Case Study

Exmouth Sub-Basin

The Exmouth Sub-basin contains significant thicknesses of Upper Jurassic Dingo Claystone, which constitutes the principal hydrocarbon source facies in the region. It has undergone a complex tectonic history, with a multiphase uplift, erosion, inversion, tilting and charge history.

Location:
Carnarvon Basin, offshore Australia

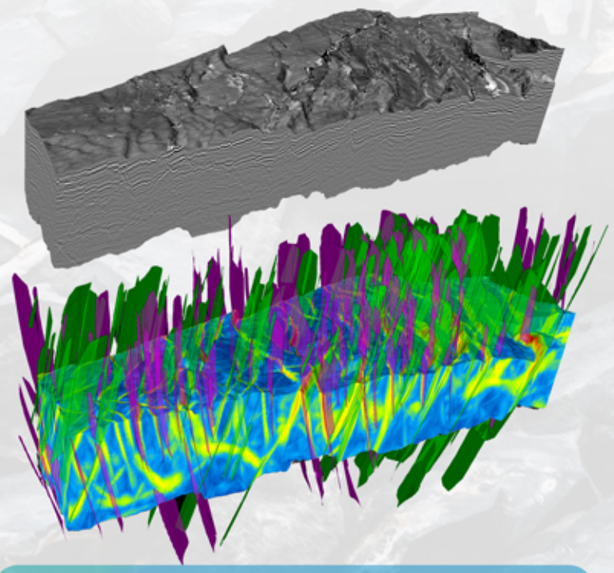
Surface area:
900 km²

Age of sediment:
Jurassic and Cretaceous

Geological context:
Intra-cratonic rifting system with multiphase tectonic history

Depositional environment:
Deep marine (Dingo source & Dupuy reservoir Formations), deltaic (Barrow Group)

Main challenges:
Faulted deposits



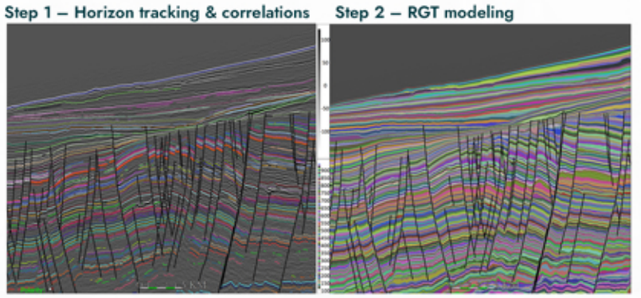
Phase 1 - Fault extraction from seismic amplitudes

Machine automation analyzes the seismic amplitudes to deliver the Fault Plane attribute and then model a preliminary fault network, composed of 80 % of seismic scale fractures. The integration of domain expertise and basin knowledge lately allows for an exhaustive extraction of classified fractures.

Make the most of machine automation and domain expertise

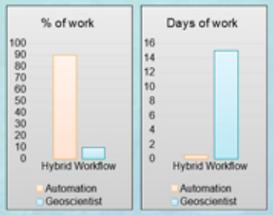
Step 1 – Horizon tracking & correlations

Step 2 – RGT modeling



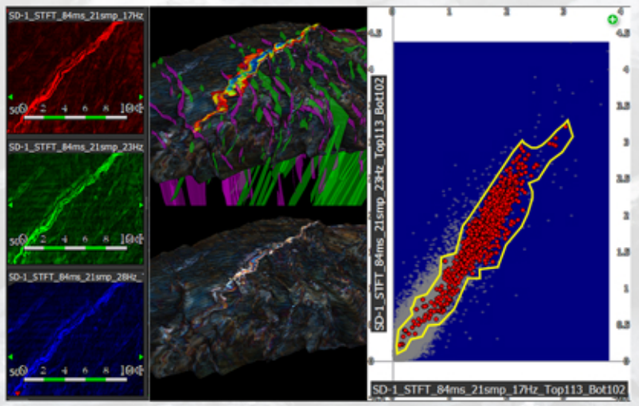
Phase 2 - RGT modeling framework from seismic reflections

The RGT model is automatically delivered with major large-scale stratigraphic trends consistency. The interpreters then control in an iterative way the delineation of the optimal geological correlations including tilted blocks, key chronostratigraphic surfaces and seismic stacking patterns.



Since routine work (fault extraction, horizon modeling, attribute analysis, geobody extraction) is accurately performed and/or assisted by machine automation, interpreters can focus on critical decisions and geological interpretation by using their knowledge and domain expertise.

Hybrid workflow relying on the synergy between machine automation and geoscientist intervention

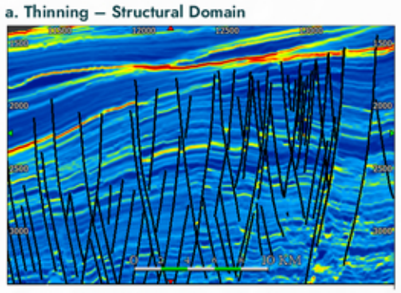


Geological reconnaissance and play generation

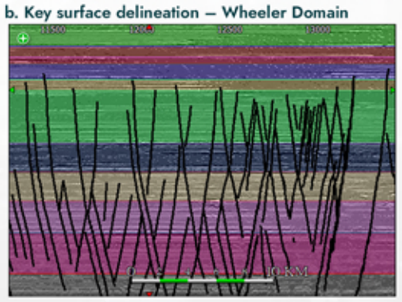
The sub-sample stratal slicing is combined with a Spectral Decomposition analysis. The 17Hz, 23Hz and 28Hz magnitudes are RGB-blended to emphasize a Jurassic turbidite system assumed to belong to Dupuy Formation. Classes are created from a cross plot, then encompassed data points are used to automate the geobody extraction from the stack of surfaces.
Attributes and geometrical features can be computed from the geobody, including the isochore data, lately matched with fracture distribution toward preliminary compartmentalization analysis.

HCA2000A seismic survey is courtesy of Australian Government

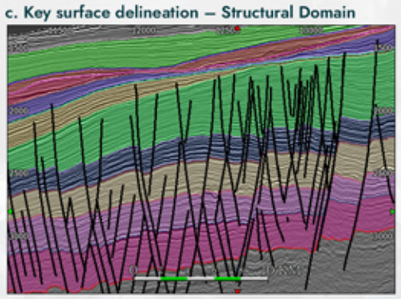
a. Thinning – Structural Domain



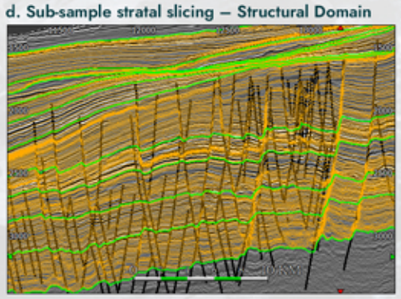
b. Key surface delineation – Wheeler Domain



c. Key surface delineation – Structural Domain



d. Sub-sample stratal slicing – Structural Domain



Wheeler transform & key isochrone delineation

Thinning attribute and seismic reflections geometry are analyzed in both the structural and Wheeler domains. The delineation of key stratigraphic surfaces is driven by stacking patterns and seismic stratigraphic terminations. As a result, stratigraphic zones are isolated and the vertical resolution for stratal slicing is flexible to fit seismic expression scale and well log responses.

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