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from ffA

Using Geological Expression Techniques to Reveal Complex Regional Structural Information Without Conventional Interpretation

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Structural Interpretation

3D Seismic structural interpretation workflows are a legacy of 2D interpretation styles

Manual interpretation is time consuming, at risk of subjectivity, and an inefficient use of volumetric data

The aim of this study was to determine structural information contained in a 3D seismic dataset, without recourse to conventional manual interpretation

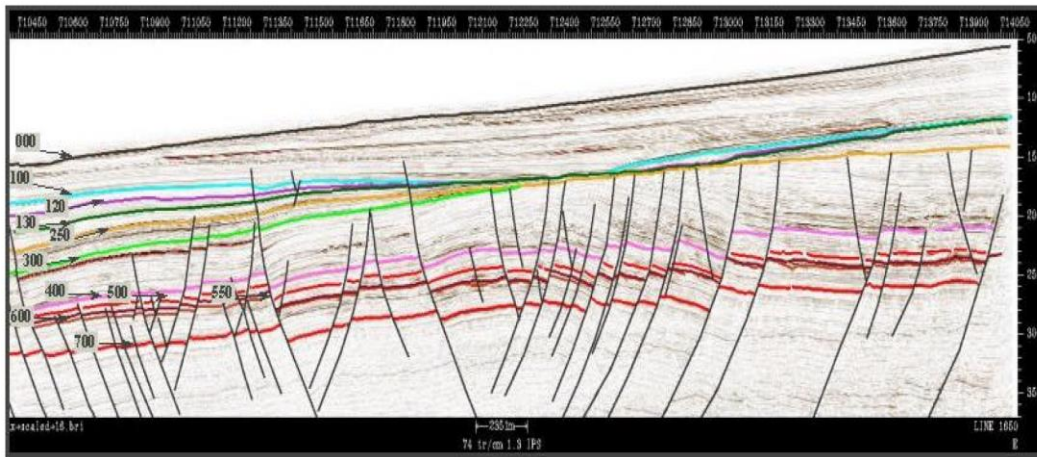


Image: Craig Dempsey/BHP Billiton, *WA-255-P HCA2000A 3D Seismic Survey Interpretation Report*, 19th Aug 2002

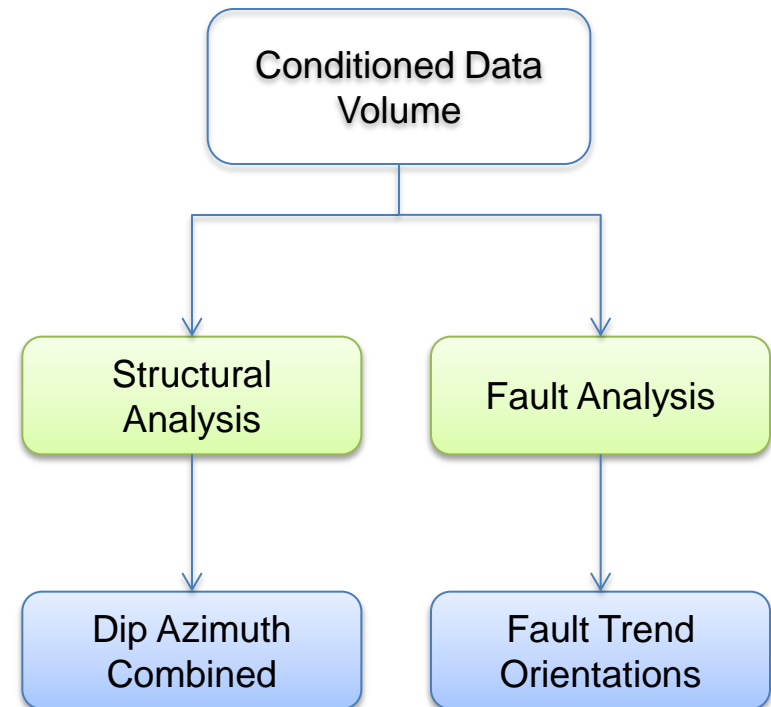
Theory

Geological Expression techniques convert geophysical data into geological information

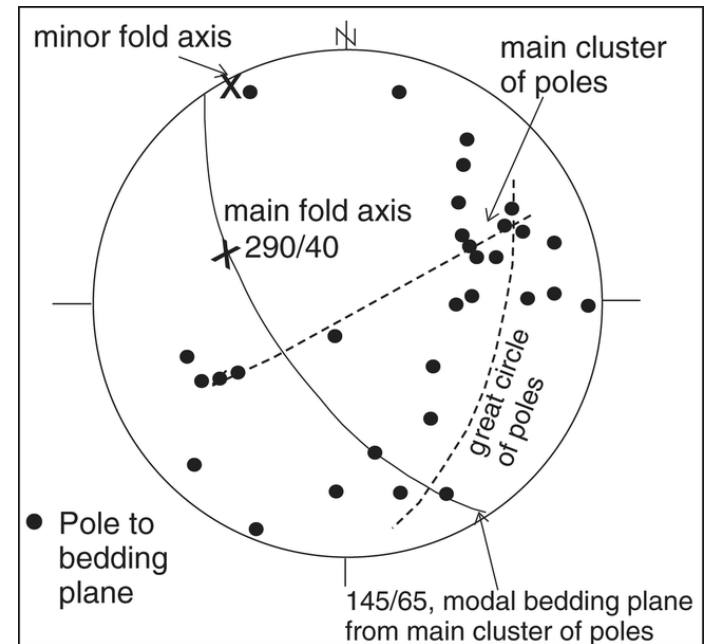
Interpreter knowledge and geological experience combined with data-driven automation and accuracy

