Testing a grain size-based approach to TCN isochron burial dating

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We hypothesize that a significant sediment flux to the Andean piedmont occurred at the Pliocene-Pleistocene transition (ca. 2.6 Ma) based on thermochronology results from Antinao et al. (in prep) and tenuous terrestrial cosmogenic nuclide (TCN) burial dating by Veloza (2.6 + 0.75/ - 0.65 Ma, unpublished). However, it is difficult to date Cenozoic-aged sediments that are older than the limit of radiocarbon and OSL (Optically Stimulated Luminescence) dating, in the absence of volcanic ashes, or a high-resolution biostratigraphy. A recently developed $^{26}Al/^{10}$ Be isochron burial dating approach uses samples with differing TCN concentrations collected from depth profiles in buried sediment. However, the use of this isochron burial dating method is dependent on finding a buried paleosol, or any surface that was exposed for a significant period of time and then subsequently buried. In regions of high relief, which are prone to landslides, there may be an alternative for sediments lacking paleosols. We evaluate here a new method of $^{26}Al/^{10}$ Be isochron burial dating based on previously observed relationship between fluvial sediment grain size and TCN concentration. There may be a sufficient range in TCN concentration across the different grain sizes (150 to 2000 μm) that an isochron curve can be precisely defined.

Fine sand to granular gravel fractions were extracted from a single 3 kg sediment sample previously collected 100 m below an incised river terrace in the Eastern Cordillera of the Colombian Andes (4.979 N, 72.825 W, 686 m elevation above sea level). The site is ideal for this study because it is still tectonically active, has high sedimentation rates (therefore low TCN concentrations to test the method's limit) and high relief. Pure quartz from six different grain size fractions was extracted, cleaned, dissolved, and converted to Al_2O_3 AMS targets at the Dalhousie Geochronology Center. $^{27}Al/^{26}Al$ results from AMS (Accelerator Mass Spectrometer) at Lawrence Livermore National Lab reveal a linear relationship in ^{26}Al concentration (ranging from 2.79 to 4.19 X 103 atoms/g) with grain size, as well as sufficient scatter (beyond the 20% 1-sigma precision of the AMS measurements) to define an isochron and test the new dating method. Pending 10Be concentrations will be higher (longer half-life) and more precise, so we are optimistic that this new approach will provide a useful option for dating deeply buried sediment that lack paleosols and other exposure surfaces. This should allow us to test the hypothesis of a significant Andean sediment flux increase at the climate transition.

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