Geophysical Research Abstracts
Vol. 13, EGU2011-10027-1, 2011
EGU General Assembly 2011

Tectono-stratigraphic evolution of the southeast Mediterranean margin, offshore Egypt and Libya

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The southeast Mediterranean passive margin, comprising the Libyan, Egyptian and Levant continental margins, has a complex tectonic evolution from the break-up of Gondwana and opening of the Tethyan Ocean during the Triassic-Early Cretaceous to the convergence of the African and Eurasian plates from the Late Cretaceous to the present-day. The passive margin is presently in the early stages of collision as the African plate subducts northwards below the Hellenic-Cyprus Arc. The aims of this research are to determine the tectono-stratigraphic history and regional sub-salt structural styles along the southeast Mediterranean margin using a regional seismic dataset, and to develop an integrated model for the geodynamic evolution of the eastern Mediterranean basin.

The offshore southeast Mediterranean margin records multiple rift phases associated with the break-up of the northern margin of Gondwana and the evolution of the western Tethys during the Mesozoic. Syn-rift megasequences define phases of regional extension during the Triassic-Jurassic and Early Cretaceous oblique rifting in the offshore Sirte Basin. The margin has been divided into distinct structural domains along strike based on variations in morphology, structural styles and basin evolution. Offshore northern Egypt and in the Levant basin Mesozoic rifting resulted in the development of NE-SW trending domino-style rift fault systems, indicating NW-SE oriented extension orthogonal to the Levant margin. This is consistent with the structural styles observed offshore northwest Egypt-Cyrenaica, characterised by a steep, narrow continental shelf and abrupt continent-ocean transition, which indicate a component of transform deformation along this part of the margin. Offshore northern Libya rift fault systems dominantly trend NNW-SSE indicating the influence of pre-existing structural fabrics, highlighted by gravity and magnetic anomalies, on the tectonic history of this part of the margin.

Post-rift thermal subsidence was interrupted by a change to a compressional regime and the reactivation of major basement-involved fault systems along the margin during phases of inversion in the Late Cretaceous and Eocene-Oligocene, and which continued through the Miocene-Pliocene in the Levant basin. Inversion was focused on NE-SW trending structures and increased from west to east along the margin as a result.

Many contrasting models have been developed to explain the Mesozoic rift history of the eastern Mediterranean. This study suggests that seafloor spreading propagated from east to west along the margin during the Jurassic to Early Cretaceous. Oblique NW-SE to N-S oriented continental break-up in the western Tethys resulted in segmentation of the margin into distinct structural domains.