- Reduced time to generate geologically meaningful results
- More accessible information and reduced uncertainty
- Enhanced value of original seismic through maximum data usage

Workflow



Theory



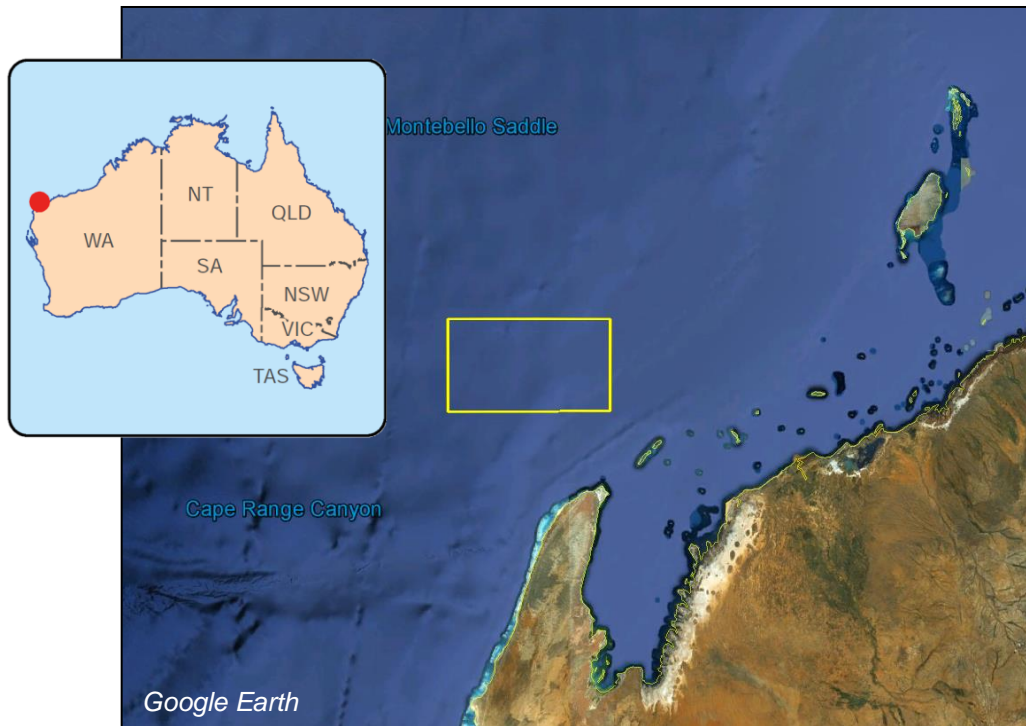
Seismic data contains a vast number of individual data samples, each of which represents a potential measurement

These can be used to populate analyses, in a fashion analogous to classic structural interpretation methods

