Ceramah Teknik (Technical Talk)

TECTONO-SEDIMENTARY EVOLUTION OF RIFT BASINS

28 February 2005
Geology Department
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(In collaboration with the Dept. of Geology, Universiti Malaya)

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Report

Despite the short notice and it being the beginning of the exam week in the University of Malaya, a small group of academics and students attended the talk by Prof. Robert Gawthorpe who was in town to promote the newly established University of Manchester (merging UMIST & Victoria University). The talk was held at 5.30pm at the Geology Lecture Hall of the university on 28[th] February 2005. His very well illustrated talk on the rift basins in Greece and Suez was very interesting and informative.

Lee Chai Peng

Abstract

The evolution and linkage of fault segments to form continuous, basin-bounding normal fault zones is recognized as a first-order control on the size, shape and stratigraphy of sedimentary basins within areas of continental extension. Integrated structural and sedimentological studies from the North Sea, Suez rift and central Greece have allowed the evolution of fault populations to be investigated and the landscape and sedimentary response to fault evolution to be determined. The active faulting phase of rift basin evolution can be divided into three progressive stages each with a characteristic tectono-sedimentary style: i) rift initiation, ii) fault interaction and linkage, and finally iii) rift climax. Typically the rift initiation to rift climax evolution occurs on the time-scale of several million years.

During rift initiation, fault activity is distributed on short (1-4 km long), low displacement (<1 km) segments. Major tilted fault blocks that characterize the structural style during the later rift climax stage are absent, and fault-propagation folding above blind normal faults is a prominent feature at the Earth's surface. As a result, structural control on depositional systems is subtle, pre-existing drainage systems commonly dominate sediment dispersal, and early depocentres are 'over-filled'. Examination of stratal terminations around fault tips suggest that faults may attain their maximum length soon after the onset of rifting. Over the first several millions of years of rifting, early-formed segments either begin to hard link, forming longer, segmented fault zones, or become inactive and die. Stress feedback between ruptures on adjacent fault segments is an important control on fault growth.

Following rift initiation, displacement becomes progressively localized onto >25 km long border fault zones that bound broad, tilted fault blocks. During this interaction and linkage phase, many of the early intra-block fault zones become inactive. Thus strain becomes progressively localized on fewer, but longer, fault zones and, as a result, displacement rate on the remaining 'rift climax' faults is greater than during rift initiation times. The stratigraphic expression of this strain localization is a change in the basin fill from overfilled during rift initiation times, when sedimentation is dominated by continental to shallow marine/lacustrine deposits, to sediment-starved, deep-water facies during the rift climax phase when displacement rates outpace sedimentation. Furthermore, the

breaching of relay ramps during linkage may cause major readjustments to the drainage networks feeding sediment into the rift. The locus of fault activity continues to migrate following the development of a through-going, linked border fault zone. Commonly this is associated with a narrowing of the rift zone such that old, inactive faults become progressively abandoned and uplifted in the footwalls of younger fault zones. This results in cannibalization of older basin fills.

The dynamics of fault population evolution illustrated here are comparable to those suggested by analogue and numerical modeling studies. They have important implications for the tectono-stratigraphic evolution of rifts and for understanding complex and often subtle syn-rift plays and the structural compartmentalization of major fault blocks.

Photos from Technical Talks

SULFUR CYCLE THROUGH NEOPROTEROZOIC AND CAMBRIAN: STUDIES ON SULPHUR AND OXYGEN ISOTOPIC STUDIES OF CHEMOGENIC SEDIMENTS FROM INDIA



THE CORUNDUM (RUBY & SAPPHIRE) MINES OF MOGOK, MYANMAR



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