MAPPING OF BASEMENT AND SEDIMENTARY HORIZONS IN THE OFFSHORE ANDAMAN SEA BASIN OF MYANMAR, USING MARINE MAGNETIC AND GRAVITY DATA

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INTRODUCTION

Marine magnetic and gravity data, acquired with a regional 2D seismic survey in 2010 over an area of 15,000km2 in the deep water Andaman Sea Basin (Figure 3), was interpreted using spectral methods. The gridded magnetic and gravity data (Figures 1, 2) was analysed using the Horizon Mapping method to map depth to basement and sedimentary interfaces.

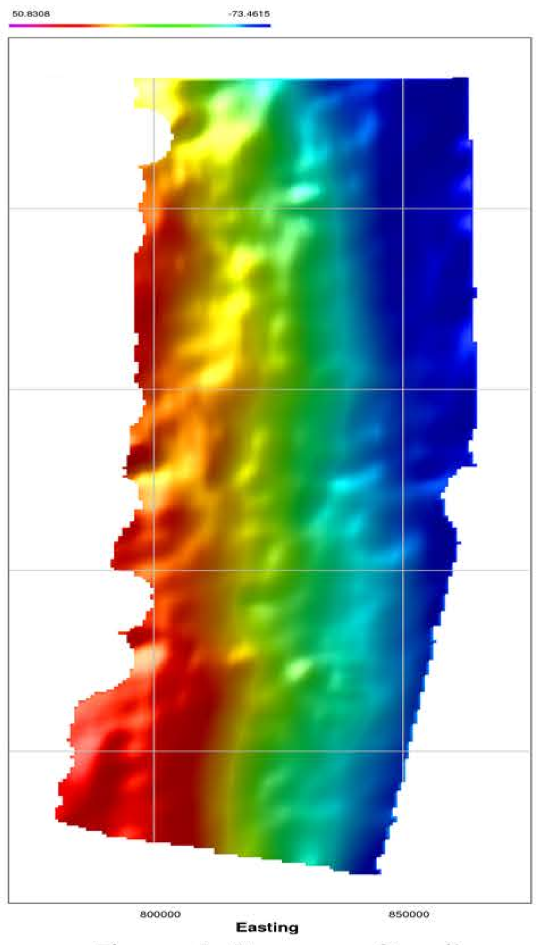


