

## The OZ SEEBASE™ Project: A New View of Australia's Phanerozoic Basins

During 2000 Tom Loutit, Managing Director of FrOG Tech (formerly the SRK Consulting Energy Services Group), gave the PESA Distinguished Lecture tour of Australia, that outlined the FrOG Tech approach to rapid basin evaluation from the 'bottom-up' which featured a product based work flow called SEEBASE™ (Structurally Enhanced view of Economic Basement).

This year a first-pass OZ SEEBASE™ product (Figure 1), representing many work years by the FrOG Tech team in the petroleum, mineral and coal sectors, has been completed. During this time, FrOG Tech has undertaken numerous projects in Australia with both the private and government sectors.

However, the bulk of the progress was made during the past year after Shell Development Australia provided the funding to complete the project under an arrangement with the Commonwealth Government which ensures

that the product will be available to the public. During the past year the FrOG Tech team led by Dr Lynn Pryer has mapped the basins over two-thirds of the Australian continent.

The work has resulted in the development of a consistent, testable structural model of the geological evolution of Australia's Phanerozoic basins presented in a GIS project. The model is consistent with a wide range of datasets including airborne and satellite remote sensing, seismic, well and outcrop observations. The product should prove useful for predicting petroleum potential, especially in the deeper parts of the more prolific basins. But the OZ SEEBASE™ GIS project also provides important information for a range of resource sectors including groundwater, minerals, coal, and geothermal.

The approach has involved interaction with all of the State, Territory and Commonwealth geoscience institutions in order to construct

the underlying database used in calibration of the model. Data were compiled and processed and put into the GIS project so that the on-screen interpretation process could begin. Key geological information was extracted and used to constrain the construction of the SEEBASE™ surface. The first step in the interpretation process involved building a kinematically and mechanically consistent model of the key tectonic events that are likely to have impacted the architecture of the target sedimentary basins. Interpretive layers including basement terranes, basement composition and lithology, intrusive and extrusive bodies, and faults by event age (Figure 2) are commonly generated primarily from the non-seismic data and checked against seismic, wells and maps. Most of the information is attributed and stored in a customised geodatabase within ArcMap 9.0.

At least 128 different basement blocks, or terranes, underlie the basins of Australia (Figure 3). Each has a distinct 'reactive fabric'