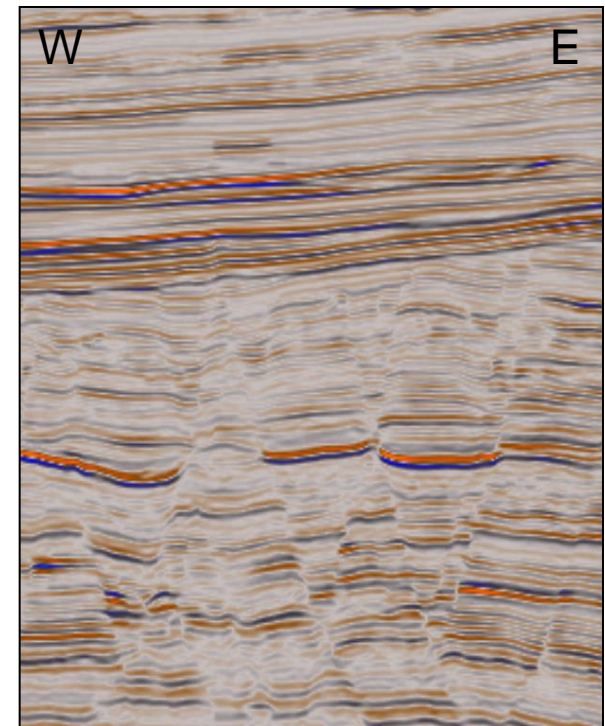
Data

HCA2000A 3D Seismic Survey

Courtesy of Geoscience Australia

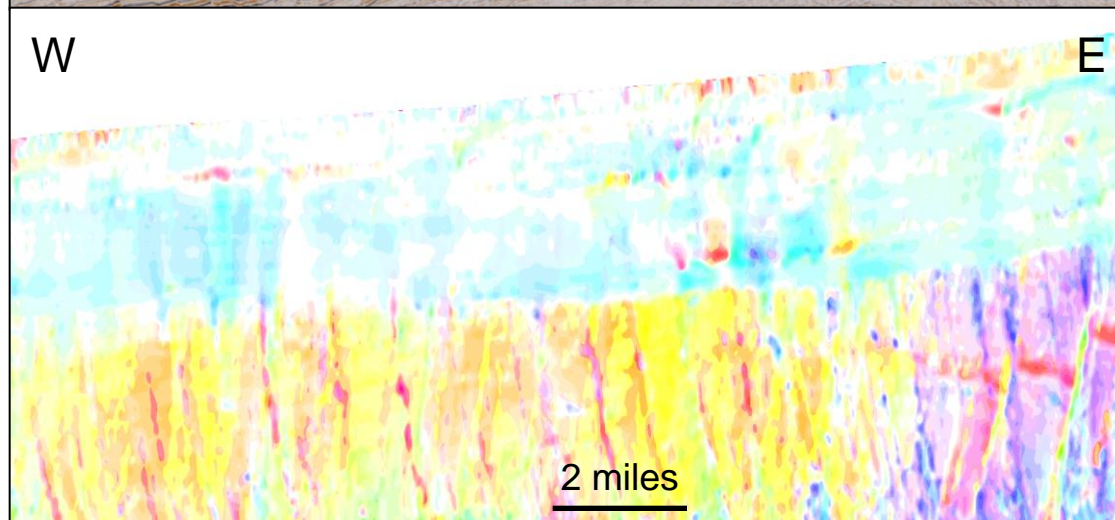
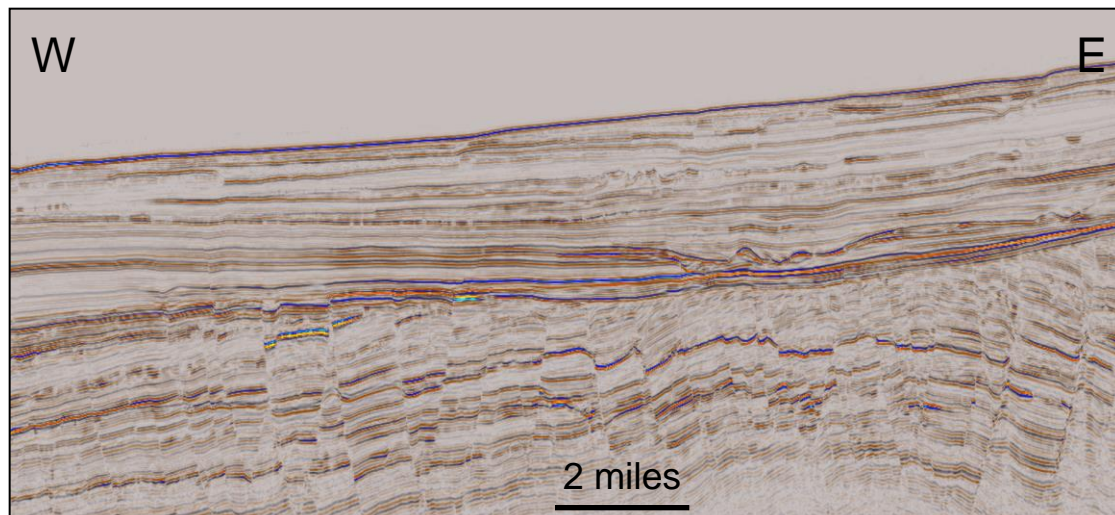
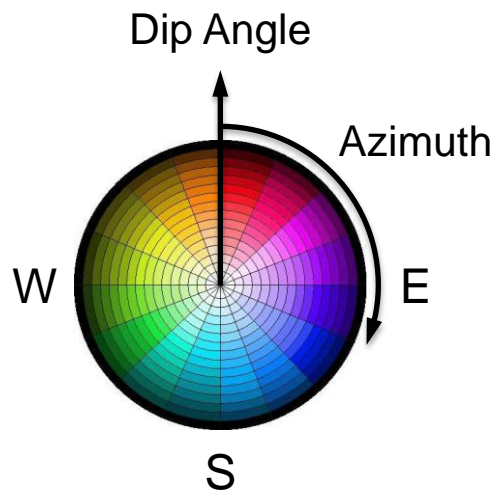


