IMPACTOR TYPE OF THE LATE EOCENE AGE IMPACT CRATERS ON EARTH: CONSTRAINTS FROM IMPACTITE STUDIES AT THE CHESAPEAKE BAY IMPACT STRUCTURE.

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There are currently at least five impact craters known that are of late Eocene age, a relatively large number within a short time span. These impact craters are accompanied by tektites and clinopyroxene-bearing spherules (microkrystites) in upper Eocene marine deposits, some containing an iridium anomaly. Specifically, upper Eocene marine sediments around the world contain evidence for at least two closely spaced impactoclastic layers – i.e., layers containing impact debris, such as tektites and microtektites and shocked minerals and rock fragments. The Chesapeake Bay impact is thought to be responsible for the younger of the two impact layers. It is now commonly assumed that the older global upper Eocene microkrystite layer originated from the Popigai impact event.

Enhanced levels of ^{3}He were found to coincide with the two upper Eocene impactoclastic layers [1]. This isotope is a proxy for the influx of extraterrestrial dust and is interpreted as indicating that, during the late Eocene, there was a time of enhanced collision activity in the inner solar system, probably resulting in a higher impact rate than usual. An open question is whether or not the two large impact events (Chesapake Bay and Popigai) and the smaller ones were all produced by parts of the same asteroid (or comet) after a collision event in the inner solar system.

The melt rocks of the Popigai impact structure show enrichments in characteristic siderophile trace elements, the ratios of which point towards an ordinary chondrite projectile, possible of the L chondrite type (e.g., [2]). These authors also indicate a chondritic projectile for the late Eocene Wanapitei impact structure. Therefore, identification of the projectile involved in the late Eocene Chesapeake Bay impact structure (CBIS) may provide more information about the nature of the late Eocene impactors and whether they are related to a comet or asteroid shower.

At the Chesapeake Bay impact structure (age 35.5 Ma, diameter 85 km) the situation is less clear cut than at Popigai. In 2005/6 an ICDP-USGS drilling project obtained the Eyreville drill core, which penetrated through post-impact sediments and impactites, into fractured crystalline basement to a total depth of 1766 m; suevites and lithic impact breccias are at 1397-1551 m depth [3]. Even samples, including 7 suevites, were analyzed for their PGE composition by [4], but only very low PGE abundances (e.g., Ir from 0.03 to 0.09 ppb) and fractionated (non-chondritic) PGE abundance patterns were found, which does not constitute evidence for a distinct extraterrestrial component. Thus only a small but measurable Os isotopic anomaly [5] indicates a meteoritic component in Chesapeake Bay impactites. The question if Chesapeake Bay and Popigai formed from projectiles of the same origin remains open at this time.

References: [1] Farley et al., Science 280, 1250 (1998). [2] Tagle and Claeys, GCA 69, 2877 (2005). [3] Gohn et al. *EOS* 87, 349 & 355 (2006). [4] McDonald et al., GSA SP (Chesapeake volume), in press. [5] Lee et al. MAPS 41, 819 (2006).