221-7 - A FAN-DELTA ARCHIVE OF EARTHQUAKES, BASIN INVERSION, AND MOUNTAIN BUILDING IN THE PELORITANI MOUNTAINS OF NORTHEASTERN SICILY

Wednesday, 18 October 2023

10:00 AM - 10:15 AM

321 (3, David L Lawrence Convention Center)

Abstract

Rapid sediment accumulation rates (SAR) in a fan delta situated on the rapidly uplifting footwall of the Taormina normal fault in NE Sicily preserves a rare record of earthquakes and base level change for a tightly coupled source to sink system. We use this sedimentary archive to reconstruct the kinematics and slip history of the fault and further an understanding of how tectonic forcing across various scales are encoded in stratigraphy. A revised luminescence-based age model indicates that ~82 m of the Pagliara fan-delta foreset facies was deposited in ~11 ka at a mean SAR of ~0.74 cm/yr during MIS 7. Syn-depositional terrestrial cosmogenic nuclide (TCN) determined paleoerosion rates of 0.91±0.12 mm/yr and 1.31 ±0.61 mm/yr are similar to published modern erosion rates for the Pagliara basin of 0.97 ±0.11 mm/yr. At the stratigraphic scale, a time series of magnetic susceptibility (χ) sampled at 1 m intervals in the foresets displays four ~2,800 yr / 20 m-thick cycles of growing χ, bounded by sharp decreases that do not coincide with changes in sediment texture. The χ of the low-grade metamorphic bedrock in the source is 20-100 times weaker than the χ of rubified soils mantling the hillslopes, which is comparable to the χ of the delta sediments. We propose that large, bedrock-cored landslides quasi-periodically deliver weak χ sediment to the delta that dilutes a χ signal otherwise dominated by the stripping of soil-mantled hillslopes. We propose that centennial-scale recurrence interval earthquakes are most capable at triggering a basin-scale landslide only after channel incision has increased relief of hillslopes to the threshold condition, which requires millennia to achieve. At the landscape scale of delta geometry and location, the Pagliara delta accumulated in a hanging wall basin that has since been inverted. We reconstruct the history of base level fall for the delta from an inversion of fluvial topography and apportion that record to its rock uplift, delta deposition, and eustatic components. We show that footwall uplift has been unsteady over the past 600 ka ranging from -1 to 3 mm/yr. The integration of our stratigraphic- and landscape-scale observations furthers our understanding of the natural hazards related to normal fault earthquakes and their impact on sediment dynamics in this steep, active tectonic setting.

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