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Sponsor Investment
$25k (USD)

Project I 01069_2

Sheared Margins of Western Australia" Phase 1 – Supplement

Sealed versus leaky structural highs of the Late Jurassic, Aptian/Albian, Turonian and Cretaceous/Paleocene West Australia; learning from the spatial and temporal distribution of fault activity, burial minima, erosional unconformities and missing strata

Project Rationale & Significance

Outer frontier margins of Western Australia are characterized by stranded continental blocks and marginal plateaus. Sedimentary section is prospective in Permian, Triassic, Jurassic and Cretaceous marine sequences with potential oil source rocks and siliciclastic reservoirs. Potential traps extend over 2500 km of under-explored Western Australian margin. This study will open minds to new plays over a vast region of Australian waters.

Studying the spatial and temporal distribution of fault activity, burial minima, erosional unconformities and missing strata allows one to interpret:

1. which eroding structures were footwall edges and which were horsts;
2. which structures did not have a top seal and for which time span;
3. which positive topographic features must have been hydrocarbon migration destinations and for which time span;
4. where were the main sediment entry points into the deeper basins (i.e., the main input of the reservoir-rock prone sediment);
5. where were the main sediment distribution pathways in the deeper basins (i.e., the main zones of the reservoir-prone sediment); and
6. which sediment catchment areas were separated by positive topographic features from any potential reservoir-prone sediment input (i.e., areas prone to seal and source rock deposition).

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Study Area

Study area (Fig 1) includes West Australian margin segments spanning from the Argo rifted margin segment in the north to the Perth rifted margin segment in the south, including the Exmouth Plateau, Cuvier obliquely-rifted margin segment, Wallaby Plateau, Zenith Plateau and Zenith-Wallaby-Perth transform margin segment.