Figure 1. Bouguer Gravity

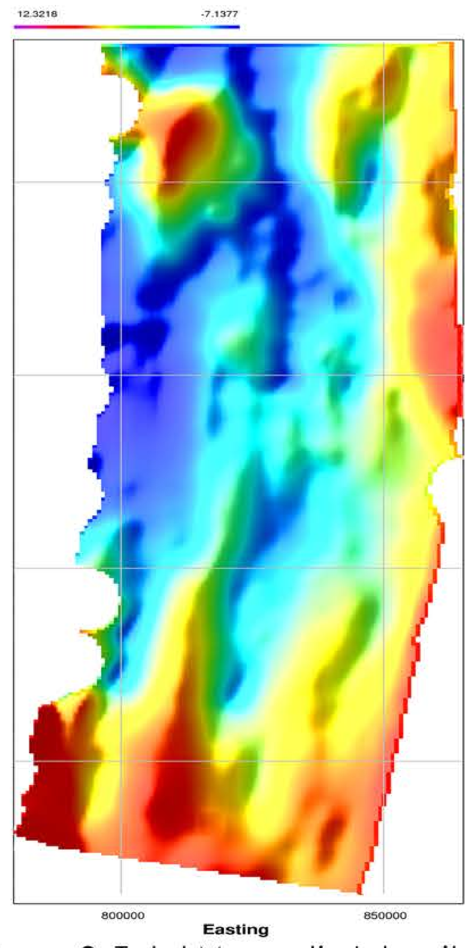


Figure 2. Total Magnetic Intensity

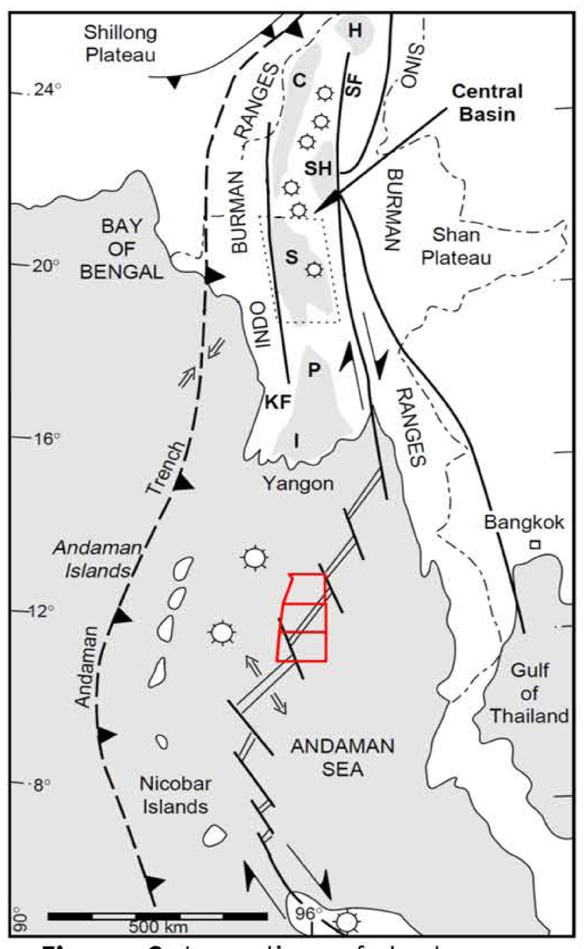


Figure 3. Location of study area (after Pivnik et al. 1998)

METHODOLOGY

Stage-1: Horizon Detection

- ESA-MWT on coarse mesh.
- Depth-Plateaus laterally merged to construct Horizon Skeleton.
- Optimal Windows selected.
- QC of Horizon Skeleton.

Stage-2: Detailed Mapping

- Depth mapping on dense mesh.
- Spectra over Optimal Windows.
- High-resolution Horizon Map is constructed.

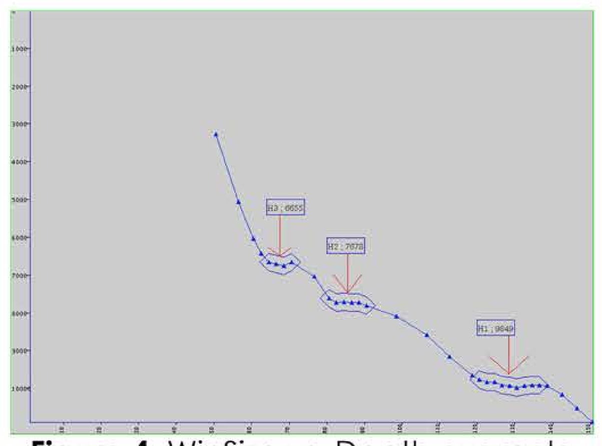
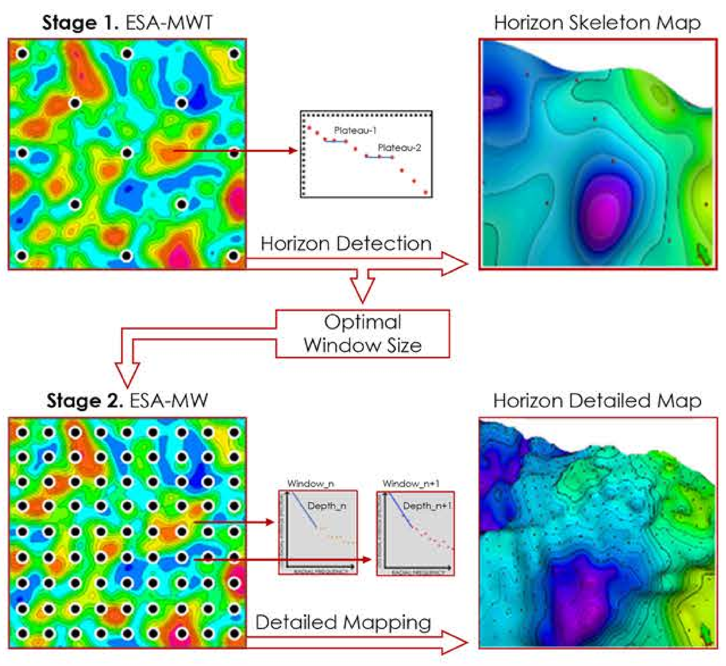


