

Revival of the Nova Scotian petroleum province: Applying global analogues and enhanced seismic imaging

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In the search for buried sources of energy, including hydrocarbons, seismic data continues to be the most powerful tool for understanding and therefore de-risking the subsurface. Whilst 2D seismic data helped to define the play systems which led to the discovery of the Sable Island Fields offshore Nova Scotia, 3D seismic allowed the development of those areas. At the time of writing there is no ongoing production despite recent past production of around 2.1 TCF of gas from these fields and the presence of undeveloped discoveries estimated to contain at least 1.3 TCF of gas. The good news is that the 3D data acquired at the end of the last and beginning of this century (Figure 1), has never been reprocessed, offering a huge opportunity through image enhancement. Nowadays, seismic processing algorithms such as SRME (Surface Related Multiple Elimination), shallow water demultiple and de-ghosting, have revolutionized imaging of sedimentology, structure, DHI's (Direct Hydrocarbon Indicators) and source rocks. Reprocessing of these data is expected to bring a new level of insight which should facilitate a second phase of exploration for advantaged gas.

Analogies from reprocessing of seismic data from the North Sea, India and Oman (Figure 2) in similar conditions with similar challenges will be used to illustrate the expected uplift and the hydrocarbon potential which could be revealed in untested amplitude anomalies as well as new plays which have not been targeted in the past.

In the deeper water of the Scotian Slope lies the Tangier 3D dataset (Figure 1), a state of the art wide azimuth 3D processed through the most advanced algorithms available at the time and providing an unprecedented image in a complex salt basin setting. The Aspy well drilled in 2019 proved the petroleum system, though source rock quality and reservoir presence remain as key risks. Source rock characterization indicates the presence of a good quality, thick and mature, probably of mid-Jurassic age, source rock to the west. BSR-derived geothermal gradients together with results from seabed core, Site 41, indicate an anomalously high geothermal gradient to the east associated with salt diapirs which get close to the sea surface, indicating that younger source rocks could be generating hydrocarbons in the vicinity of these salt bodies. At the same, quality controlled, geologically led, automatic interpretation of hundreds of horizons together with RMS amplitude, spectral decomposition and AVO related horizon attributes were used to identify possible reservoir fairways into the basin, indicating not only the presence of major sediment fairways but also of significant potential accumulations (Figure 3).

The above evidence combined with analogies from the Gulf of Mexico and from the recent huge Venus and Graff discoveries made in deep water, offshore Namibia, have enabled further source rock and reservoir de-risking.

With an ongoing bid round offshore Nova Scotia, enhanced seismic datasets and indications of huge untested potential which can be compared to recent successful examples around the globe, this is the right time for the revival of the Nova Scotian petroleum province, where significant capacity for CCUS

(Carbon Capture Utilization and Storage) provides a unique opportunity for net zero hydrocarbon production.