Representative Section Inline



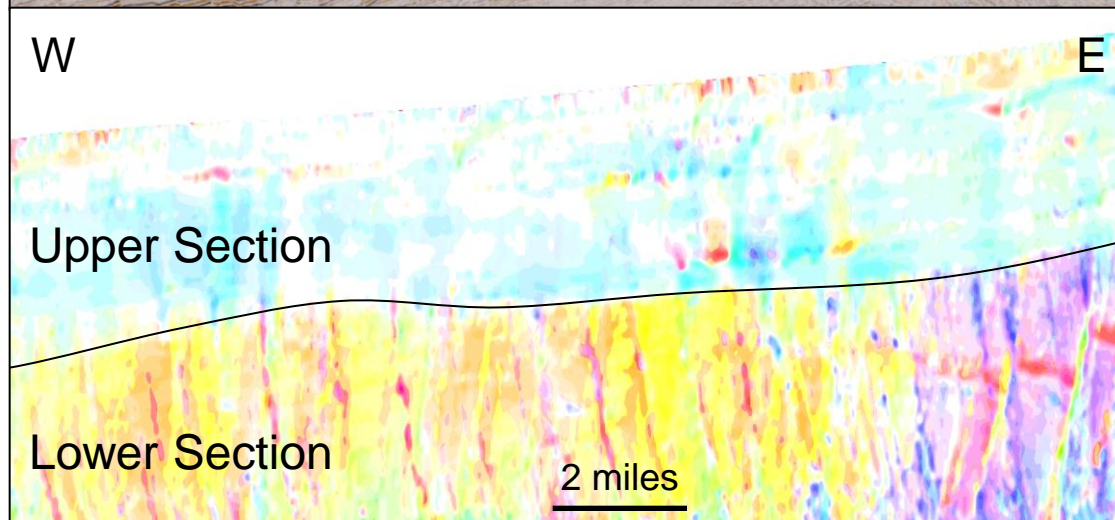
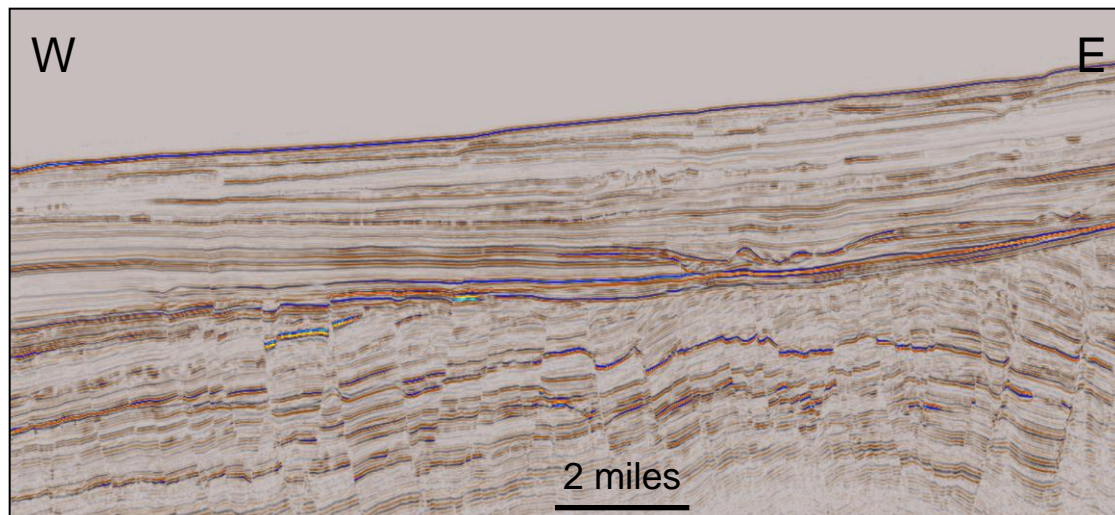
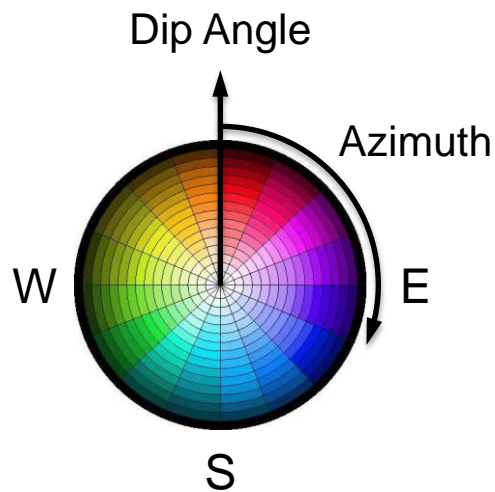
Dip Azimuth Combined