Figure 4. WinSize vs. Depth example



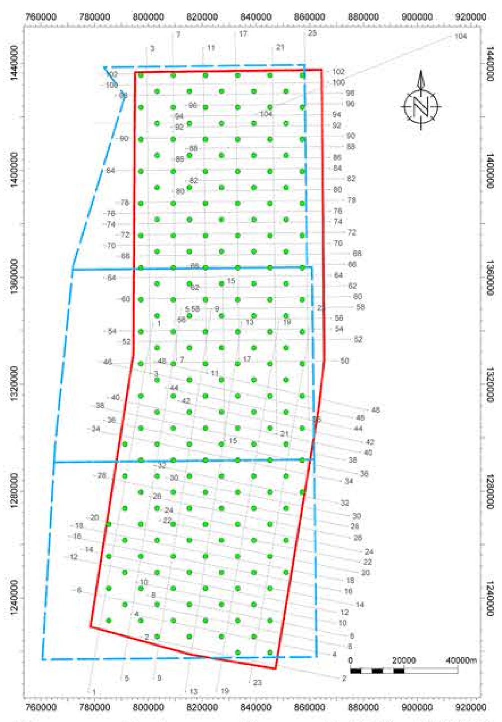


Figure 5. Location of ESA-MWT stations

HORIZON MAPPING

Horizon Mapping technique was applied in two stages; Stage-1, Horizon Detection and Stage-2, Detailed Mapping. In Stage-1, the ESA-MWT method (Kivior et al., 2012) was used to detect magnetic and density contrasts which were laterally merged and correlated to crystalline and economic basement, and an inter-sedimentary Tertiary erosional event. The detection of the contrasts was conducted on a regular mesh of 8.5km by 8.5km using ESA-MWT (Figure 4, 5). The optimal data window sizes determined in Stage-1 were used to interpret the final depth on a 6km by 6km mesh in Stage-2. Detailed Mapping of each horizon is following the same procedure.

Horizon 1. Crystalline Basement - The deepest mapped horizon H1 is the top of the crystalline basement. Depth varies from 7.5km in the south eastern corner to 12km at the south western edge. These depth estimates compare well with thickness of sediments interpreted from gravity by Mukhopadhyay and Krishna (1991) in the Andaman Sea, as well as Morley (2009) reporting 12km sediment thickness in the adjacent Central Basin, a northern extension of this study area (Figure 6, 9).

Horizon 2. Economic Basement - The interpreted, shallower H2 horizon coincides with the seismic economic basement (Figure 7, 10). The depth to the H2 horizon ranges from 5.5km in the shallowest part to 10km at the deepest. This depth range shows a good correlation with depth to basement derived from seismic. Stratigraphic information from the more explored adjacent region south of the study area, indicate that Pre-Tertiary and younger meta-sediments, such as the Eocene Tampur Fm carbonates in the Mergui-North Sumatra basin, form the economic basement.

Horizon 3. Tertiary Erosional Surface - The interpreted H3 horizon was the shallowest interface mapped from the magnetic and gravity data (Figure 8, 11, 12). Interpreted depths in the shallowest part are 4.5 km to 8.9km in the deepest section. Comparison with seismic interpretation carried out along some seismic profiles indicate that the horizon shows broad correlation with a Tertiary erosional surface event interpreted on seismic.

