Zircon (U-Th)/He thermochronology of the Santa Fe Impact Structure

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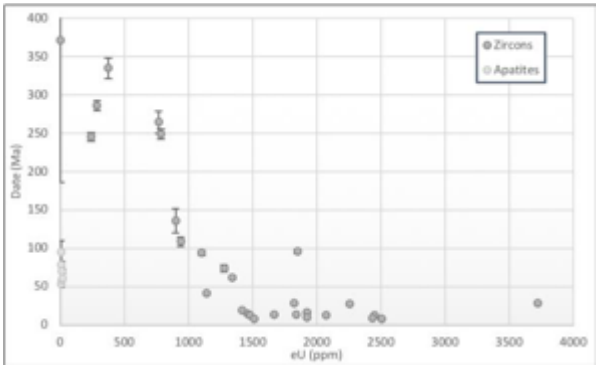
The age of the Santa Fe Impact Structure (SFIS) is poorly defined, ranging between 320 Ma and 1.2 Ga [1]. We tested the utility of U-Th/He zircon (ZHe*) and apatite thermochronometry to better constrain the age of impact; this structure lacks a preserved melt sheet, and has a complex, post-impact tectonic and thermal history. Zircon and apatite grains were separated from shatter cone samples from the central uplift region. Selected grains span a range of apparent radiation damage to access a spectrum of He retentivities. Grains preserving planar fractures (PFs) were also included. Apatite U-Th/He dates (c. 60 Ma) predominantly record cooling following the Laramide orogeny, in agreement with published apatite fission track dates [2]. In contrast, individual ZHe* dates have a wider range (371.76 ± 185.56 Ma to 7.7 ± 0.2 Ma) with pronounced negative correlation vs. effective uranium content (eU). The preservation of ZHe* dates (n=3) older Laramide resetting in apatite means that low eU zircons are promising candidates for both recording and preserving the age of the impact. Therefore, further dating of low-eU zircons may provide evidence to narrow stratigraphic estimations. Finally, we also report the first planar fractures (PFs) in zircons sampled directly from the central uplift zone of the crater where shatter cone morphologies are preserved. The discovery of PFs in zircons increase the minimum pressure generated by the impact to at least 20 GPa [3], indicating a much larger crater (>>13 km diameter) than previously estimated.



[1] Fackelman *et al.* (2008) *EPSL* 270, 290-299. [2] Kelley & Duncan (1986), *J. Geophys. Res.* 91, 6246–6262 [3] Leroux *et al.* (1999) *EPSL* 169, 291-301.