Inline Strike Section



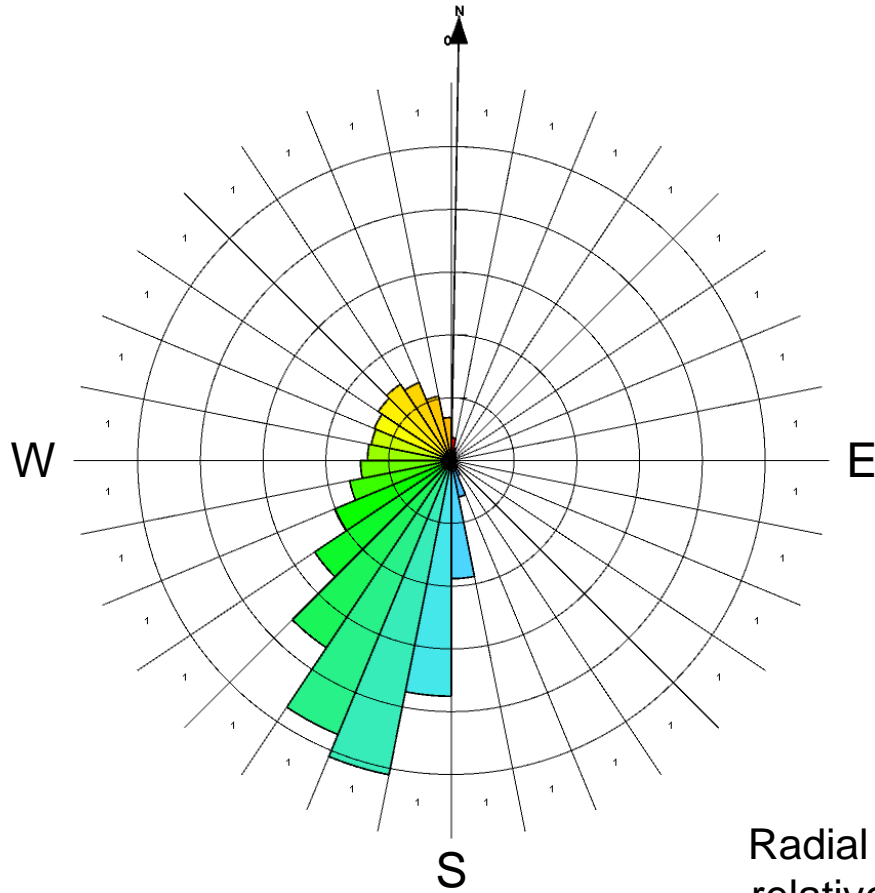
Dip Azimuth Combined

Inline Strike Section

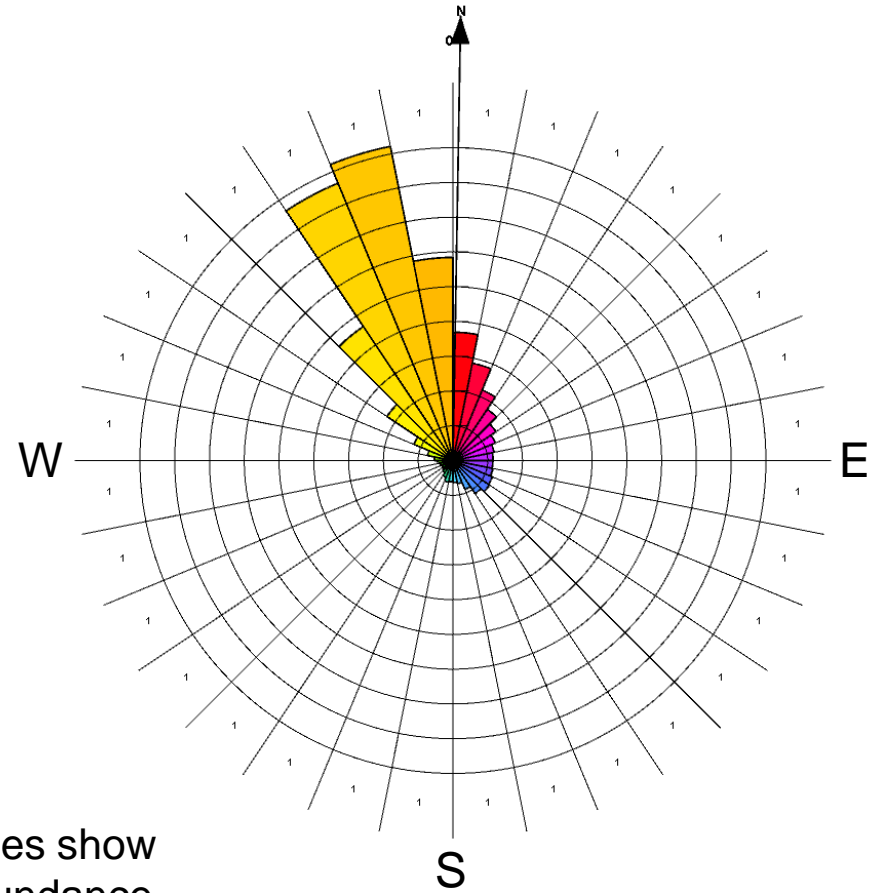


Azimuth Analysis

Upper Section

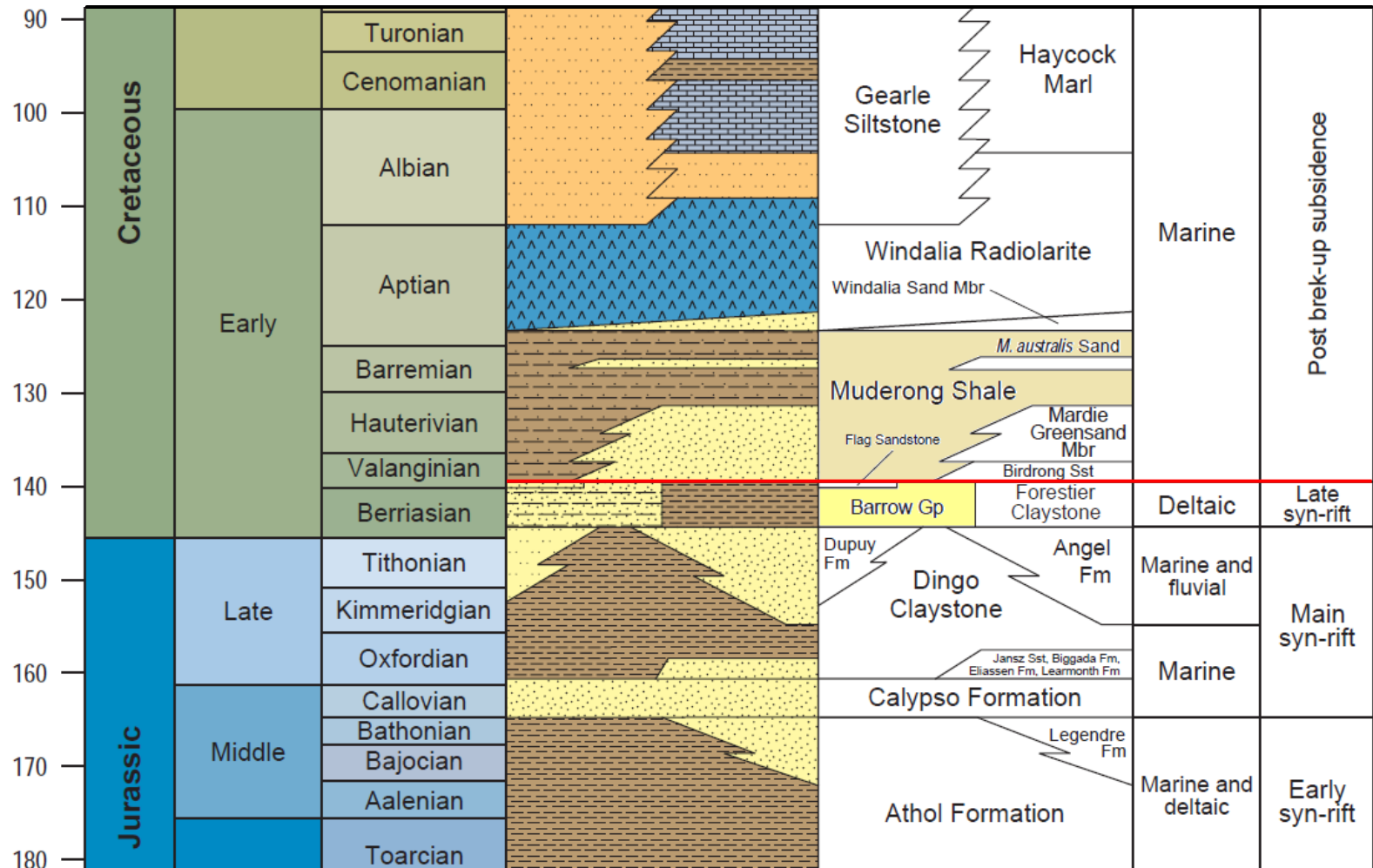