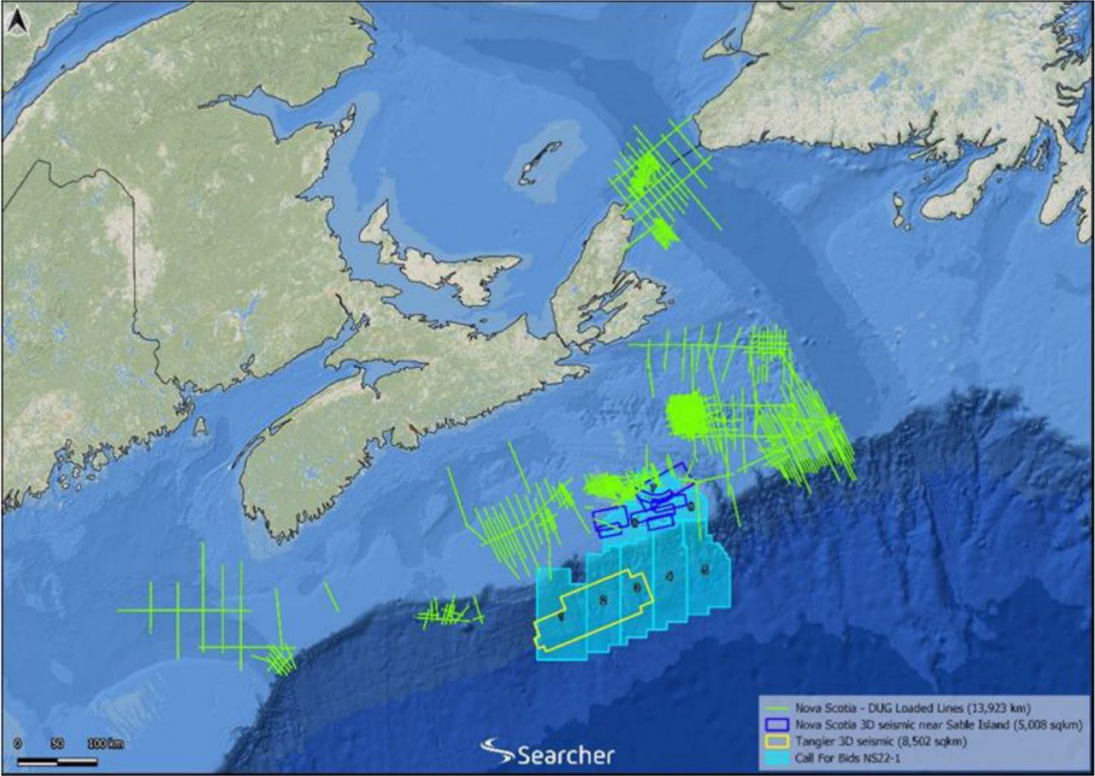


Figure 1: Map showing the location of the 3D datasets available near Sable Island as well as the Tangier 3D dataset. Available 2D seismic lines in green.

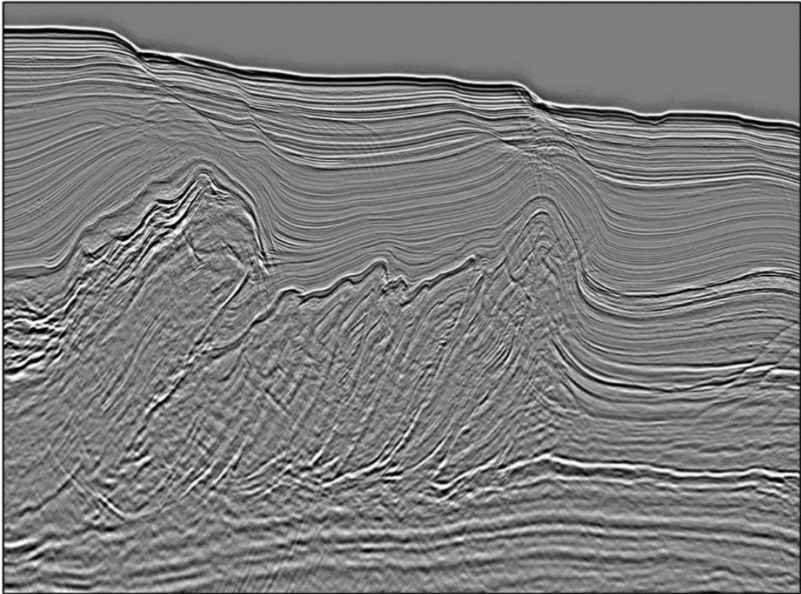


Figure 2: Reprocessed Seismic Example from Offshore Oman (Searcher 2022)

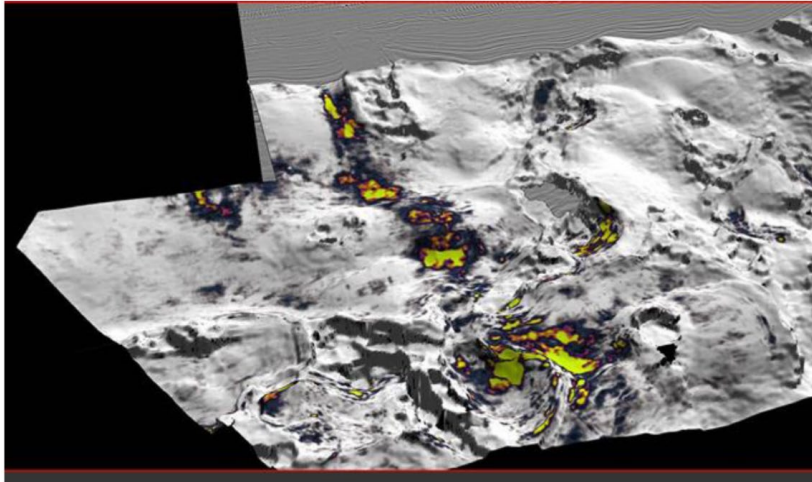


Figure 3: Large Cretaceous Channel overlying interpreted mid-Jurassic source rock, with AVO Type III anomalies in yellow. Image provided by Lyme Bay Consulting.

Biography

Karyna is an Oxford University graduated Petroleum Geoscientist with over 30 years of multidisciplinary technical experience in global exploration-inclined projects. She possesses diverse experience from her time at PEMEX, BG and other major oil companies, including regional seismic interpretation, prospect generation, amplitude anomaly and sequence stratigraphic play analyses, integrated reservoir characterization field studies and prospect and volumetric chance evaluation. She has participated in implementing companywide customized systematic probabilistic risk analysis processes, working closely with high level management to develop their strategic portfolios. She currently works at Searcher as part of a high performing team dedicated to Identifying, pursuing, and realizing new ventures to support efforts in optimizing exploration for oil and gas in mature and frontier basins around the globe.

