



## Chesapeake Bay Impact Structure Deep Drilling Project

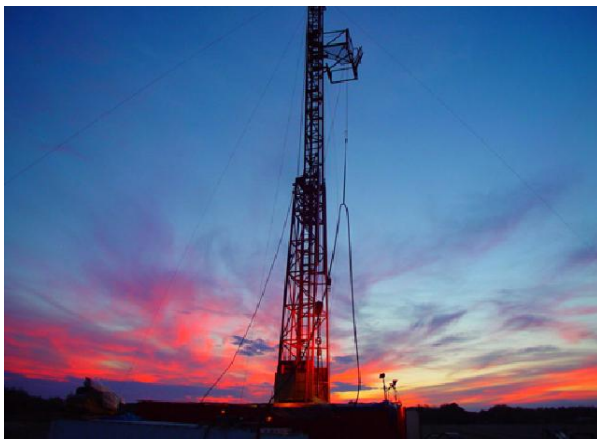
Virginia, USA



### Goal & Scientific Objective

Drilling in the central Chesapeake Bay crater will provide important constraints on cratering processes in multi-layered marine targets in general and for comparison with results from the larger Chicxulub crater. Important features to be addressed are crater structure, crater materials and physical properties, salinity and other chemical attributes of ground water for water-resource management purposes, and the post-impact hydrogeologic history of the crater including any hydrothermal system.

Post-impact studies comprise the impact-produced local biotic crisis and recovery and the physical transition from high-energy impact environments to the normal shelf environment, the effects of impact cratering relative to other tectonic, sea-level, climate, and sediment-supply effects on the long-term evolution of the mid-Atlantic continental margin, and deep biosphere studies.



*Eyreville drilling site*

### Operational Achievements

Three boreholes were drilled at the Eyreville site in several stages.

Eyreville A was drilled to a total depth of 940.9 m.

Eyreville B was derived from borehole A at 737.6 m depth and goes down to 1766.3 m total depth.

Eyreville C was drilled down to 140.2 m.

### Web & Media Resources

<http://chesapeake.icdp-online.org>

### Timeline

2004 ICDP proposal submission

2005 (September – December) and 2006 (April – May) drilling operations

### Principal Investigators

Gregory S. Gohn, U.S. Geological Survey at Reston

Christian Koeberl, University of Vienna

Kenneth G. Miller, Rutgers University

Wolf Uwe Reimold, Humboldt University Berlin

### Data & Sample Access

Sedimentary, Magmatic and Impact Rocks are stored at the U.S. Geological Survey at Reston.

## Scientific Findings

1322 m of crater materials and 444 m of overlying postimpact Eocene to Pleistocene sediments have been recovered by scientific drilling.

The crater section consists (from bottom to top) of basement-derived blocks of crystalline rocks, a section of suevite, impact melt rock, lithic impact breccia, and cataclasites, a thin interval of quartz sand and lithic blocks, a granite megablock, sediment blocks and boulders, polymict, sediment-clast-dominated sedimentary breccias, and a thin upper section of stratified sediments.

The near-absence of shock metamorphism in the basal schist-pegmatite-granite unit suggests that the corehole did not reach the presumably shocked in situ crater floor, but instead sampled basement-rock blocks that slumped from higher on the transient-cavity wall toward the center of the cavity.

Chemical, isotopic and physical evidence have concluded that the saline water currently present in the Chesapeake Bay impact crater's resurge breccia and crystalline blocks is a remnant of Early Cretaceous North Atlantic sea water with an average salinity twice that of modern sea water.

Given that several other locations along the North American Atlantic Coastal Plain have salinities greater than that of sea water at depth, we believe remnants of ECNA sea water probably persist at many other locations along the Atlantic margin as well.

## Key Publications

Sanford, W.E.; Doughten, M.W.; Coplen, T.B.; Hunt, A.G.; Bullen, T.D. (2013): Evidence for high salinity of Early Cretaceous sea water from the Chesapeake Bay crater. *Nature letter*.

doi:10.1038/nature12714

Geological Society of America, Special Paper:

Gohn, G.S.; Koeberl, C.; Miller, K.G.; Reimold, W.U. (eds.) (2009): The ICDP-USGS Deep Drilling Project in the Chesapeake Bay Impact Structure: Results from the Eyreville Core Holes. 458 839-865

Gohn, G.S.; Koeberl, C.; Miller, K.G.; Reimold, W.U.; Browning, J.V.; Cockell, C.S.; Horton, J.W.Jr.; Kenkmann, T.; Kulpecz, A.A.; Powars, D.S.; Sanford, W.E.; Voytek, M.A. (2008): Deep drilling into the Chesapeake Bay impact structure. *Science* 320 1740-1745.

doi:10.1126/science.1158708

Gohn, G.S.; Koeberl, C.; Miller, K.G.; Reimold, W.U.; Schientific Staff of the Chesapeake Bay Impact Structure Drilling Project (2006): Chesapeake Bay Impact Structure Deep Drilling Project Completes Coring. *Scientific Drilling* 3 34-37. doi:10.2204/iodp.sd.3.07.2006

Gohn, G.S.; Koeberl, C.; Miller, K.G.; Reimold, W.U.; Cockell, C.S.; Horton Jr., J.W.; Sanford, W.E.; Voytek, M.A. (2006): Chesapeake Bay Impact Structure Drilled. *Eos, Transactions, American Geophysical Union* 87(35) 349 355



*Variably brecciated schist (top) and lithic breccia (bottom) from a depth of about 1,606 m.*