Lower Section



Radial values show
relative abundance

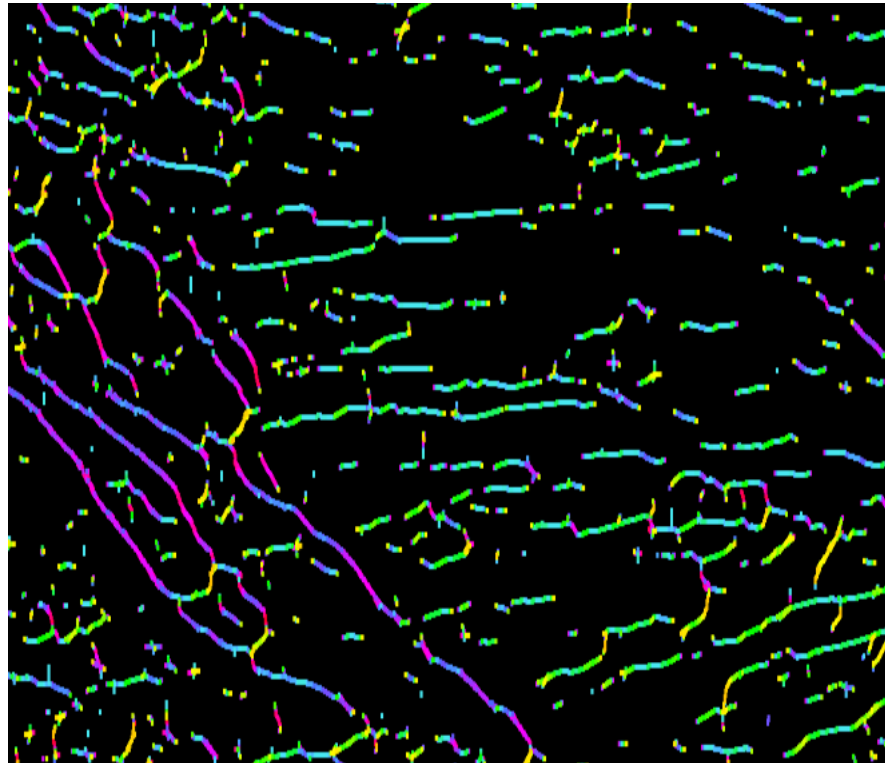
Stratigraphic Relationships



Adapted from: *Exmouth Sub Basin 2010 Offshore Petroleum Exploration Acreage Release*, Geoscience Australia

