Geophysical Research Abstracts,
Vol. 11, EGU2009-3412, 2009
EGU General Assembly 2009

Shock metamorphic studies on suevite from the ICDP-USGS Eyreville drill core, Chesapeake Bay impact structure, Virginia, USA.

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The Chesapeake Bay impact structure (85 km in diameter and 35 Ma old) belongs to the largest and best preserved impact structures on Earth [1]. In 2005–2006, three cores were drilled as part of the International ICDP-USGS Chesapeake Bay impact structure drilling project, at Eyreville farm, in Northampton County (Virginia). The lithologies cored from top to bottom comprise sedimentary-clast breccia and sedimentary blocks of the Exmore beds, a granitic and an amphibolitic megablock, gravelly sand, impact breccia, and granite/pegmatite and mica schist [1]. A stratigraphic column for the impact breccia section was established by [2].

Shock metamorphic effects in rock and mineral clasts were studied in the impact breccia section of the drill core (1397–1551 m; e.g., [3]). Rare shocked quartz grains and relatively abundant melt particles, mostly concentrated in specific depth intervals, were found also in the Exmore breccia [4]. The shock and related features in the minerals of the impact breccia interval comprise abundant planar deformation features (PDFs) and rare planar fractures (PFs) in quartz, ballen quartz, rare PDFs in feldspar, and (not shock diagnostic) kink banding in mica. Also melt particles are very abundant, especially in the upper part of the impact breccia section. Previous investigations of the proportions of shocked quartz grains (i.e., grains with PFs and/or PDFs) did not reveal any trends with depth [3], but noted that the average proportion of shocked grains in sedimentary clasts was higher compared to the crystalline clasts [3]. Here we present a more detailed study investigating the relative proportions of shocked quartz grains in clasts (of different lithologies) in suevite samples. The clasts show different proportions of shocked quartz grains, from 0 to about 60 rel% of all quartz grains. Generally, clasts with higher proportion of shocked quartz grains become less abundant with increasing depth. Clasts with more abundant shocked quartz grains were noted especially in the upper part of the impact breccia section (above $\sim$1450 m). Polycrystalline quartz clasts are relatively more shocked. Slightly metamorphosed clasts (i.e., metasandstones) and schist/gneiss clasts are relatively less shocked. The quartz grains display (under the optical microscope) mostly one or two, rarely three or more, sets of PDFs per grain. First results of the universal stage measurements show that the most common crystallographic orientation of PDFs is the $\{10\bar{1}3\}$ orientation. Also the $\{10\bar{1}4\}$ and basal (0001) orientations were noted. This implies the investigated clasts were moderately shocked, probably at 10–20 GPa [5].

Acknowledgments: The drilling at Eyreville was supported by ICDP, USGS, and NASA. The present work was supported by the Austrian Science Foundation FWF, project P18862-N10 (to C.K.).

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