Paradigm®

Advanced Migrations Resolve Targets below Complex Overburden to Explain Production

The Challenge

Explore hydrocarbons in a reservoir that should have been depleting, according to previous surveys. Optimize production of the remaining hydrocarbons.

The Assessment

Models created based on imaging done several years ago in the Neptune field resulted in the expectation that the field would begin depleting at a certain point. In reality, the field continued to produce, making it clear to the client that the original forecast for this field was incorrect and needed to be updated. In order to enable more accurate well planning and optimal exploitation of the field, it was important to understand the true condition of the field.

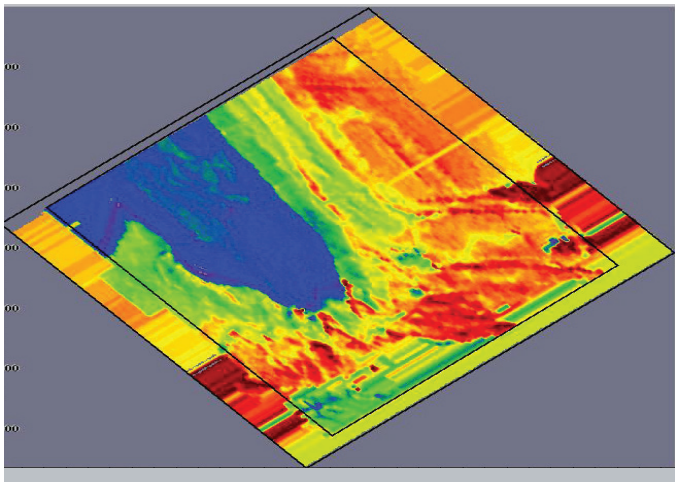
The main imaging problem was caused by the reservoir's position beneath a complex overburden, which included a near surface anomaly. The dimensions of the overburden were similar to the target depth, which in turn approximated the available offset at the target level. This combination made the reservoir extremely difficult to image.

The Solution

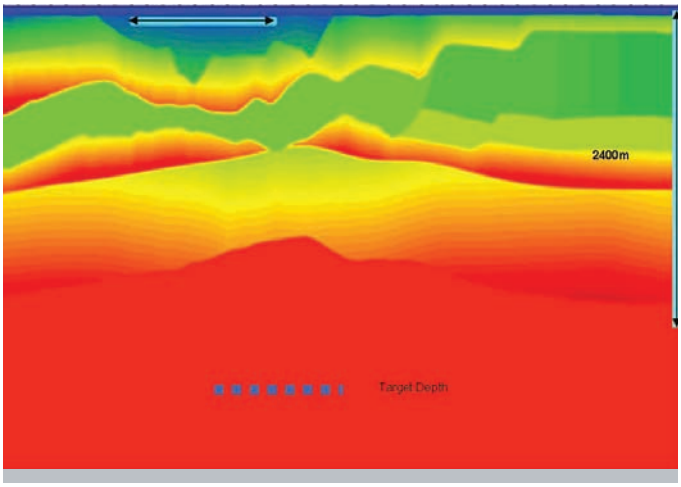
The study began by deriving a near-surface velocity model that combined the refraction data of the 3D survey with mult-line 2D data and site survey high-resolution 2D lines.

A final overburden velocity model, integrating near-surface data with 3D reflection data, was generated using Paradigm's advanced GeoDepth® velocity model building and depth imaging software. This resulted in a significantly improved velocity model of the overburden, which in turn enabled a much clearer image of the underlying reservoir horizon.

The project was first migrated using a Kirchhoff pre-stack depth migration. The GeoDepth common shot wave equation migration was then performed to further enhance the image.



▲ Refraction velocity map



▲ Final velocity model

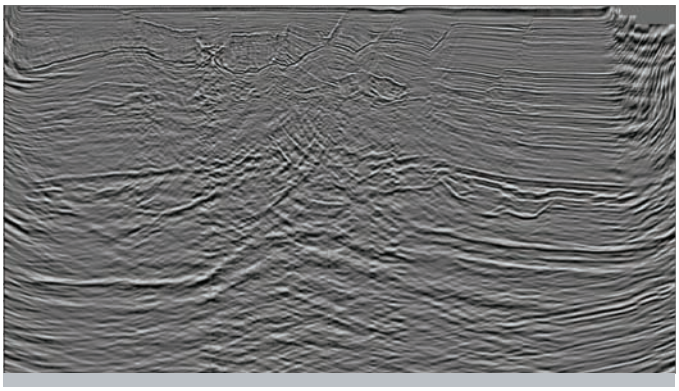
The Benefit

The pre-stack depth migration data, both Kirchhoff and wave equation, allowed confident interpretation of the reservoir throughout the field, even in areas where the overburden was highly complex. This had not been possible with the original time migration, or the earlier pre-stack depth migration processing.

