Half Graben Evolution in the Kopet Dagh Fold and Thrust Belt – Sedimentation and Paleo-Current History

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ABSTRACT

The Kopet Dagh inverted fold and thrust belt refers to the northern border of the Alpine-Himalayan orogeny and is a key area for understanding of the tectono-sedimentary evolution of the whole North-East Iranian region. Recently, much effort has been made towards investigating the role of basement-involvement in the thin-skinned deformation of fold and thrust belts. The understanding of the basement involvement needs to present the location, geometry and history of paleo-highs as well as the geometry of the basement. The main criteria to recognize the basement geometry of the Kopet Dagh fold and thrust belt, which are playing an important role in morphology and reservoir properties distribution of the Late Jurassic Carbonate and Early Cretaceous Siliciclastic hydrocarbon prospects, are: paleo-current trends of the sedimentary covers, abrupt changes in the folded structure geometries, anomalous potential fields, well data and seismic data. The numerous field surveys beside a large amount of 2D and 3D seismic data, which coupled with borehole information, represent the paleo-current directions in syn-rift and post-rift sediments. The determined paleo-currents improve the resolution of the paleo-highs location and geometry of the basement that have been indicated by potential field methods. The Late Triassic-Jurassic extensional setting in the Eastern Kopet Dagh Basin has created a domino-type half-graben/tilted-block system, with more than 9 km thickness of the syn to post-rift sediments (Late Triassic- Present Day). The subsidence was typically asymmetric to the East, with a clockwise rotation as a result of sediment accommodation and normal faulting. The stratigraphy of the clastic units, derived from a marginal fault scarp, depended on the balance between uplift and erosion of the marginal side. Seismic profiles interpretation, growth strata pattern and structural restoration on the giant Gonbadly-Khangiran gas fields, illustrate that the Gonbadly anticlinal structure started to fold in the Late Tithonian due to a horizontal compaction of the Mid-Jurassic Kashafrud formation as the Syn-Rift sediments and block rotations in the existing half graben, while Khangiran structure was formed by Paleocene-Present Day oblique inversion setting.