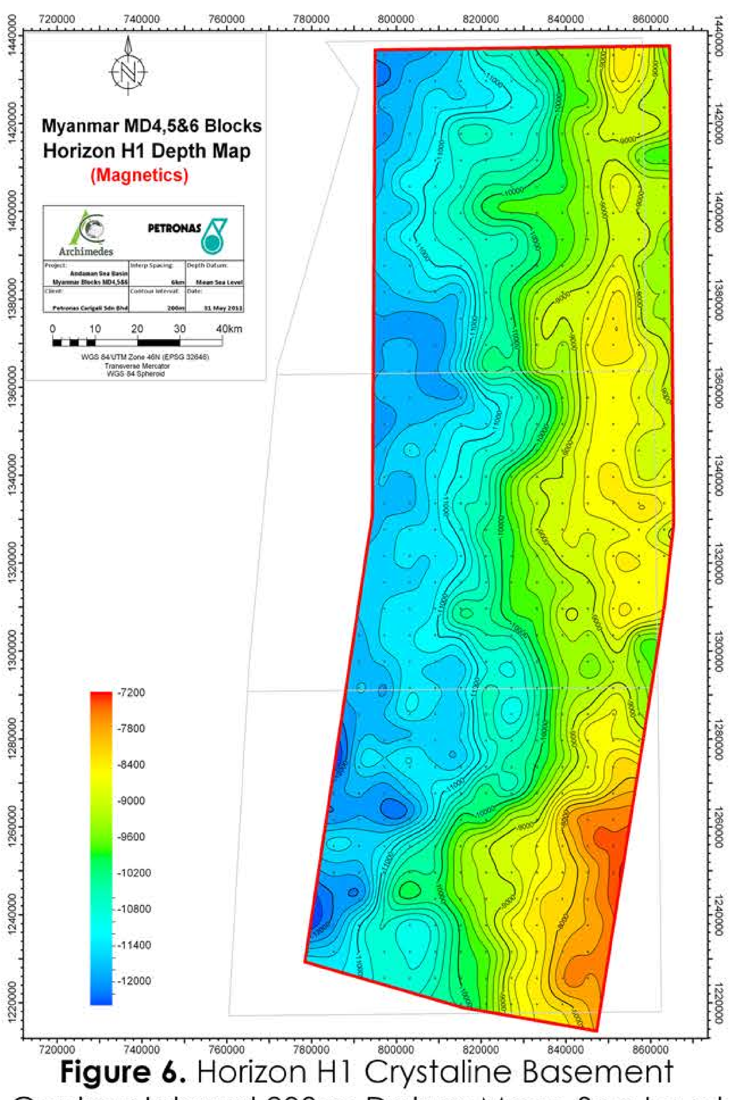


Figure 6. Horizon H1 Crystaline Basement
Contour Interval 200m; Datum Mean Sea Level

