Paper No. 11
Presentation Time: 3:55 PM

TRANSIENT HILLSLOPES AND THE LEGACY OF CLIMATE IN THE COLORADO FRONT RANGE

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Hillslope regolith cover provides direct insight to the balance between weathering, sediment production, and the downslope transport of mobile material. Climate plays a crucial role in the regulation of this balance by mediating the vegetative cover of hillslopes and influencing sediment transport processes such as rainsplash and frost heave. Here, we present the results of a systematic study that documents basin-wide variation in mobile regolith thickness and uses inventories of meteoric ^{10}Be to assess the mechanisms and time scales of sediment transport and storage in Gordon Gulch, a mid-elevation watershed in the Colorado Front Range. Gordon Gulch lies within the unglaciated topography of the Front Range believed to be in long-term steady state, despite the current warm climate regime being representative of just 20% of the past 65 ka. This 3.7 km^2 watershed is characterized by soil mantled hillslopes with prominent bedrock outcrops (tors) on ~10% of slopes and intermittent gullying. Analysis of over 200 soil pits indicates mobile regolith thickness, which is defined as the depth to immobile weathered bedrock and/or saprolite, averages 39 cm but displays a wide range (10-200 cm). Mobile regolith cover, meteoric ^{10}Be inventories and soil residence times all increase downslope on north-facing hillslopes, but this trend is absent on south-facing slopes. Meteoric ^{10}Be inventories on low-slope ridgetop locations within Gordon Gulch indicate soil residence times <21 ka. Regolith thickness patterns and meteoric ^{10}Be inventories thus support efficient transport of hillslope material prior to and during the colder climates associated with the end of the last glacial maximum (~21 ka), with transported regolith stored at the bottom of hillslope transects, yet to be excavated by the Gordon Gulch stream. This transient state of hillslope deposition and hillslope-channel decoupling is supported by the presence of alluvial fans and toe-slopes at the base of north-facing slopes, as well as terraces adjacent to the modern stream course. Carbon-14 dates confirm that these features represent Holocene sediment redistribution in the basin (~5-10 ka), most likely the result of hillslope sediment transport associated with episodic events such as wildfire and short-intervals of colder climate.

Session No. 165

T18. Critical Zone Evolution: Climate and Exhumation
Monday, 28 October 2013: 1:00 PM-5:00 PM

Mile High Ballroom 2C (Colorado Convention Center)

Geological Society of America *Abstracts with Programs.* Vol. 45, No. 7, p.409

Back to: T18. Critical Zone Evolution: Climate and Exhumation

<< Previous Abstract | Next Abstract >>