Geophysical Research Abstracts
Vol. 18, EGU2016-5821, 2016
EGU General Assembly 2016

Antecedent rivers and early rifting: a case study from the Plio-Pleistocene Corinth rift, Greece

Romain Hemelsdaël (1), Mary Ford (2), and Fabrice Malartre (3)

(1) CRPG, Université de Lorraine, Vandœuvre-lès-Nancy, France (romainh@crpg.cnrs-nancy.fr), (2) CRPG, Université de Lorraine-ENSG, Vandœuvre-lès-Nancy, France (mary.ford@univ-lorraine.fr), (3) GeoRessources, Université de Lorraine-ENSG, Vandœuvre-lès-Nancy, France (fabrice.malartre@univ-lorraine.fr)

Models of early rifting present syn-rift sedimentation as the direct response to the development of normal fault systems where footwall-derived drainage supplies alluvial to lacustrine sediments into hangingwall depocentres. These models often include antecedent rivers, diverted into active depocentres and with little impact on facies distributions. However, antecedent rivers can supply a high volume of sediment from the onset of rifting. What are the interactions between major antecedent rivers and a growing normal fault system? What are the implications for alluvial stratigraphy and facies distributions in early rifts?

These questions are investigated by studying a Plio-Pleistocene fluvial succession on the southern margin of the Corinth rift (Greece). In the northern Peloponnese, early syn-rift deposits are preserved in a series of uplifted E-W normal fault blocks (10–15 km long, 3–7 km wide). Detailed sedimentary logging and high resolution mapping of the syn-rift succession (400 to 1300 m thick) define the architecture of the early rift alluvial system. Magnetostratigraphy and biostratigraphic markers are used to date and correlate the fluvial succession within and between fault blocks. The age of the succession is between 4.0 and 1.8 Ma. We present a new tectonostratigraphic model for early rift basins based on our reconstructions.

The early rift depositional system was established across a series of narrow normal fault blocks. Palaeocurrent data show that the alluvial basin was supplied by one major sediment entry point. A low sinuosity braided river system flowed over 15 to 30 km to the NE. Facies evolved downstream from coarse conglomerates to fined-grained fluvial deposits. Other minor sediment entry points supply linked and isolated depocentres. The main river system terminated eastward where it built stacked small deltas into a shallow lake (5 to 15 m deep) that occupied the central Corinth rift. The main fluvial axis remained constant and controlled facies distribution throughout the early rift evolution. We show that the length scale of fluvial facies transitions is greater than and therefore not related to fault spacing. First order facies variations instead occur at the scale of the full antecedent fluvial system. Strike-parallel subsidence variations in individual fault blocks represent a second order controlling factor on stratigraphic architecture.

As depocentres enlarged through time, sediments progressively filled palaeorelief, and formed a continuous alluvial plain above active faults. There was limited creation of footwall relief and thus no significant consequent drainage system developed. Here, instead of being diverted toward subsiding zones, the drainage system overfilled the whole rift from the onset of faulting. Moreover, the zones of maximum subsidence on individual faults are aligned across strike parallel to the persistent fluvial axis. This implies that long-term sediment loading influenced the growth of normal faults.

We conclude that a major antecedent drainage system inherited from the Hellenide mountain belt supplied high volumes of coarse sediment from the onset of faulting in the western Corinth rift (around 4 Ma). These observations demonstrate that antecedent drainage systems can be important in the tectono-sedimentary evolution of rift basins.