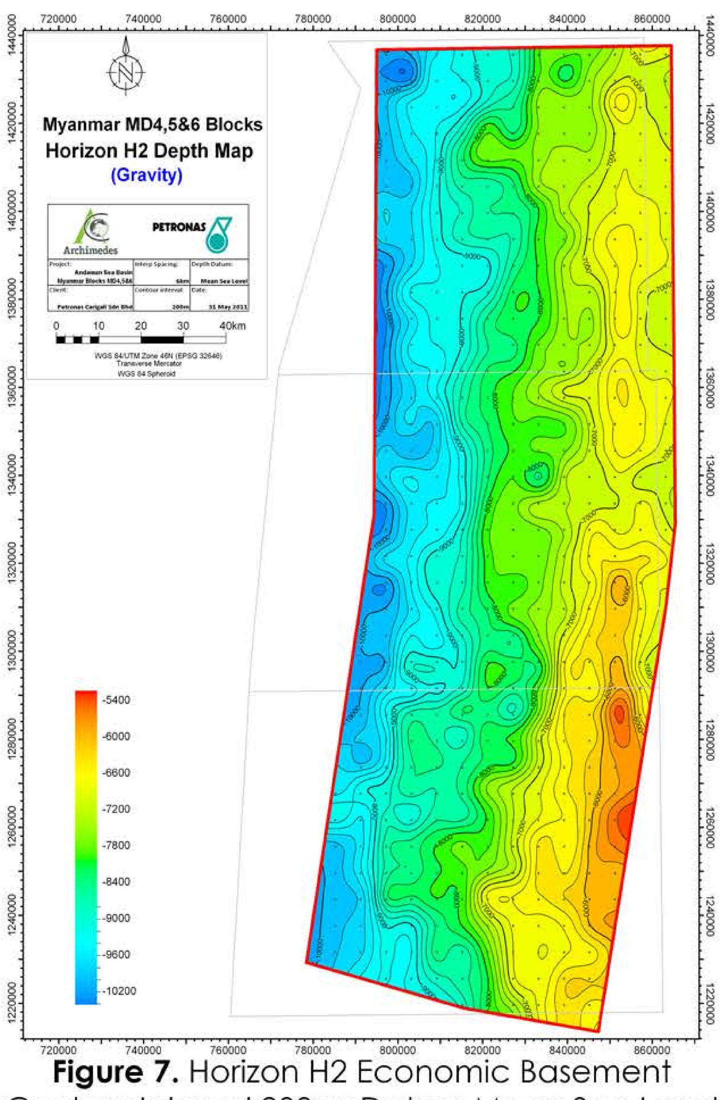


Figure 7. Horizon H2 Economic Basement
Contour Interval 200m; Datum Mean Sea Level

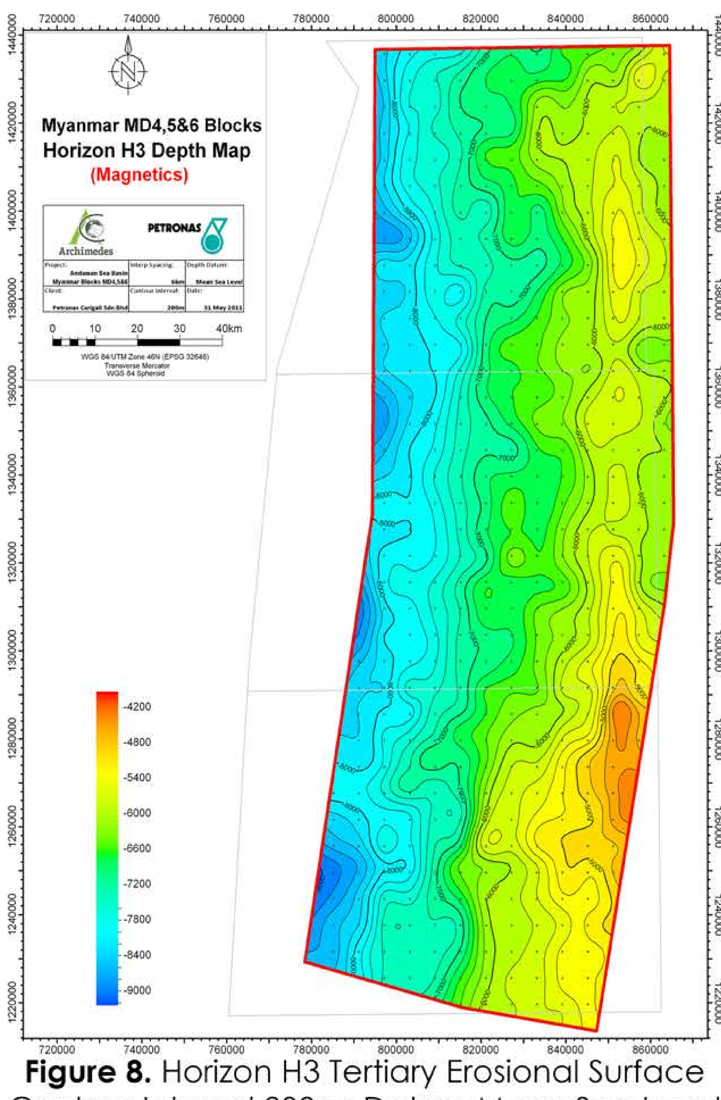


Figure 8. Horizon H3 Tertiary Erosional Surface
Contour Interval 200m; Datum Mean Sea Level