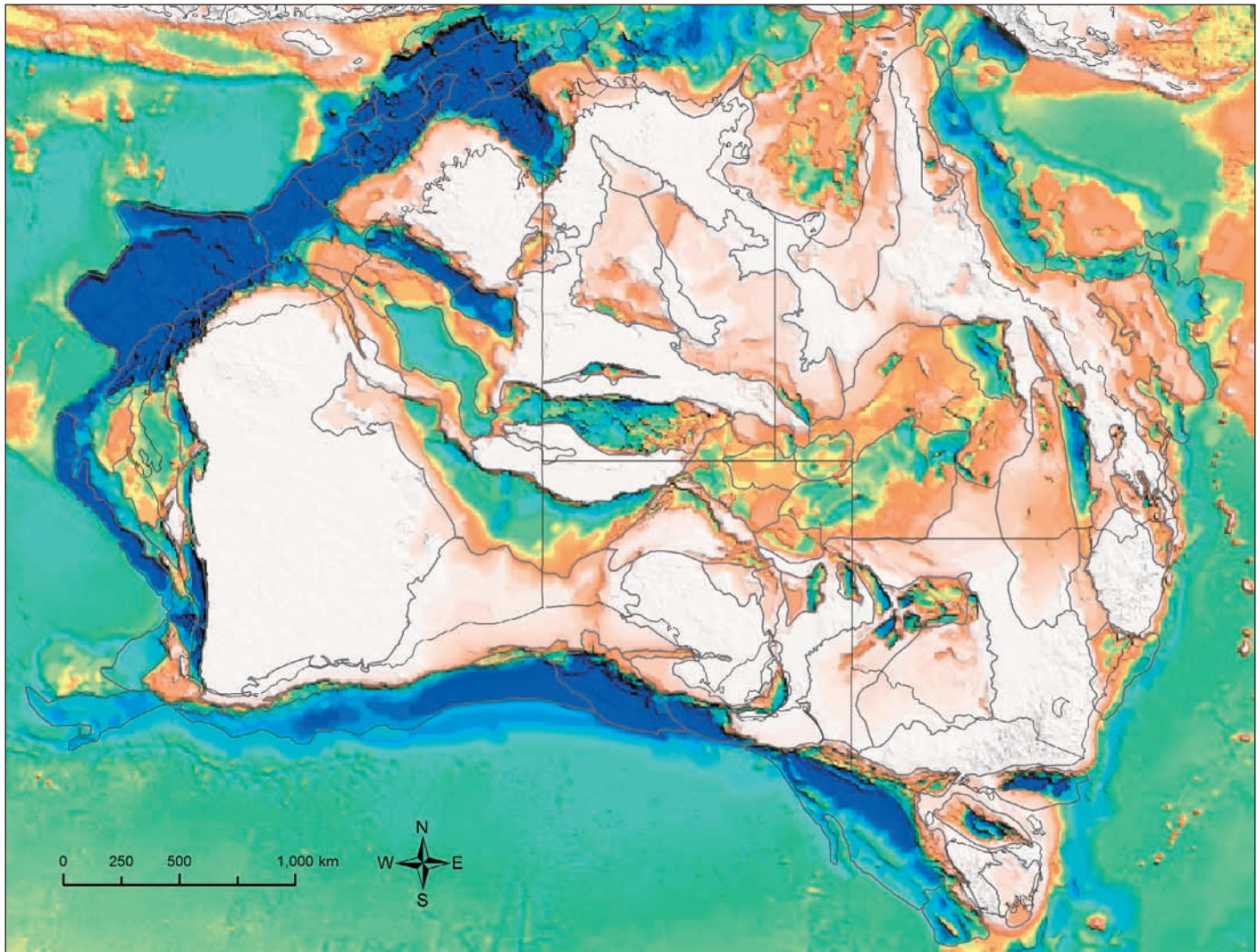


Figure 1. SEEBASE™ image of the Phanerozoic Basins of Australia

that has responded differently to changes in the regional stress field since the Early Palaeozoic resulting in the formation of a suite of basins and sub-basins of markedly different architecture. Each basin or sub-basin has developed in a series of phases characterised by variations in subsidence mechanism and geometry.

The SEEBASE image provides a view of the present day shape of each basin that can be restored to earlier shapes. It provides a framework within which to place observations on stratal geometry and reservoir, seal and source distribution. In addition, the knowledge of basement structure and its possible response to younger stress events can be used to predict the timing, distribution, type, size and integrity of basement-involved traps.

The 'bottom-up' approach also pays dividends when trying to predict reservoir and seal quality as the mapping of river catchments and discharge areas defines the provenance, composition, lithology and grain-size of sediments likely to be found in the basin.

The systematic integration, calibration and interpretation of non-seismic and seismic datasets using a combination of mineral and petroleum exploration techniques provides significant improvements in the efficiency and effectiveness of basin and petroleum systems evaluation. The 'bottom-up' approach resulting in the generation of SEEBASE™ images dramatically changes the way in which petroleum systems, plays and play elements can be mapped and evaluated. The approach is especially relevant in the deeper parts of more prolific hydrocarbon basins when they are approaching a period of declining production and attention begins to focus on older and deeper petroleum systems.

The principal objective of the OZ SEEBASE™ project has been to lower risk and assist exploration for oil and gas, minerals and groundwater in Australia's sedimentary basins by providing:

- a new view of Australia's sedimentary basins from an integrated regional interpretation (nominally 1:500,000 scale) of basement composition, structure and depth to basement SEEBASE™ image (grid) for the whole of onshore Australia and its offshore margins.
- the first consistent testable structural model for the evolution of Australia's sedimentary basins.
- a new illustration of the effects of basement geology on basin evolution and petroleum systems in the individual basins, focusing on structural evolution/reactivation, basin architecture and tectonic history.
- a GIS project (ArcMap 9.0) containing all interpretive layers, and accompanying reports.
- a base for a new set of maps of palaeogeography, crustal heat flow, crustal thickness, hydrocarbon generation volumes, etc.

