

Petrographic and geochemical studies of impact breccia from the Eyreville drill core, Chesapeake Bay impact structure, USA.

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The Chesapeake Bay impact structure, 35.5 Ma old and 85 km in diameter, is one of the largest and best preserved impact structures on Earth. It was drilled in the central part in 2005-2006 by ICDP (International Continental Scientific Drilling Program) and USGS (United States Geological Survey) [1]. At Eyreville, the crater fill comprises sediment-clast breccia and sedimentary megablocks of the Exmore Beds, a granitic and an amphibolitic megablock, gravelly sand, suevitic impact breccia (a polymict, melt-bearing breccia), and granite/pegmatite and mica schist [1].

We performed petrographic and geochemical investigations of 43 samples of suevite, impact melt rock, polymict lithic impact breccia, cataclastic gneiss, and clasts in suevite, from the impact breccia section of the depth interval 1397-1551 m of the Eyreville B drill core. The impact breccia consists mainly of suevite. The suevite displays a grayish matrix with various mineral and lithic clasts (including metamorphic, igneous, and sedimentary lithologies) and melt particles. The amount of melt particles generally decreases with increasing depth. The suevite contains two intercalations of impact melt rock in the upper part and abundant large blocks of cataclastic gneiss in the lower part. Various shock metamorphic and related features have been observed in suevite, including abundant planar fractures (PFs) and planar deformation features (PDFs) in quartz, toasted appearance of quartz, ballen quartz, rare kink-banding in mica, and extremely rare PDFs in feldspar. Evidence of hydrothermal alteration, as the presence of smectite and secondary carbonate veins, was observed especially in the lower parts of the impact breccia section. Chemical composition does not vary much in the upper part of the impact breccia section (above ~1450 m), whereas in the lower part, larger differences occur, which is in agreement with decreasing homogeneity (in terms of increasing clast-size) with increasing depth. The impact breccias show a decrease in the content of SiO₂ combined with a slight increase of the abundances of TiO₂, Al₂O₃, and Fe₂O₃ with increasing depth, which might be caused by an increase of the gneiss/schist component with depth. Concentrations of siderophile elements (e.g., Co, Ni) are lower in the suevite than in the basement schists and do not suggest presence of a meteoritic component.

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