MODELLING THE FORMATION OF THE GLOBAL K/Pg LAYER.

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Introduction: The K/Pg boundary [1,2] is widely recognized as a global ejecta layer from the Chicxulub impact crater [3]. However, some properties of this layer (thickness, shocked quartz distribution, chemical composition) are inconsistent with the idea that ejecta was transported around the globe purely on a ballistic path.

Numerical model: We model the Chicxulub impact with the 3D hydrocode SOVA [4] complemented by the ANEOS equation of state for geological materials [5]. In three separate stages we model: 1) the impact and initial ejection of material [6]; 2) the ballistic continuation of ejecta on a spherical earth [7]; and 3) ejecta re-etnry into the atmosphere (at an altitude of 200 km re-entering tracers are replaced by real particles with a size-frequency distribution in accordance with their maximum shock pressure; the interaction of these particles with the atmosphere is modeled using a multi-phase approximation).

Results: Up to distances of 1000-1500 km from the crater, ballistic ejecta is deposited rapidly. At larger distances, the mass of ejecta and atmosphere are comparable, hence, their interaction becomes significant. Re-entering ejecta create strong winds in the upper atmosphere and these winds disperse small fragments (molten spherules and shocked quartz grains of < 1 mm in diameter) preferentially downrange. For two-three hours after the impact, these dispersed ejecta travel up to a few thousand km from their re-entry site (final deposition through the dense lower atmosphere or ocean may take days or weeks). This mechanism is much more intense than observed for volcanic aerosols in stable atmospheric flows. Similar phenomena (atmospheric skidding) has been suggested for re-entering ejecta after the Shoemaker-Levy 9 Comet impact on Jupiter [8], but has never been modeled before.

Conclusions: Numerical modeling of the interaction of ejecta with the atmosphere allows us to reproduce the constant thickness of the distal K/Pg layer, as well as the presence of low-velocity ejecta from the crystalline basement (shocked quartz) around the globe.

References: [1] Alvarez L. et al. 1980. *Science* 208:1095-1108. [2] Smit J. 1999. *Annual Review of Earth and Planetary Science* 27:75-113. [3] Hildebrand A.R. et al. 1991. *Geology* 19:867-871. [4] Shuvalov V. 1999. *Shock Waves* 9:381-390. [5] Thompson S.L. and Lauson H.S. 1972. *SC-RR-61 0714.* Sandia Nat. Lab. 119 p. [6] Artemieva N. and Morgan J. 2009. *Icarus* 201:768-780. [7] Dobrovolskis A. 1981. *Icarus* 47:203-219. [8] Colgate S.A. and Petschek A.G. 1985. *LA-UR-84-3911*. Los Alamos Nat. Lab