Geophysical Research Abstracts
Vol. 19, EGU2017-8343, 2017
EGU General Assembly 2017

Quantifying sediment dynamics on alluvial fans, Iglesia basin, south Central Argentine Andes

Rebekah Harries (1), Linda Kirstein (1), Alex Whittaker (2), Mikael Attal (1), and Silvio Peralta (3)

(1) School of Geosciences, University of Edinburgh, Edinburgh, United Kingdom, (2) Department of Earth Science and Engineering, Imperial College London, London, United Kingdom , (3) Faculty of Exact, Physical and Natural Sciences, National University of San Juan, San Juan, Argentina

Qualitative interpretations of environmental change drawn from alluvial fan stratigraphy typically tie the deposition of greater volumes of coarser sediment to wetter climatic periods. For example, step changes in sediment flux and discharge associated with glacial-interglacial cycles are often linked to the progradation and back stepping of a fan's toe (Harvey et al, 2002). Indeed, more recent quantitative stratigraphic models demonstrate changes in the volume and calibre of sediment fluxed from an uplifted catchment can produce predictable shifts in the rate at which fluvial deposits fine downstream (Duller et al. 2010, Armitage et al. 2011).

These interpretations, however, make three important assumptions: 1) the volume and calibre of the sediment transferred from an eroding mountain belt to a depositional basin is directly related to climate through some value of time-averaged discharge or catchment wetness; 2) lateral sources of sediment, such as tributaries, do not significantly influence the pattern of deposition in a basin and, similarly, 3) the reworking of older fan surfaces is minimal and does not impact the depositional pattern of younger deposits.

Here we demonstrate each of these assumptions underestimates the importance of variance in transportable grain sizes in influencing the local and basin-wide deposited grain size trends. Using the Iglesia basin in the Argentine south Central Andes as a natural laboratory, we compare three large, adjacent, alluvial fan systems whose catchments experience the same background tectonic and climatic forcing. We find regional climate forcing is not expressed uniformly in the downstream grain size fining rates of their modern systems. Furthermore, we observe the variance in transportable grain sizes supplied from each primary catchment and the variance of material introduced by tributaries and fan surfaces downstream can act as first order controls on the rate of downstream fining. We also raise the importance of considering factors such as climate storminess and degree of glacial cover in having a dominant control on the variance of sediment released.

These findings have significant implications for our ability to invert the fluvial stratigraphy for climatically driven changes in discharge and highlight a need to quantify the impact of sediment dynamics on modern systems so that we may better understand the limitations in applying quantitative models to ancient stratigraphy.