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Marine Seismic Data Acquired over the Libyan Offshore Area - A Case History

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SUMMARY

During 2004 and 2005, over 38,000km of 2D non-exclusive data were acquired in the waters offshore Libya in cooperation with NOC and NAGECO. This consistent dataset provides regional correlation from the existing developed western fields into the largely un-explored offshore Gulf of Sirt and Cyrenaica regions. It provides a unique resource for reviewing the potential of some of the world's most prospective acreage and complements NOC in their efforts to boost Exploration in Libyan waters.

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Prior to the 2004 acquisition programme, very little seismic data had been acquired in the region in the last 20 years. The selection of the program and acquisition parameters at that time presented particular problems in that international sanctions over many years had limited the number of modern offshore surveys. Most regional data had been shot in the 1970s and 1980s with smaller arrays and very limited streamer offsets. In addition the limited time available before the EPSA IV Round One meant that it would be necessary to deploy several vessels with similar characteristics in order to achieve significant coverage in the available timeframe. A requirement was that the project would cover as much as possible of the Libyan offshore with coverage in as little as 20 metres water depth and out to 3,000 metres.

Powerful airgun sources were selected along with a long streamer length of 8,000m. All equipment was specified so as to comply with the remaining international constraints on so-called "Dual use Technology" e.g. hydrophones, prevailing at that time. In order to accommodate greater water depths a standard 10 second recording time was specified, but to handle the deepest areas a longer recording time was specified necessitating an adjustment of the shot point interval to maintain adequate vessel speed.

The planned programme was of 38,000 kms based on two main orientations of a grid of 25 kms by 11.5 kms, with a N-S / E-W alignment east of Benghazi, but more orthogonal to the coastline westwards to the Tunisian border. Lines were deviated to achieve as many well-ties as possible, and a requirement to optimise coverage by the Libyan authorities meant unrestricted access to held acreage and through producing areas was required from the current licence holders. It was possible to schedule additional infill coverage in two areas in readiness for EPSA IV Round 2.

Acquisition commenced in August 2004 and completed in July 2005, with an intermediate data set being made available for Round 1 evaluation in October/ November 2004. Although three acquisition vessels were deployed in total, there was a maximum of two working at any one time. With the additional programme, the final size of the survey was 39,844 kms.

Included within the seismic data package are gravity and magnetic data. This provides additional potential field data showing basement structure and the possible presence of volcanics.

Data processing was performed using a full Kirchhoff ray traced pre-stack time migration workflow and provided a reasonable quality dataset during the licensing round process. Subsequently, targeted reprocessing has occurred over key areas with respect to specific data quality issues. One of the issues is the presence of the Messinian Anhydrite layer which causes transmission loss and scattering of energy, with subsequent imaging and signal to noise ratio issues beneath. The reprocessing has resulted in substantial improvements in data quality in some areas whilst confirming the presence of major structures in other areas.

In an attempt to further enhance the value of the seismic data, extensive interpretation work has been conducted on the survey, initially concentrating on the more prospective Pelagian Shelf and Sirt Basin in western and central offshore Libya respectively. The majority of the offshore wells have been tied to the seismic to allow greater accuracy in the dating of horizons. 2D seismic data acquired during the 1970's and 1980's, has also been used as infill to allow greater detail and to provide additional constraint to the interpretation.

Figure 1 – Location of the seismic data

Figure 2 – Example Data from Offshore Libya

Figure 3: SSW-NNE seismic line across the Sabratah Basin, Pelagian Shelf.