A novel 3D seismic survey, Shoal Point, Newfoundland: new data, new interpretation

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The Port-au-Port Peninsula in western Newfoundland has been a recent focus for petroleum exploration. The exploration effort has targeted the Lower Palaeozoic carbonate succession of the St. George's Group both on the peninsula and in the immediate offshore. The drilling targets have been mostly related to structures in the thrust slices of the carbonate platform, and especially in the complex triangle zone. The most recent exploration well, K-39 (PanCanadian and partners), drilled on Shoal Point tested a structure under Shoal Bay. The well was guided by limited seismic data as acquisition was difficult in the shallow water immediately surrounding the Point. This paper describes a research project to develop 3D acquisition methods suitable for the transition zone in the area. The interpretation of these data gives rise to a new understanding of the structural detail and tectonic evolution of the region. This new interpretation assists in explaining the negative result of the K-39 well and identifies a structure that is worthy of further investigation.

The acquisition of exploration seismic data in the transition zone is a difficult challenge. Conventional marine seismic methods using large vessels and many streamers are not logistically feasible. Similarly, land methods using vibrators or explosives cannot be employed in the marine setting. Compounding this challenge is the fact that the shoreline is often a zone of geological complexity that requires 3D seismic coverage for proper exploration. Furthermore, the shallow, near-shore environment is the most environmentally sensitive region and any approach to data acquisition must be designed for minimal environmental impact. The survey at Shoal Point met these challenges and produced an excellent 3D seismic image that agrees with industry 2D seismic data in the bay, but provides extended coverage.

The processing of the 3D data did not follow a conventional processing strategy as most of the traces were for large source-receiver offsets, making conventional normal moveout correction (NMO) and velocity analysis impossible. Nonetheless, a binning strategy was developed that employed 25 m by 50 m bins, led to a mean fold of over 20, and produced good 3D images of the subsurface.

The interpretation of these data has shown that the K-39 well was probably drilled below the target structure. The interpretation has led to a greatly increased knowledge of the detail of the geology in the immediate Shoal Point area and to a better understanding of the tectonic evolution of both the Cambro-Ordovician platform and the allochthons of western Newfoundland.