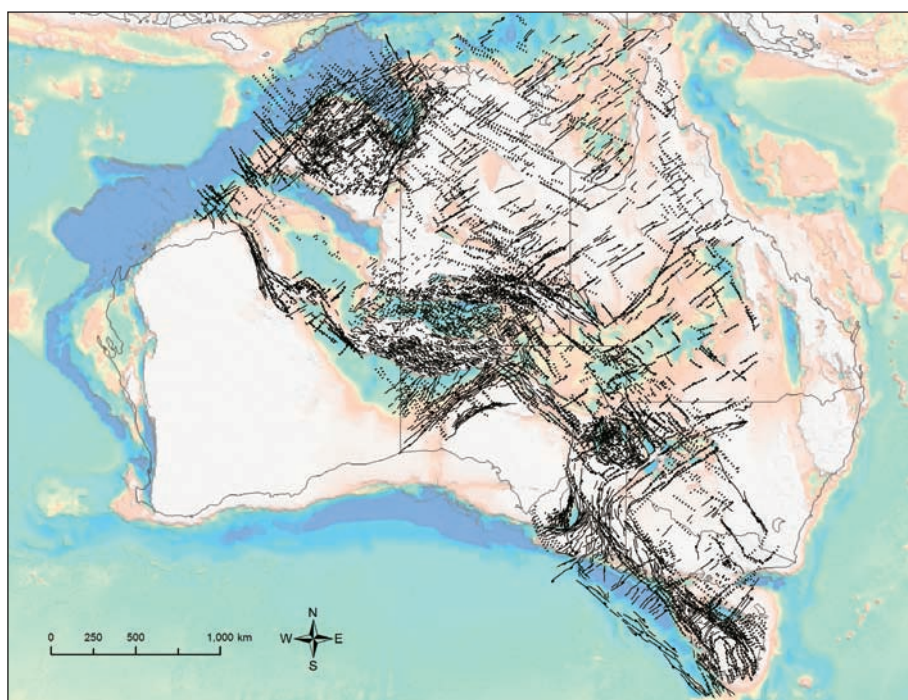


Figure 2. Fault movements related to the Antrim tectonic event (Cambrian 530-510 Ma), derived from non-seismic data.

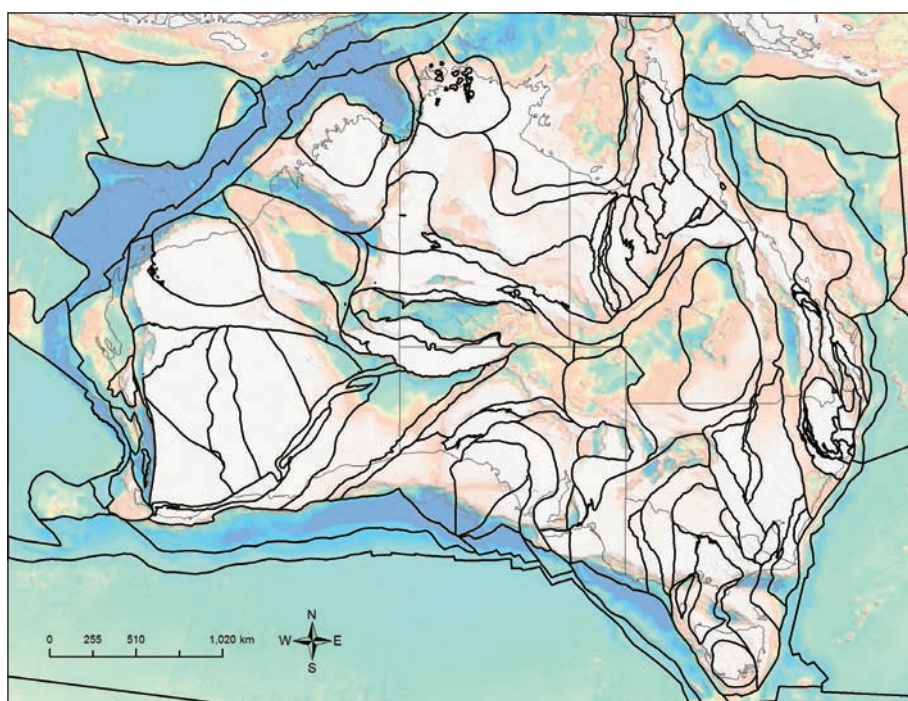


Figure 3. Terranes mapped during the OZ SEEBASE™ project.

The project will be available as a GIS project in August 2005. Contributors in addition to Shell Development Australia include Anadarko Petroleum Corporation, Apache Energy Australia, Encana, Encom Technology, ESRI, ExxonMobil Exploration, Geoscience Australia, MRNSW, MRT, PIRSA, SRK Consulting, and Woodside Energy.

FrOG Tech is intending to run a series of workshops with each State, Territory and

Commonwealth geoscience institution as part of the handover process during the next few months. FrOG Tech is also discussing a range of mechanisms to revise, improve and maintain the database over the coming years.

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