Fault Analysis

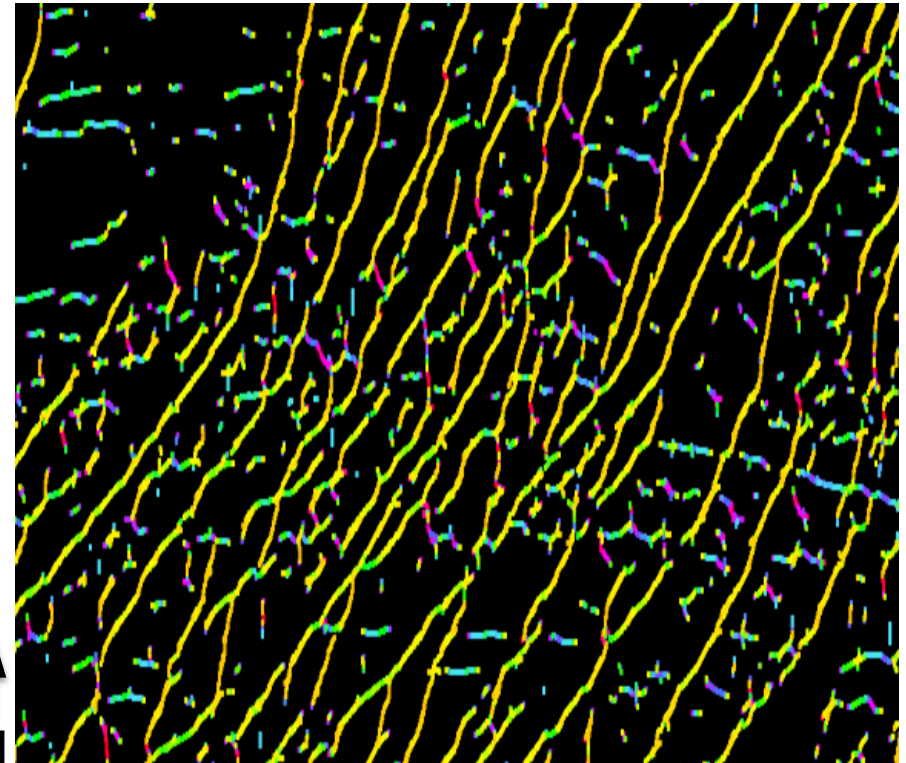
Upper Section



1336ms

1mile

Lower Section



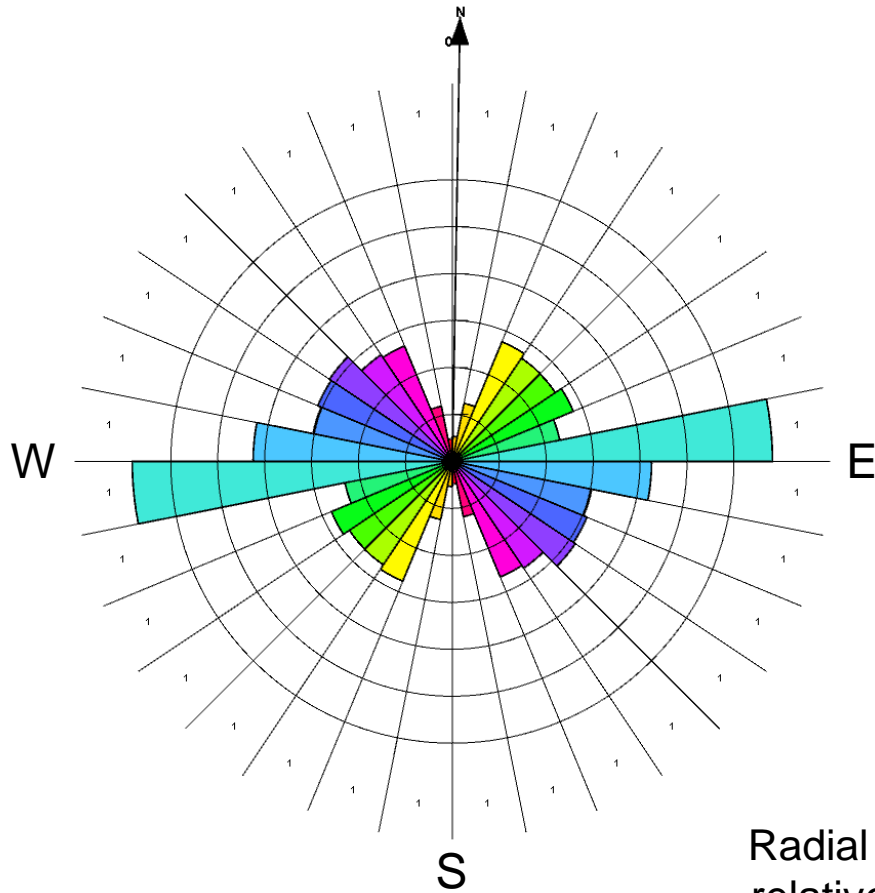
2060ms

1mile

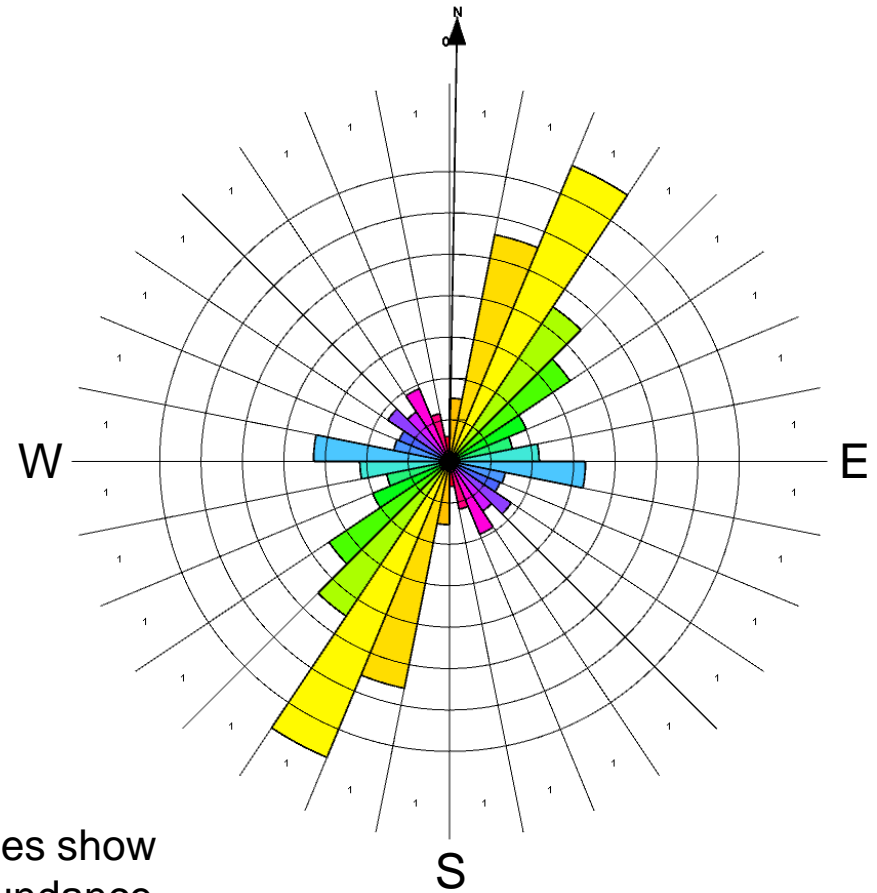
Time slices through Detected Fault Volumes