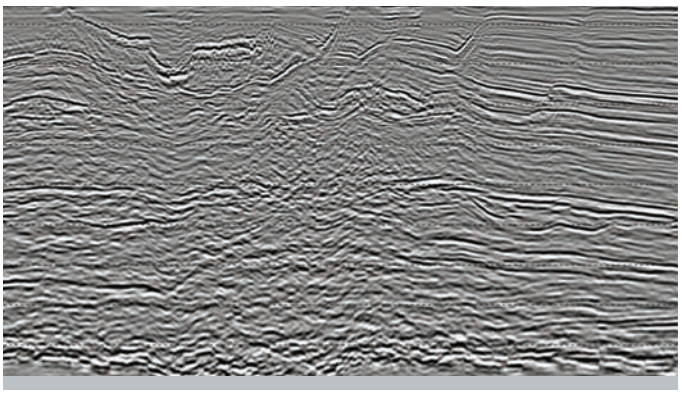
The advanced technology in Paradigm's pre-stack depth migration resulted in a striking improvement in seismic imaging in this very challenging area.

The markedly increased confidence in the overall structure of the reservoir allowed the reservoir model to be updated, and improved history matching to be performed. The final result enabled the reservoir to be mapped confidently for the first time. This led to optimal exploitation of the field, including the drilling of new wells.

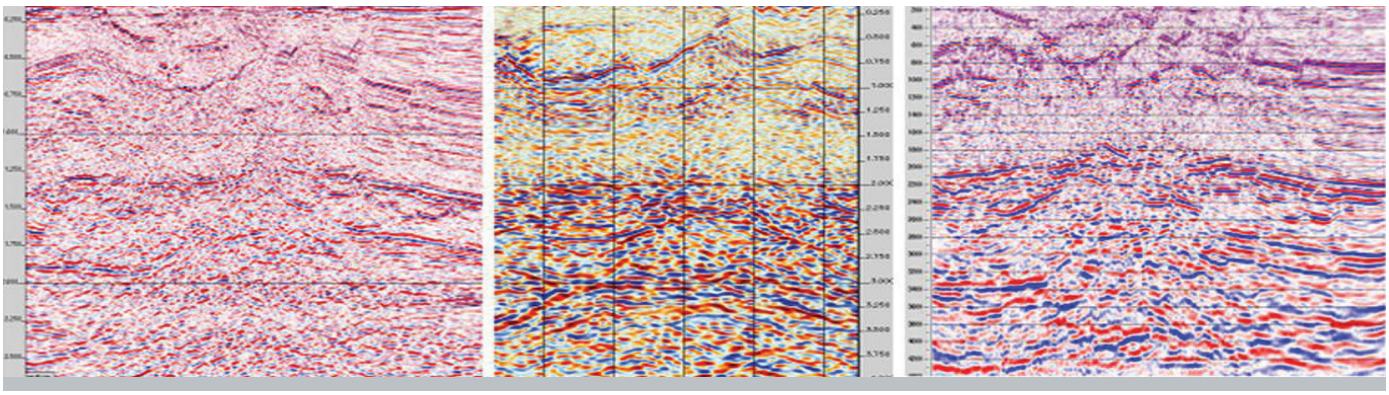
The success of this project demonstrated the opportunities that modern technology can offer in providing additional insights into vintage seismic data, even when that data was acquired years ago using older techniques. Paradigm solutions today are capable of handling processing and imaging problems which only a few years ago were considered difficult or impossible to solve.



▲ Kirchhoff Migration



▲ Wave Equation Migration



▲ Comparison of results from 1992 - 2003

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Paradigm thanks the BG Group and its partner Amerada Hess Ltd. for their permission to use their data.