HIGH-RESOLUTION SEISMIC REFLECTION IMAGES SPANNING THE 1.76-KM-DEEP ICDP-USGS EYREVILLE COREHOLES WITHIN THE MOAT OF THE CHESAPEAKE BAY IMPACT STRUCTURE. D. S. Powars[1], R. D. Catchings[2], G. S. Gohn[1], J. W. Horton Jr.[1], [1]U.S. Geological Survey, 926A National Center, Reston, VA 20192, dspowars@usgs.gov, [2]U.S. Geological Survey, 345 Middlefield Rd., MS 977, Menlo Park, CA 94857, catchings@usgs.gov.

Introduction: In 2006, the USGS acquired two 1.4-km-long, high-resolution seismic reflection and refraction profiles (5-m source and geophone spacing) across the 1.76-km-deep, ICDP-USGS Eyreville coreholes (EC) [1,2]. These images provide semi-3D, detailed views of the stratigraphy and structure of the upper 1.0 km of the central part of the 14-km-wide moat that surrounds the 10-km-wide central uplift (north-south axis) within the central crater of the Chesapeake Bay impact structure (CBIS) [3,4]. These images locally complement the upper parts of a USGS 30-km-long, deep, low-resolution seismic profile acquired in 2004 across the northern half of the central crater of the Chesapeake Bay impact structure (CBIS) [4]. The upper 656 m of impactites penetrated by the EC have been broadly subdivided into four lithostratigraphic units, in descending order: (1) a matrix-supported, sediment- and crystalline-clast oscillation-resurge breccia; (2) a matrix-supported, sediment-and crystalline-clast antiresurge to oscillation-resurge breccia; (3) a clast- and block-supported, sediment-clast resurge to antiresurge breccia; and (4) a block-supported, sediment avalanche deposit [5,6].

High-Resolution Seismic and Core Correlation: Preliminary data processing and analysis indicate excellent correlation of the seismic images with the EC, including individual block and impact-debris patterns in the upper 300 to 400 m of the impactites that reveal a multidirectional emplacement. Variations in reflection patterns correspond to variations in conditions and processes within the central crater during impact and are consistent with deposition by resurge, antiresurge and oscillation-resurge wave interactions for these upper impactites.

Postimpact sediments. Continuous reflections, including reflections that dip into a paleochannel, characterize the top 60 m and correlate with Pliocene to late Pleistocene shallow-marine to fluvial-paludal sands and basal gravels. Short to relatively continuous reflections form a series of prograding clinoforms that correlate with upper Miocene shelly sands in the EC from 90 to 60 m depth. Strong, mostly continuous, subhorizontal reflections typical of marine strata represent the postimpact sediment units (upper Eocene to upper Miocene) identified in the EC from 444 to 90 m depth. On the 30-km-long, low-resolution seismic profile, the postimpact strata dip toward, and thicken above, the center of the moat with relatively minor disruption.

Synimpact breccias. In contrast with the postimpact reflectors, the upper 50 to 75 m of synimpact deposits are represented by subhorizontal, overlapping-to-shingled reflections that dip and pinch out in various directions and correlate with multiple fining-upward sequences in matrix-supported breccia of the EC (527 to 444 m depth). These shingled units are interpreted as deposits formed by multiple resurge-wave reverberations. Seismic signatures vary laterally in the underlying 200- to 300-m-thick section of the moat, and the reflections are highly disrupted. This interval has discontinuous, chaotic reflections that bound relatively continuous lenses that truncate, overlap, and pinch out in multiple directions and correlate with resurge breccias in the EC (618 to 527 m depth). These units are underlain by relatively continuous reflections that pinch out in various directions as well as chaotic, discontinuous reflections, some of which show imbrication. This interval correlates with clast-supported, sediment-clast breccias assigned to the lower resurge section in the EC (867 to 618 m depth). Until further processing is done the deeper reflections are too poorly resolved to characterize the underlying sediment-avalanche deposit (1,096 to 867 m depth).

High- and Low-Resolution Seismic Correlation: Local correlation with the 30-km-long low-resolution seismic profile shows that four strong reflections correlate with the upper 656 m of impactites. These reflections represent, in descending order: (1) the lower 65 m of the shingled, matrix-supported, sediment- and crystalline-clast oscillation-resurge unit; (2) the upper 60 m of the more chaotic clast-supported, sediment-clast antiresurge to resurge unit; (3) 55 m of liquefied sand in the lower half of the clast-supported, sediment-clast resurge unit; (4) and the lower 100 m of the clast-supported, sediment-clast breccia unit interpreted as sediment avalanche from collapse of the upper part of the transient crater-wall. Across the inner part of the moat the upper three strong reflectors dip away from the central uplift into the central part of the moat, suggesting either an antiresurge or postdepositional movement of these units away from the central uplift. The lowest reflector dips from the opposite direction inward from the central-crater rim to the central part of the moat and is consistent with a transient crater-wall avalanche interpretation.

Collectively, the seismic images suggest that the upper impactites in the central crater are highly variable laterally, with similar units at different depths deposited from multiple directions at multiple times.

References: [1] Catchings, R. D. et al. (2007) *GSA Abstracts 39(6)*, 450. [2] Powars, D. S. et al. (2007) *GSA Abstracts 39(6)*, 533. [3] Powars, D. S. et al. (2007) *EOS 88(52)*, Fall Meet. Suppl., Abstract U21E-07. [4] Catchings, R. D. et al., (2007) *EOS*, *88(52)*, Fall Meet. Suppl., Abstract U21E-06. [5] Gohn, G. S. et al. (2007) *GSA Abstracts*, *39(6)*, *532*. [6] Powars, D. S. et al. (2007) *GSA Abstracts*, *39(6)*, *314*.