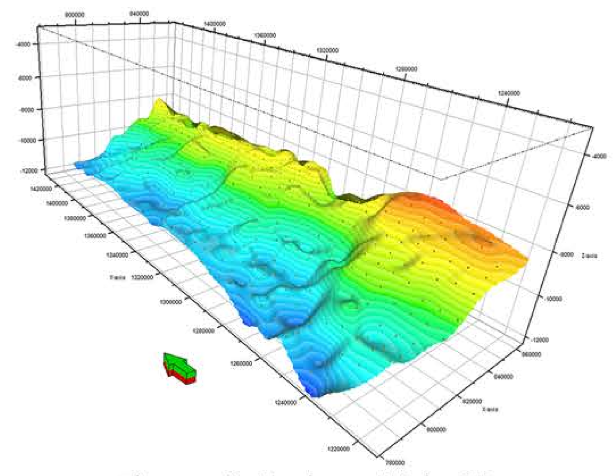


Figure 9. Horizon H1 in 3D

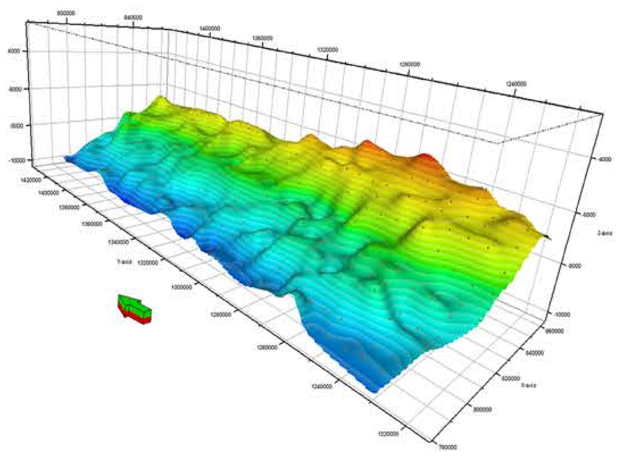


Figure 10. Horizon H2 in 3D

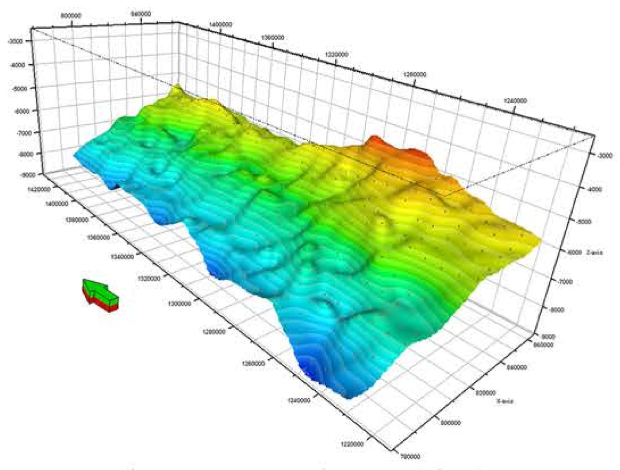


Figure 11. Horizon H3 in 3D

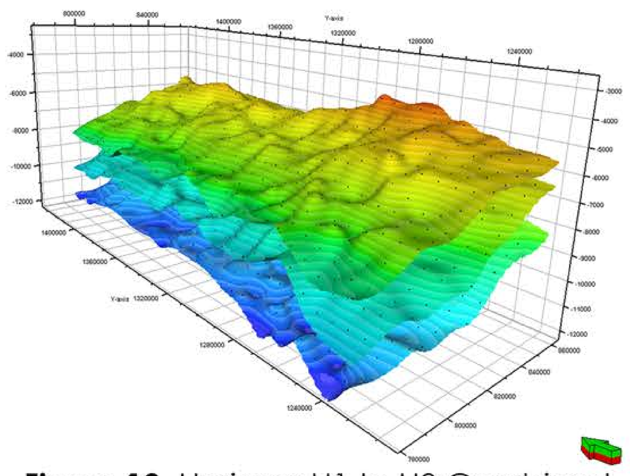


Figure 12. Horizons H1 to H3 Combined in 3D

CONCLUSIONS

Application of spectral methods to magnetic and gravity data proves to be a useful and robust approach in mapping deep crystalline basement, economic basement and shallower sedimentary horizons in the deep waters of the Andaman Sea Basin. The interpreted horizons show good correlation with corresponding seismic events as well as with the known tectono-structural configuration of the area and the surrounding geology.

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