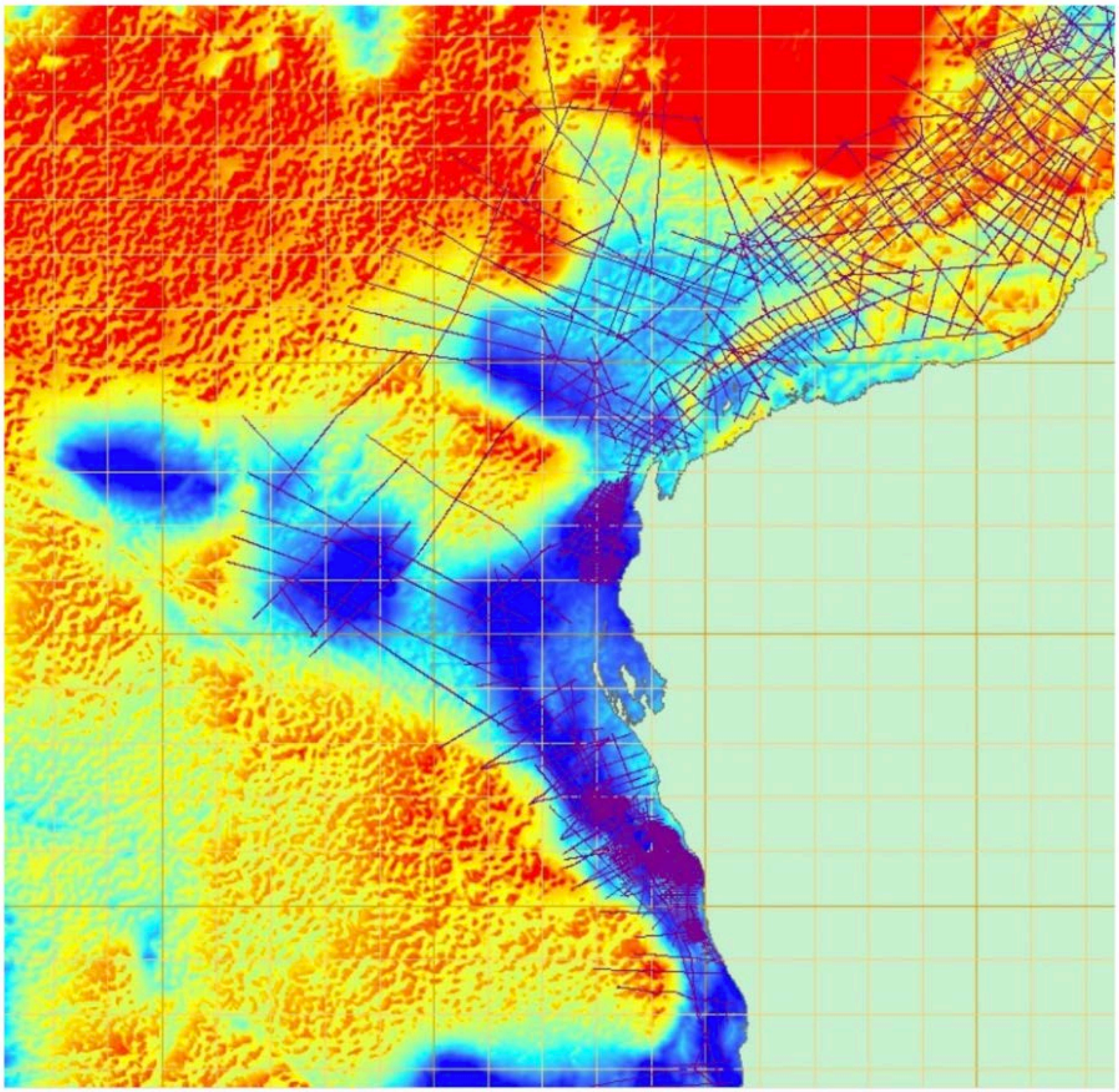

Figure 1. Map of the study area showing offshore isostatic residual gravity anomalies, which were calculated during Phase 1 study, and locations of interpreted reflection seismic data accessed from the Geoscience Australia.

Deliverables

The result of this study is the Arc GIS project (Arc Map v. 10.3), which contains:

a) **10 horizon depth maps** in milliseconds of TWT (Moho, top Middle Jurassic, base Barrow Delta, top Barrow delta, stretching unconformity, thinning unconformity, Aptian/Albian boundary, top Turonian, Cretaceous/Tertiary boundary, sea floor)

b) **8 sedimentary (resp. rock) thickness maps** in milliseconds of TWT including:

   (1) thickness between Moho and top of the crust for the entire study area with thinner continental crust

   (2) thickness between Moho and Middle Jurassic top for the outer portion of the Exmouth Plateau

   (3) thickness of Barrow Delta and its local stratigraphic equivalents

   (4) thickness between top Middle Jurassic surface and stretching unconformity for the Exmouth Plateau and Argo margin segments

   (5) thickness between top Middle Jurassic and top Turonian surfaces for the Exmouth Plateau and Argo margin segments

   (6) thickness between stretching unconformity and top Turonian surface for the Exmouth Plateau and Argo margin segments

   (7) thickness between top Turonian and Cretaceous/Tertiary boundary for the Exmouth Plateau and Argo margin segments

   (8) thickness between Cretaceous/Tertiary boundary and sea floor for the Exmouth Plateau and Argo margin segments

c) **fault activity timing map** (pre-Late Jurassic, pre-Aptian/Albian boundary, pre-Cretaceous/Tertiary boundary and Tertiary faults)

d) **4 maps of unconformable and conformable portions of key horizons** (top Middle Jurassic, Aptian/Albian boundary, top Turonian, Cretaceous/Tertiary boundary horizons)

e) **6 maps of color-coded missing age span associated with erosional unconformities determined in wells** (Middle Jurassic, Upper Jurassic, Lower Cretaceous, Aptian/Albian boundary, Turonian, Cretaceous/Tertiary boundary erosional events)

Project Timeline & Investment

Project sponsors and participants will be updated regularly regarding analyses, models and their interpretations. The project is planned for ?? DURATION ??. Investment per sponsor is $25,000 (USD).

