ALTERATION OF IMPACTITES FROM THE CHESAPEAKE BAY IMPACT STRUCTURE, USA.

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The Chesapeake Bay impact structure, 35.5 Ma and 85 km in diameter, was drilled in 2005/6 during an ICDP-USGS drilling project. The Eyreville drill core penetrated through post-impact sediments and impactites, into fractured crystalline basement to a total depth of 1766 m [1]. The section of suevites and lithic impact breccias (SLIB) was cored at 1397-1551 m depth [2].

Detailed petrographic and chemical analyses were performed on 43 samples from the SLIB section. The suevites are most melt-rich in the upper part, where they locally grade into impact melt rocks. Below 1474 m the suevites are melt-poor and grade into polymict lithic breccias, intercalated with large blocks of cataclastic gneiss.

The impactites from the Eyreville drillcore show evidence of hydrothermal alteration. Most melt particles in suevite are altered to phyllosilicate minerals and, rarely, replaced by secondary carbonate; only near the top of the section (at around 1415 m) unaltered glass particles were found. The impactites contain some secondary carbonate veins and patches and also rare secondary opaque minerals, mostly pyrite. The carbonate veins, which were found mostly in the lower parts of the section and also in the cataclastic schist below, have $\delta^{13}C$ values of -7 ‰. The lower $\delta^{13}C$ value of the carbonate veins compared to limestone indicates hydrothermal or diagenetic origin. Smectite, a mineral typical for hydrothermal alteration, was confirmed by XRD in the suevites and was probably formed by alteration of melt. Amygdules filled with zeolites were observed in the melt-rich parts. The notable alteration of feldspar and the chloritization of mica are interpreted to be possibly of pre-impact age, as similar alteration exists in the crystalline basement rocks. The quartz grains in the impactites show abundant PDFs, which are commonly decorated with tiny fluid inclusions. The decoration of PDFs in quartz may also be a consequence of hydrothermal alteration [3]. The loss on ignition (LOI) increases with increasing depth and does not correlate with the CaO content. This suggests that the LOI is caused mostly by presence of organic matter, as well as structurally bound water in phyllosilicate minerals, and carbonates are not very significant. The increase of LOI with depth might imply increase of alteration, but can be also due to an increasing schist component with abundant mica in the SLIB interval with depth. Hydrothermal alteration was observed in samples from the STP drill core near the center of the Chesapeake Bay structure [3]. Temperatures of hydrothermal fluids reached the boiling point of seawater (~220°C at 300 m water depth), but were lower than 550°C [4].

References: [1] Gohn G. S. et al. 2006. *EOS* 87, 349 & 355. [2] Horton J. W. et al. 2007. *Geological Society of America Abstracts with Programs*, 39 (6), 314. [3] Horton J. W. et al. 2005. Abstract #2003. 36th Lunar & Planetary Science Conference. [4] Horton J. W. et al. 2006. *Geological Society of America Abstracts with Programs*, 38 (7), 59.