An Integration of Seismic and Non-Seismic Methods in Search of Hydrocarbons: Case Study From Southwest Britain

Katarzyna Pisaniec[1], Ivan Guerra[1], Giuseppe Bancala[1], James Penwarden[1], Andrew Furber[1], Claudio Leone[1], Giles Watts[2], Malcolm Gall[2], Peter Napier[2], and Mark Ibram[2]

[1]WesternGeco, Gatwick, United Kingdom.
[2]Consultant to Oil and Gas Authority of UK, London, United Kingdom.

ABSTRACT

In the last few decades, exploration and production activities have been conducted in the North Sea and around the Shetland Islands. In contrast, offshore southwest Britain remains relatively underexplored. Given recent discoveries made in Irish waters, the Celtic Sea, and the Dragon discovery within UK block 103, southwest Britain may emerge as new exploration basin. To encourage exploration activity in this frontier area, the UK Oil and Gas Authority (OGA) acquired a regional 2D seismic survey mid-2016, supported and funded by the UK government, covering approximately 50,000 km2 of the Southwest Approaches and the Southwest Celtic Sea. Gravity and magnetic data were acquired to support interpretation of the seismic data and prestack inversion was performed to calibrate to wells and provide a framework for amplitude variation with offset and rock physics studies. In addition, 6,000 km of legacy 2D seismic data were reprocessed. The OGA made the data publicly available mid-2017 for the 31st Frontier Licensing Round. The geology of this structurally complex region was not well understood, given the geophysical limitations during early exploration stages. The newly acquired and processed broadband seismic data enable new insight into the geology for the study area. An extensive multiple attenuation workflow was defined, combining several techniques, including shallow-water layer demultiple, surface-related related multiple attenuation from the seafloor, and chalk package and interbed multiple prediction using the base chalk generating horizon. The deep section is comprised of Palaeozoic – Triassic (SW Approaches)/Jurassic (SW Celtic Sea) sedimentary rocks. The Base Cretaceous Unconformity divides these structurally complex formations with relatively flat-lying, non-deformed overburden stratigraphy. The area evolved with the changing tectonic regimes. The folded Palaeozoic-Triassic/Jurassic section indicates a compressional regime. Development of normal faults documents an extensional phase, while a strike-slip component visible further north is also visible on those faults. Transpression is well pronounced within Cardigan Bay, where flower structures are interpreted. Structural interpretation is supported by the gravity data; in particular, a very good correlation between the thickness of sedimentary sections seen on the seismic data and structural lows on gravity data was observed. Magnetics supports the interpretation of deep structural elements.