CLAST CHARACTERISTICS IN THE SUEVITIC AND LITHIC BRECCIAS FROM THE ICDP-USGS EYREVILLE B DRILLCORE, CHESAPEAKE BAY IMPACT STRUCTURE, VIRGINIA, USA. L.C. Jolly1, R.L. Gibson1, W.U. Reimold2, J.W. Horton Jr.3.1Impact Cratering Research Group, School of Geosciences, University of the Witwatersrand, Private Bag 3, PO WITS, Johannesburg 2050, South Africa, lcjolly@yahoo.com. 2Museum of Natural History (Mineralogy), Humboldt University, Invalidenstrasse 43, Berlin, D-10115, Germany. 3U.S Geological Survey, MS 926A, 12201 Sunrise Valley Drive, Reston, VA 20192 USA.

Introduction: The Chesapeake Bay impact structure is a late Eocene complex crater that formed in a predominantly siliciclastic, continental shelf environment on the Atlantic margin of Virginia, United States [1]. This buried structure is the seventh largest and one of the best preserved on Earth [1]. In 2005-2006, three coreholes (A, B, C) were drilled as part of the ICDP-USGS drilling project. The Eyreville B core, which reached a depth of 1766.2 m, was drilled in the annular moat within the collapsed transient cavity and comprises post-impact sediments, sediment-clast breccia and lithic blocks, a large granitic and smaller amphibolitic megablock, gravelly sand, a thick sequence of suevitic and lithic breccias that also contain cataclastic gneiss blocks, and a basal section comprising granites/pegmatites and mica schists [2]. The 154 m thick suevitic and lithic breccia sequence that was recovered from depths of 1397.16 to 1551.19 m is the subject of this study, which involved macroscopic and hand-lens description of clasts in the core and more detailed analysis of thin sections from 70 samples. Only the lithic and mineral clasts are considered in the present study; the melt clasts are the subject of separate investigations (e.g., [5]). In total, some 1400 clasts over the entire breccia sequence were examined and precise shape and size data collected.

Results: The breccias comprise an upper, melt-rich, portion and a lower portion that is dominated by polymict and monomict lithic breccias [1, 5] and that contains less matrix material. Clasts of cataclased quartzofeldspathic gneiss up to several metres across are found in the lower section. Preliminary analysis of the >4 cm clast population (i.e., clasts larger than the nominal 4.7 cm core diameter) indicates a preponderance of lithologies seen in the underlying crystalline basement section (granitoid, mica schist, and rare mafic and felsic orthogneiss) and that the proportion of the large clasts increases with depth. Overall, approximately 60% of the large clasts are derived from the medium- to high-grade crystalline rocks. The remainder of the large clasts are made up predominantly of 30% sedimentary rock (arkosic grit) and 10% phyllite. In contrast to the large clasts, the clast population below 4 cm diameter is dominated by 57% fine-grained sedimentary rocks (shale and silty claystone), with 25% comprising igneous components (granitoid and quartz pegmatoid) and 17% metamorphic components (mica schist and mafic orthogneiss).

Mineral clasts: In this study, mineral fragments above 0.5 mm have been classified as clasts. The population of mineral clasts throughout the impactite section is a highly heterogeneous mixture of quartz, K-feldspar, plagioclase, muscovite, biotite, opaques (pyrite), and other, accessory, minerals (epidote, chlorite, zircon and garnet). Preliminary analysis suggests that approximately 60% of the entire clast population (mineral, lithic, and melt clasts) is made up of mineral clasts. Variation of the volume percentages for the main mineral clasts along the core interval are: quartz (25 to 50 rel%), K-feldspar and plagioclase (20 to 30 rel%), and micas (15 to 20 rel%), all increasing with depth. The grain size and internal features of the mineral clasts (e.g., types of internal strain, recrystallization and alteration) indicate primary derivation from the crystalline metamorphic-granitoid
sequence. The average minimum and maximum grain sizes in length, measured for the clasts were 0.8 and 2.4 mm, respectively. Initial results show that, in general, the mineral clast size increases with depth. Clast shapes vary from angular (quartz and feldspars) to rounded (opales) to platy/elongate (micas). Point counting analysis is in progress to better constrain the mineral fragment population.

**Lithic clasts:** Initial results indicate that the lithic clasts make up approximately 25% of the total fragment population (<4 cm clasts). The lithic clasts comprise igneous (quartz pegmatoid and granitoid), sedimentary (shale, grit, sandstone, siltstone, silty claystone, and claystone) and metamorphic (phyllite, mica schist and felsic and mafic orthogneiss) lithologies. Analysis of the variation of the relative percentage of the clast types with depth shows that granitoid (11 to 5%), mica schist (1.4 to 0.3%), mafic orthogneiss (1.6 to 0.25%), and silty claystone (10 to 4%) decrease with depth, whereas quartz pegmatoid (5 to 6%), mica schist (2 to 3%), phyllite (0.7 to 1%), shale (10 to 14%), sandstone (0.2 to 0.3%), and grit (1.1 to 1.5%) increase in abundance with depth. The igneous, metamorphic and sedimentary lithologies have average clast sizes of 1.23 cm, 1.2 cm and 0.8 cm, respectively. The sedimentary components, which constitute 63% of the total lithic clast population in the <4 cm size fraction, come from sedimentary rocks of undetermined age, with shale comprising 42% of the population, whereas the metamorphic (12%) and igneous (25%) components are from the crystalline basement.

**Discussion and Conclusion:** The clast population in general does not show a uniform mixture of lithologies: the larger clasts are derived more from the crystalline basement whereas the smaller clasts are derived predominantly from a hitherto unidentified sedimentary sequence. This dichotomy may reflect impact-induced fracturing behaviour linked to rock type, with the more massive and coarser-grained igneous and metamorphic rocks producing larger clasts. Precursor rock character may also explain the variation in clast shape, with the larger clasts being rounded (length-to-breadth ratio of 1.2), whereas the smaller, sedimentary and phyllite clasts are more elongated with a ratio of 2. Preliminary petrographic analysis of mineral and lithic clasts, and analysis of clast sizes and shapes, suggest that most of the smaller clasts were derived from fine- to medium-grained sedimentary rocks (sandstone, shale and arkose) and greenschist-facies rocks that have yet to be intersected beneath the crater, whereas the remaining clasts were derived from medium- to coarse-grained, metamorphic and igneous basement rocks (mica schist and granite) [3, 4]. This suggests a heterogeneous target structure, possibly in part related to amalgamation of disparate Appalachian terranes, but also requiring an unmetamorphosed, consolidated, post-Appalachian sedimentary succession. Observations of the mineral and lithic clasts show that the volume of the sedimentary component decreases with depth, whereas the igneous and metamorphic components increase in volume with depth. This may reflect an increasingly autochthonous character of the breccias with respect to the underlying crater basement.

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**References:**