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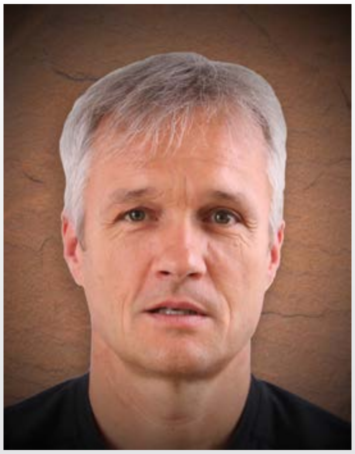

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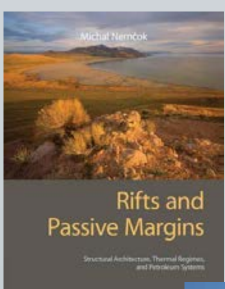
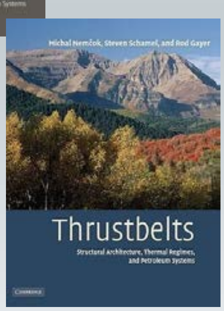
Research Interests

- Continental break-up processes and controlling factors
- Thrustbelt development and controlling factors
- Fracture development prediction





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Michal Nemčok, PhD

Research Professor

Michal holds a Ph.D. in Structural Geology from the Comenius University, Bratislava. He has 35 years of applied and basic research experience at the Slovak Geological Survey, University of South Carolina, University of Wales, Cardiff, Imperial College London, University of Salzburg, University of Wurzburg, and University of Utah. He joined EGI in 1998 and is a Research Professor and Structural Group leader. Michal has published 80+ articles, coauthored 5 monographs, and coedited five books.

Continental Break-up Processes & Controlling Factors

Continental break-up research focuses on both extensional and transform settings, with a focus on driving mechanisms and controlling factors to achieve predictive models with respect to structural architecture, thermal regimes, and petroleum systems. The main research contribution includes understanding anomalous thermal and uplift histories of transform margins, break-up mechanisms in extensional settings, and micro-continent-releasing mechanisms. A summary of his last eight years of break-up research is recorded in a monograph titled *"Rifts and Passive Margins; Structural Architecture, Thermal Regimes and Petroleum Systems"* published by Cambridge University Press, and authored by Nemčok, M. Together with co-authors, a new monograph called *Strike-slip Terrains and Transform Margins—Structural Architecture, Thermal Regimes & Petroleum Systems* is being written in contract with Cambridge University Press.

Thrustbelt Development & Controlling Factors

Michal's current research focuses on the thrustbelt-foreland interactions, with a concentration on driving mechanisms and controlling factors behind thick-skin tectonics, foreland plate flexure mechanisms, and flexural faulting in control of structural architecture and play concept elements. The main research contribution includes the factors and mechanisms leading to the lack of foreland flexing and transitions from initial inversion to full accretion. Accompanying research focuses on modeling of the fluid flow mechanisms occurring in the thrustbelt front and its foreland. A summary of thrustbelt research is written in a monograph called *"Thrustbelts; Structural Architecture, Thermal Regimes and Petroleum Systems",* published by Cambridge University Press, and authored by Nemčok, M., Schamel, S. and Gayer, R.. Current research findings are summarized in several articles included in the Geological Society of London Special Publication 377, which is edited by Nemčok, M., Mora, A., and Cosgrove, J.

Fracture Development Prediction

Fracture prediction research includes both detailed well core, rock outcrop and numerical simulation studies focused on predicting timing, location and kinematics of developing fractures. Most of the fracture studies come from thrustbelts, although some core-based studies come from various geothermal reservoirs. The main research contribution includes tools capable of predicting fracture locations, kinematics and propagation timing in two and three-dimensions for hydrocarbon reservoirs in thrustbelts, which were tested by well-based fracture data. Accompanying research includes understanding the role of mechanical stratigraphy on developing structural architecture. This research is published in a number of journals run by structural and geothermal communities.