

by Andrew Thomas, NewField Exploration, Kevin M. Robinson, Paul Baltensperger, William Schneider, Alan J. Finlay, Chandra Velu and Paula Hix

## De-Risking Deepwater Sarawak with Controlled-Source Electromagnetic Imaging

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In late 2005 Newfield and Petronas Carigali acquired controlled source electromagnetic imaging (CSEMI) data over a series of rank wildcat prospects in the Deepwater 2C block, offshore Sarawak, Malaysia. The CSEMI, 3D seismic and remote sensing data were used as a risk reduction tool to high grade a prospect for drilling in late 2006. An exploratory well has since been drilled.

The CSEMI survey acquired 390 km of data along 10 lines over 11 prospects and two dry holes. The prospects are Pliocene turbidites and large structures at the mid Miocene unconformity (MMU). Water depths were generally greater than 1000 meters with reservoir targets 1500 to 2500 meters below the sea floor. Sediments are primarily shales and sands with resistivities in the 1.5 to 2.5 ohm range. Data with a fundamental transmission frequency of 0.25 Hz were collected at approximately 1 km intervals along the lines.

A series of EM anomalies, 20 to 60 % above the normalized field amplitude, were found over a number of the Pliocene turbidite prospects and large MMU structural prospects, although not all of the turbidite or MMU prospects showed EM anomalies. In addition no EM anomalies were found at the two dry holes. Comparison of unconstrained and constrained 2.5D EM inversion, with the 3D seismic data, indicated that the EM anomalies

*Comparison of unconstrained and constrained 2.5D EM inversion, with the 3D seismic data, indicated that the EM anomalies coincided with prospects identified on seismic.*

coincided with prospects identified on seismic. There was good agreement where the EM lines crossed.

A positive test of the EM anomalies will considerably reduce future exploration risk in the block. ■

### Biographical Sketch

ANDREW THOMAS has Bachelor and Honours degrees in Science from the University of Adelaide, Australia. After graduation he worked for Geoscience Australia as a structural geologist mapping

the Precambrian terrains of central Queensland. From 1988 to 1998 Andrew worked for Santos Ltd and Gulf Australia. Assignments included exploration roles in a variety of onshore and offshore Australian basins (Cooper/Eromanga, Carnarvon, Bonaparte) and in International New Ventures teams. In 1999 Andrew joined Newfield Exploration and has worked on projects in the offshore Timor Sea and in SE Asian New Ventures. He transferred to Houston in 2003 and is currently working in the International New Ventures team.



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change providing another significant but smaller contribution. Annual fossil CO<sub>2</sub> emissions increased from an average of 6.4 [6.0 to 6.8] GtC (23.5 [22.0 to 25.0] Gt CO<sub>2</sub>) per year in the 1990s, to 7.2 [6.9 to 7.5] GtC (26.4 [25.3 to 27.5] Gt CO<sub>2</sub>) per year in 2000–2005 (2004 and 2005 data are interim estimates). Carbon dioxide emissions associated with land-use change are estimated to be 1.6 [0.5 to 2.7] GtC (5.9 [1.8 to 9.9] GtCO<sub>2</sub>)

per year over the 1990s, although these estimates have a large uncertainty.”

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