

Faults Array and their Control on Rift Basin Geometry, Central Saudi Arabia

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ABSTRACT

To assess the prospectivity of sedimentary sequences in Central Saudi Arabia we have conducted a study of fault array patterns using seismic data, gravity, magnetic and borehole logs. The objective was to decipher fault patterns and their impact on hydrocarbon entrapment. The majority of the faults are extensional basements-rooted in an identified fault belt trending NNW-SSE. The gravity and the magnetic data show lineaments that coincide with the seismically resolvable faults direction. A similar lineament trend is apparent in the exposed Arabian Shield to the northwest of the study area. The faults trace lengths and throws ranging from 13 to 50 km and 180 to 2000 feet, respectively. Three-dimensional seismic reflection data was used to delineate the subsurface syn-rift fault geometry. The earliest stage of rifting is characterized by several extensional faults, which form structural grabens and half grabens. Two sedimentary units have been identified. The older unit, referred to as Unit-A, is seismically characterized by wedging reflectors indicating that these sediments thicken toward a growth fault and are therefore interpreted to be syn-rift sediments. The younger unit, referred to as Unit-B, is characterized by a relatively constant layer thickness and does not change toward the growth faults. The seismic reflectors in Unit-B are mainly flat and sub-parallel to each other. Therefore, they are interpreted to be post-rift sediments. This fault related basin configuration and sedimentary sequence present a range of scenarios for potential source, trap and reservoirs.