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Synergistic Interpretation of Labrador Sea Geophysical Data

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The Labrador Sea, a Mesozoic Frontier area with stranded gas discoveries totalling 4.2 tcf, is the latest Canadian offshore region to be reopened for exploration. The Labrador Call for Bids NL07-2 successfully concluded in September 2008 with all four parcels being awarded to oil and gas companies. The total dollar value of work commitments of $186.4 million in these bids is the third largest in the Newfoundland and Labrador's petroleum exploration history (after the Orphan Basin and Flemish Pass Basin bids). This landsale covered just a fraction of the Hopedale Basin, with a large area of the basin and the deepwater area remaining unlicensed.

Between 2003 and 2008, over 30,000 km of new prestack time migrated seismic 2 D data and a large volume of marine potential field profiles were acquired, providing for a modern grid of geophysical data in the Labrador Sea. Integrated interpretation of seismic reflection and potential field profiles was performed for the area in order to:

1. better define half-grabens and intra-basinal ridges
2. study the nature of the ridges and other basinal highs
3. discriminate between Proterozoic highs, ridges floored by synrift volcanics and Paleozoic covered blocks
4. further investigate the presence of volcanics, intrusive bodies and possibly salt within the Labrador basins
5. obtain information on the basement configuration on the shelf break or areas of gas dissemination in the sedimentary fill, where data imaging is poor and basement interpretation is ambiguous
6. test the applicability of potential field data for resolving basement constitution and configuration in a passive margin setting with thick postrift sedimentary cover

Much of the variation in the potential field data is due to the shape and composition of the pre-rift basement. From the examples shown in this paper the potential field profiles and maps (e.g. Figures 1 and 2) are helping to define the large structural features of the basin such as half-grabens, deep troughs, rotated blocks and intra-basinal ridges. By using a combination of potential field processed data we can hypothesize on the nature of the basement and the presence of synrift volcanics. Most importantly, by integrating seismic imaging, potential field data and well results, we can elaborate on the distribution of Paleozoic carbonates in the basin and at the prospect/lead scale. While seismic amplitude and stratal truncation can be used as an indicator of the nature of the "basement" beneath sedimentary fill, potential field data can also help resolve this ambiguity. The task is more difficult when the basement plunges under thick postrift sedimentary cover on the outer ridge and slope. As the Paleozoic carbonates constitute a secondary gas reservoir in the area, the identification of high blocks preserving Appalachian carbonate platform is a critical part of hydrocarbon exploration in the area.

Potential field maps and profiles are essential for interpretation of structures at the shelf break and on the continental slope and rise, were the seismic basement and the top of synrift sequence are poorly defined markers and can only be "ghosted" on certain seismic lines. Several potential field profiles show that basement highs exists under the slope break and are situated higher than their position might be interpreted from seismic data only.

A steady gas price above $ 6 a mcf and innovative production systems are needed to be developed in order to bring the Labrador gas to the southern markets. Synergistic interpretation of geoscience data will assure the timely discovery of new reserves in this Canadian Frontier basin.

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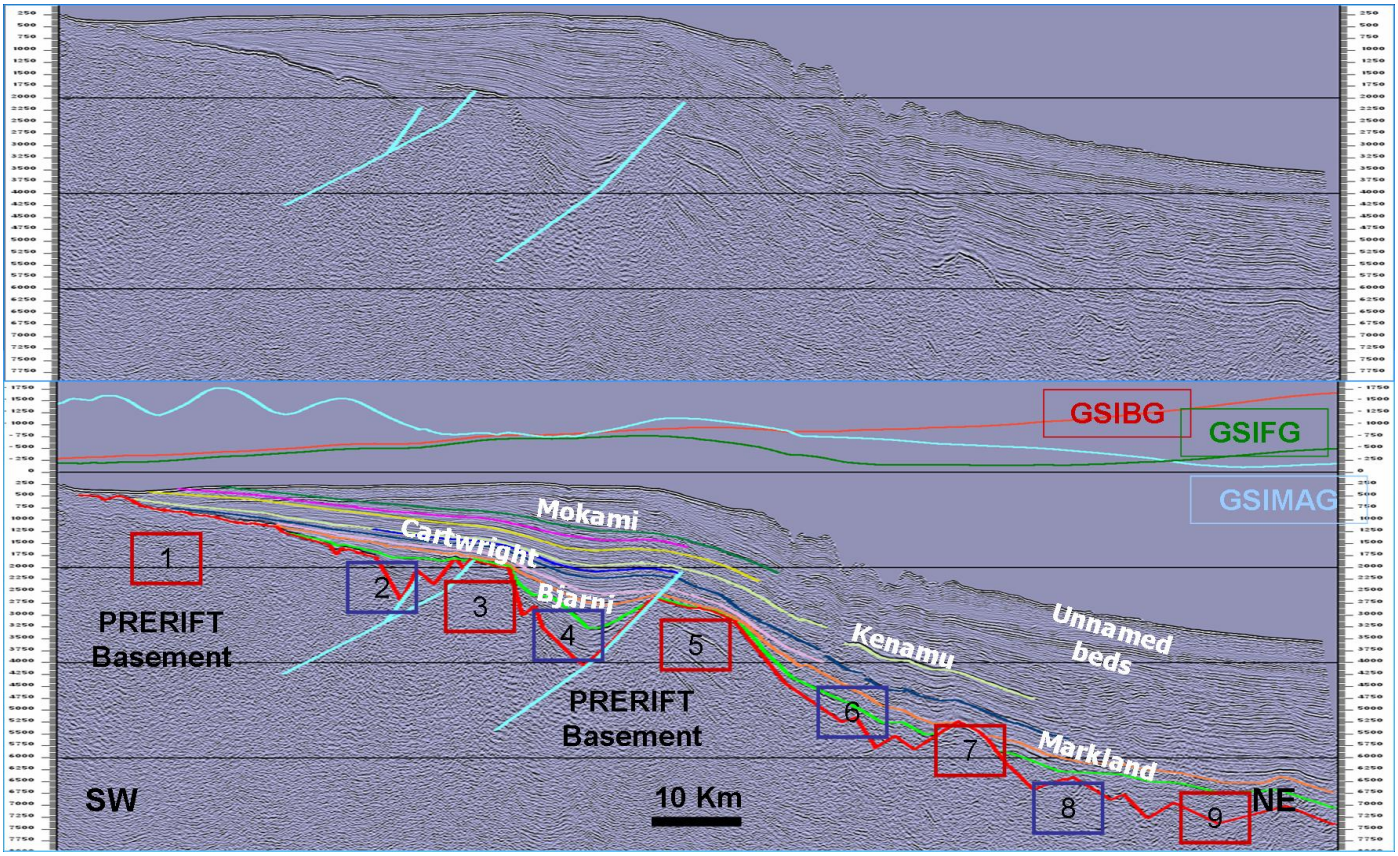

