The Late Eocene Impact Ejecta Layer: Chesapeake Bay impact structure (Virginia, USA), and comparison with the K-T Event

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During the late Eocene (LE), over a period of about 2 million years, a dramatic increase of the influx of extraterrestrial matter onto Earth has been documented from He isotopic studies, possibly as a result of a comet (Farley et al., 1998) or an asteroid (Tagle and Claeys, 2004) shower. In addition, at least five known impact structures formed during this time, two of which belong to the largest impact structures known on Earth and are associated with possibly global ejecta (Koeberl, 2009). The two largest LE impacts are the 85-km-diameter Chesapeake Bay impact structure (CBIS) and the 100-km-diameter Popigai impact structure (http://www.unb.ca/passc/ImpactDatabase/index.html). Two closely spaced LE ejecta layers have been documented at different places around the world (e.g., Koeberl, 2009). The older ejecta layer contains spherules with clinopyroxene and/or Ni-rich spinel and is associated with the Popigai impact (Whitehead et al., 2000). The younger layer of tektites, microtektites, and shocked minerals correlates with the North American strewn field, which has been linked to the CBIS (Deutsch and Koeberl, 2006). The LE impactoclastic layers are associated also with increased Ir contents and 3He values (Koeberl, 2009). Another global ejecta, the K-T ejecta from Chicxulub, form an Ir-rich layer with shocked minerals and spherules of impact melt (Kring, 2007), which lacks a 3He anomaly.

The target rocks of the CBIS were crystalline rocks of the Appalachian orogen covered by poorly consolidated siliciclastic sediments 1 - 1.5 km thick (Poag et al., 2004). In 2005 - 2006 the central part of the CBIS was drilled at Eyreville as part of an ICDP-USGS drilling project (Gohn et al., 2006). The drilling and consequent studies, in which our group participated (see e.g., Bartosova et al., 2009a,b), helped to further constrain the structure, geology, and formation of the CBIS. The Popigai target rocks are similar: gneisses covered by 1.25 km of sandstones and carbonates (Masaitis et al., 1980). The Chicxulub impact structure, in contrast, was formed in a crystalline basement overlain by some siliciclastic sediments and 2 - 3 km of easily volatilized carbonates and anhydrite (Claeys et al., 2003).

It has been suggested that the period of global cooling (from middle Eocene to Oligocene) was interrupted by a warming pulse in the LE, which could have been caused by the multiple impact event. This relatively warmer period was followed by a sharp temperature drop near the Eocene/Oligocene boundary (Bodiselitsch et al., 2004). No evidence for mass extinction or ocean-wide pelagic crisis analogous to the K-T boundary was found in connection with the LE impacts. The presence of a dead zone, which is evident in the CBIS drill cores immediately after the impact deposits, indicates a hostile environment for both benthic and planktonic organisms for about 1 - 3 kyr after the impact event (Poag et al., 2004).

Bartosova K. et al. (2009a) (Petrology) in: GSA Special Paper (Chesapeake Bay Drilling Project volume), in press.

Bartosova et al. (2009b) (Geochemistry) in: GSA Special Paper (Chesapeake Bay Drilling Project volume), in press.

Bodiselitsch et al. (2004) EPSL 223: 283– 302.

Claeys et al. (2003) MAPS 38: 1299–1317.

Deutsch and Koeberl (2006) MAPS 41: 689-703.

Farley et al. (1998) Science 280: 1250-1253.

Gohn et al. (2006) EOS 87: 349 & 355.

Koeberl (2009) GSA Special Paper 452.

Kring (2007) Palaeogeography, Palaeoclimatology, Palaeoecology 255, 4–21.

Masaitis et al. (1980) The Geology of Astroblemes (Nedra, Leningrad) (in Russian).

Poag et al. (2004) The Chesapeake Bay crater: Geology and Geophysics of a late Eocene submarine impact structure, Impact Studies: Heidelberg, Springer, 522 p.

Tagle and Claeys (2004) Science 305: 492.

Whitehead et al. (2000) EPSL 181: 473-487.

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Artikel/Article: The Late Eocene Impact Ejecta Layer: Chesapeake Bay impact structure (Virginia, USA), and comparison with the K-T Event 7