

Regional Seismic Traverse Profiles, Western Sirt Basin, Libya

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Abstract

This study is part of a joint effort undertaken by the Petroleum Research Centre of Libya and Teknica Petroleum Services Ltd on the evaluation of the geology and petroleum potential of Tertiary and Mesozoic rocks of the Western Sirt Basin of Libya. Rift-type geometry of the Cretaceous-Tertiary carbonate-evaporite basin-fill of the western part of the Sirt Basin (WSB) is presented on several regional seismic traverse profiles and corresponding geologic cross-sections. The interpretation is based on a study of over 5800 line kilometers of 2D seismic data tied to 80 wells with sonic logs. The study is complemented by data from some 300 available wells, surface geologic maps and field studies, biostratigraphic analysis, remote sensing analysis and interpretation of gravity and magnetic data.

Because the seismic data is of various vintages and technology, reflector mis-ties had to be addressed. As widespread processing was not an option, Teknica developed software to dynamically move each seismic trace and interpreted horizon to the regional datum plane after calculating the optimum shift from the observed mis-ties, original datums, original and regional replacement velocities and the ground elevations at each trace.

Stratigraphic units of regional extent proved to be the most useful for correlation, e.g. the Kalash limestone, Facha dolomites and Hon evaporites are shown. Other units of lesser extent like the Sirt and Hagfa shales as well as the Satal, Dahra and Harash carbonates are also indicated on the seismic sections. The geometry and regional distribution of the stratigraphic units and the type and pattern of faults have allowed for the characterization of the structural style and geologic history of the basin. Major faults zones (structural hinge zones) separate the regional structural elements of the WSB such as the Hon Graben, Uaddan Uplift, Dor Alabid Trough, Bu Tumayn Trough, Zallah Trough and Dahra Platform. Following the initial rifting of the Sirt Basin, probably in mid-Mesozoic time, the two main periods of primarily extensional faulting were Early Cretaceous and Late to post Eocene time. There is also evidence of wrench faulting with accompanying transpression.

The major oil fields (e.g. Dahra-Joffra, Bahi) appear to be associated with structural hinge zones and adjoining highs or are stratigraphic traps (i.e., Satal carbonate bank). Additional prospective trends remain to be drilled in this relatively under explored area of the Sirt Basin where approximately 14.5 billion barrels of oil-place have been discovered to date.