Figure 1. Uninterpreted (above) and interpreted (below) dip seismic section through Hopedale Basin including GSI free air (green), Bouguer (red) and magnetic (light blue) field profiles. Marked annotations and seismic horizon colors are as in Figure 21. Half-grabens (blue boxes) and basement highs (red boxes) are numbered to help data interpretation.

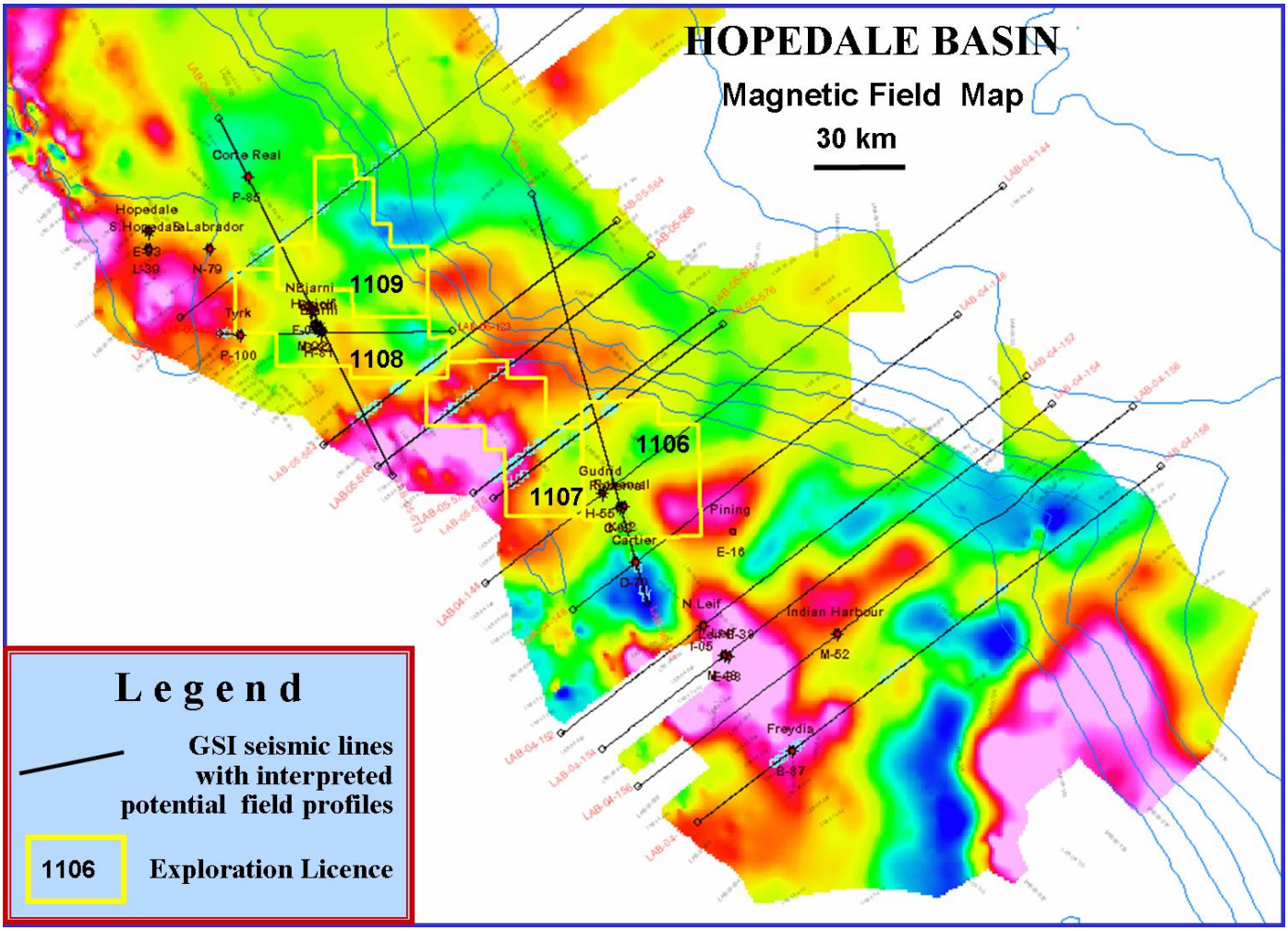

Figure 2. Magnetic field intensity map and key seismic lines. Hot colors show magnetic highs, cold colours show magnetic lows.