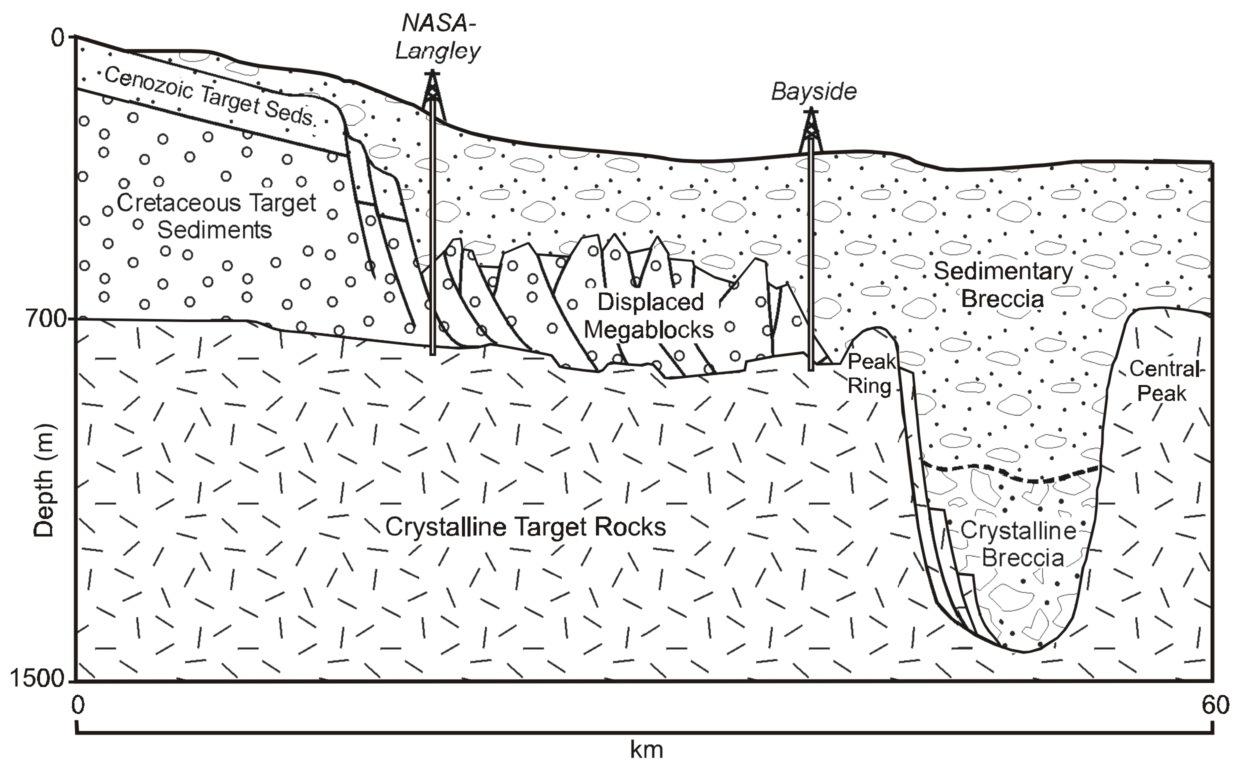

Figure 1. Conceptual cross section of western half of Chesapeake Bay impact crater. Postimpact sediments removed. Scales approximate.

Two deep coreholes recently completed (NASA-Langley 2000, Bayside 2001; Fig. 1) by the USGS and its collaborators (Hampton Roads Planning District Commission, NASA Langley Research Center, Virginia Department of Environmental Quality, Geology Department of the College of William and Mary) were designed, in part, to document the composition, thickness, and age of these megablocks and to provide ground truth regarding displacement mechanisms [4,5,6]. The cores show first of all, a marked contrast between the lithic composition of the stratified megablocks and the stratigraphically scrambled sedimentary breccia overlying the megablocks. Typically, individual clasts within much of the breccia are supported by a matrix of glauconite-quartz sand [2,4,7]. The relative volume of matrix versus clasts ranges from ~98 percent at the top of the sedimentary breccia to ~1 percent near its base. This ubiquitous breccia matrix derives its glauconite from crushed and thoroughly mixed Cenozoic target sediments (mainly Paleocene beds), which in some localities are so glauconite rich as to be classified as greensands. In contrast, but in agreement with our seismostratigraphic inferences, cores from the stratified megablocks contain virtually no glauconite.

Second, cores from the megablocks contain lithic components known elsewhere in the Virginia Coastal Plain only from Lower Cretaceous strata. Furthermore, only Cretaceous microfossils (mainly palynomorphs) have been extracted from the megablocks.

Third, some cores from the megablocks display evidence of extreme intrablock deformation. Finely comminuted breccias, injection features, and near-vertical interclast boundaries are common indicators of strong internal stresses within the shifting megablocks.

Fourth, the basal several meters of the megablock interval consists of structureless massive sands, highly fractured scaly clays, and bright, varicolored glauconite-free breccias. We interpret this basal interval as a zone of shock-generated collapse and lateral displacement (a décollement), which detaches the megablocks from the surface of the crystalline basement. The concurrence of seismostratigraphic and borehole interpretations allows us to confidently extrapolate megablock relationships along seismic profiles tens of kilometers away from the boreholes.

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