Geophysical Research Abstracts
Vol. 20, EGU2018-294-1, 2018
EGU General Assembly 2018

Straight from the source's mouth; controls on sediment export across the Corinth rift, central Greece

Stephen E. Watkins (1), Alexander C. Whittaker (1), Rebecca E. Bell (1), Sam A.S. Brooke (1), Vamsi Ganti (1), Robert L. Gawthorpe (2), and Lisa C. McNeill (3)

(1) Department of Earth Science & Engineering, Imperial College, London, SW7 2AZ, United Kingdom (stephen.watkins10@imperial.ac.uk), (2) Department of Earth Science, University of Bergen, Allégaten 41, 5007 Bergen, Norway, (3) Ocean and Earth Science, National Oceanography Centre, University of Southampton, Southampton, SO14 3ZH, United Kingdom

The volumes, grain sizes and characteristics of sediment supplied from source catchments fundamentally controls basin stratigraphy. However, to date, few studies have constrained sediment budgets, including grain size, released into an active rift basin at a regional scale.

The Gulf of Corinth, central Greece, is one of the most rapidly extending rifts in the world, with geodetic measurements of 5 mm/yr in the East to 15 mm/yr in the West. The well-constrained climatic and tectonic boundary conditions, and well-characterised bedrock lithologies make the Gulf of Corinth an ideal natural laboratory to study sediment supply within a young rift.

In the field, we visited the river mouths of 49 catchments draining into the Gulf, which drain 83% of the rift by area. At each site, we measured hydraulic geometries, surface grain-size of channel bars and full-weighted grain-size distributions of river sediment. We characterised the grain-size distribution of sediment exported from these rivers using the Wolman point count method and in-situ sieving. In total, we measured ∼17,000 clasts and processed 3 tonnes of sediment. The grain-size distributions of sediment show an overall increase from East to West on the southern coast of the gulf, with largest grain-sizes exported from the western rift catchments. The coarse-fraction grain sizes (characterised here by 84th percentile of the weighted grain size distribution, D_{84}) range from 20 to 110 mm, with 50% of the measured D_{84} values less than 40 mm.

We investigated the relative importance of geomorphic, tectonic and lithological controls on the grain-size export from these catchments. We find that simple geomorphic parameters such as catchment area and relief have little control on grain size exported from our catchments. In contrast, we find that both the strong East-West tectonic trend and bedrock lithologies that crop out along the South coast exert a first-order control on the grain-size exported.

We estimated the bankfull shear stress for rivers near their outlets using our measured hydraulic geometries and topographic slopes. Our calculations show that both D_{50} (median of the measured grain-size distribution) and D_{84} of the channel bars are likely transported in bedload during bankfull discharge conditions; however, typical sand-grade particles (0.25 mm) are likely transported in either mixed- or suspended-load for the bankfull discharge conditions. Our analysis suggests that the sediment transit times for sand and gravel may be significantly different, consistent with observations of dominant sand and mud facies within basin stratigraphy. Finally, we derived the full Holocene bedload sediment budget for the Corinth Gulf by combining our grain size data with catchment sediment fluxes, constrained using the BQART model and calibrated to known Holocene sediment volumes in the basin from seismic data. This is the first time such a budget has been derived for the Corinth rift.

Our results have significant implications for understanding the nature of source-to-sink sediment transport, in decoupling the competing effects of climate, tectonics, and lithology on grain size export, and they provide an important sediment supply context for the Corinth IODP expedition.