Is DZ driving you(r) MAD? Volcanogenic zircon in mature paleosols better determine the maximum age of deposition

A. MÖLLER[1], G.A. LUDVIGSON[2], J.J. SMITH[2], R.M. JOECKEL[3], N.M. MCLEAN[1], J.A. HALLMAN[1], B.C. SITEK[1], E. TURNER[1]

[1]The University of Kansas, Dept. of Geology, KS, USA. amoller@ku.edu

[2]Kansas Geological Survey, Lawrence, KS, USA. gludvigson@ku.edu, jjsmith@ku.edu

[3]Conservation and Survey Division, School of Nat. Resources and Dept of Earth & Atmospheric Sciences, University of Nebraska-Lincoln, NE, USA. rjoeckel3@unl.edu

Maximum age of deposition of sediments is typically determined from the youngest U-Pb zircon dates in detrital populations. Sand is the typical target grain size following the concept of hydraulic sorting and size equivalence, to ensure heavy minerals such as zircon are sufficiently large to be separated and analyzed. Zircon populations are dominantly reflecting source terrains, and even the youngest grains may not even loosely reflect the age of deposition. Especially continental clastic strata have several characteristics that make them notoriously difficult to correlate and trace over large distances. Many of them are vertically lithologically monotonous, and horizontally discontinuous, and at best they contain discontinuous datable volcanic ash beds only filling local depressions. Combination of these two effects limits the effectiveness and precision of continental chronostratigraphy, poorly constrained in many places.

We propose and have tested an entirely new approach for chronostratigraphy of continental clastic sediments using zircons extracted from mature paleosols as close proxies for exposure/deposition ages. The hypotheses is that during times of frequent, but possibly distal, explosive volcanism, paleosols with long surface exposure offer the best capture and preservation potential for deposition age-appropriate zircons in the terrestrial environment, unlike discrete ash layers or fluvial sands. Volcanogenic zircons from airfall deposition are not constrained by equivalent grain size of hydraulic transport, and relatively large zircons can be found in very fine-grained sediments.

We have improved the chronostratigraphy of the Neogene Ogallala Group and the late Cretaceous in the Central USA in a number of recent case studies with volcanic ash marker beds or multiple stratigraphic sections. Fast data acquisition by laser ablation using U-Pb zircon dating of zircon mounted on double-sided sticky tape can be combined with high precision U-Pb dating by CA-TIMS to improve precision to better than 100 ka.