Popigai impact and the Eocene/Oligocene boundary mass extinction

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We present a zircon (U-Th)/He age of the Popigai crater that is, within error, contemporaneous with the Eocene/Oligocene boundary mass extinction. Zircon (U-Th)/He provides an alternate method for determining the age of craters that lack datable melt sheets. ^{40}Ar-^{39}Ar ages are commonly used to date such impacts but can be problematic due to the presence of relic clasts, incomplete Ar outgassing, and diffusive modification during shock and heating [1]. Zircons were separated from two seuvites (from Victor Masaitis' private collection), sampled near the Rassokha river which exposes large vertical sections of impact melt bearing rocks. Zircons from Popigai yield U-Pb SIMS ages consistent with that of the target rock and show little or no Pb-loss [2, 3], underscoring the difficulty of using U-Pb ages when no neo-formed grains or rims are present. Results of 13/14 Popigai zircons yield a (U-Th)/He age of 33.9±1.3 Ma (MSWD=2.4), consistent with the ^{40}Ar-^{39}Ar age range previously reported (33.6-38.3 Ma; [4]) although significantly younger than their subjectively chosen sample (P21a) of 35.7±0.2 Ma, inferred to date the impact. Our younger age, with a robust estimate of variance, appears to exclude Popigai as a possible source of the Eocene Italian tecktites [5], but overlaps, within error, the Eocene/Oligocene boundary mass extinction (33.7±0.5 Ma; [6]), one of the largest Cenzoic annihilations of marine invertebrates [7]. Zircon (U-Th)/He offers a promising technique with which to constrain thermal pertubations associated with impact events that have either had their melt sheets eroded, or be suffeciently low energy as not to have produced a datable melt sheet.

[1] Harrison *et al* (2013) *Geological Society of London*, SP378. [2] Wielicki *et al* (2012) *EPSL* ***321-322***, 20-31. [3] Cherniak *et al* (2003) *Reviews of Min and Geochem* ***53***: 113-143. [4] Bottomley *et al* (1997) *Nature* ***388***, 365-368. [5] Montabari *et al* (1993) *Palaios*, 420-437. [6] Ivany *et al* (2000) *Nature* ***407*****,** 887-890. [7] Raup *et al* (1986) *Science* ***231***, 833-836.