Fault Analysis – Fault Trends

Upper Section



Lower Section

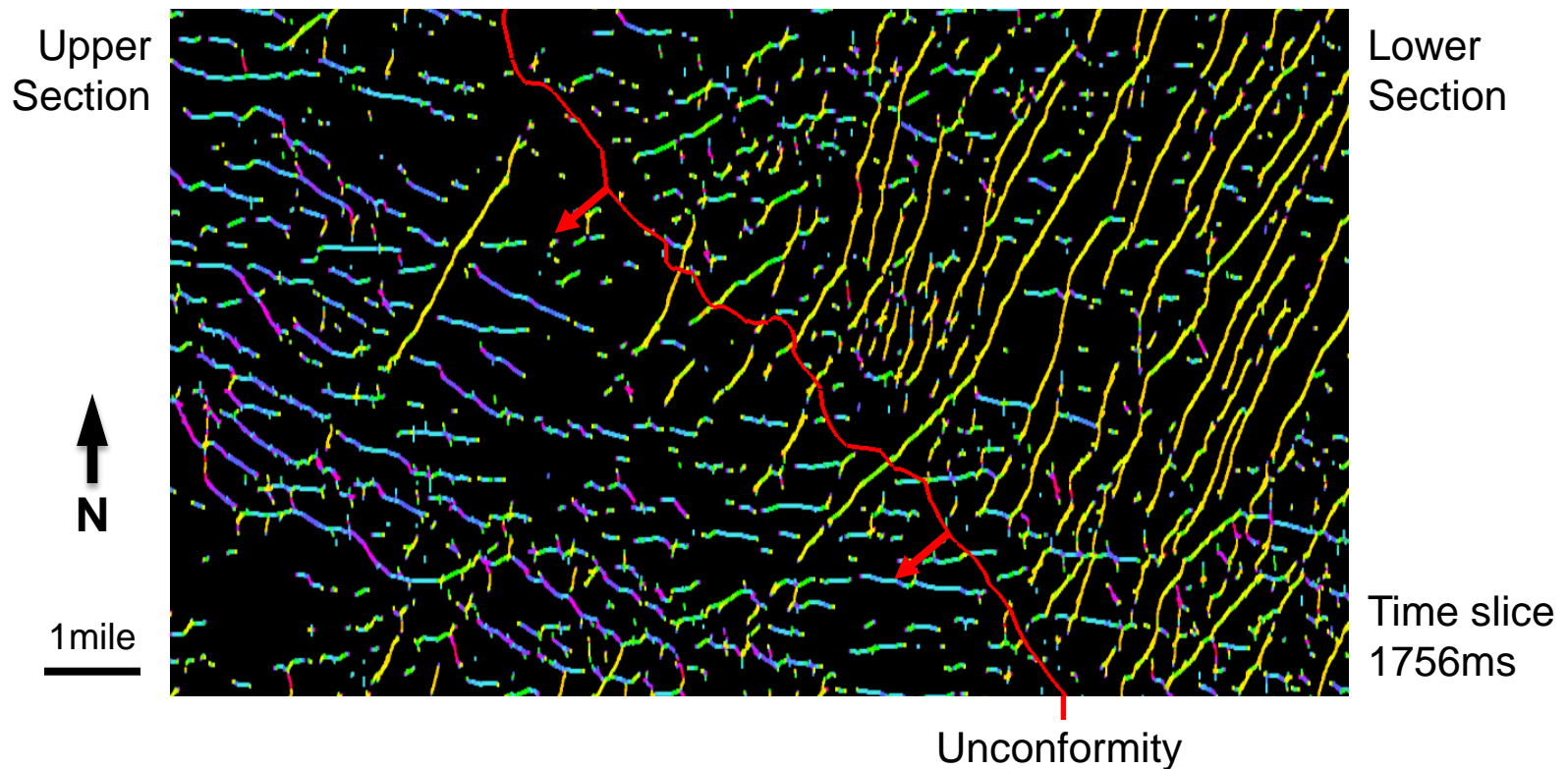


Radial values show
relative abundance

Seal Failure Risk

Multiple faults can be seen transgressing the unconformity from the lower to upper sections

This represents a potential seal failure risk in the Muderong Shale



Conclusions and Future Work

Geological Expression techniques were applied in order to obtain structural information from a 3D seismic dataset

- Structural analysis revealed Hauterivian-Valanginian age unconformities, which separate the producible Barrow Gp sandstones from the regional Muderong Shale seal, and described their structural trends
- Fault analysis informed interpretation of the structural history and revealed a major fault family transgressing the unconformities, potentially jeopardizing seal integrity and increasing petroleum exploration risk
- The total workflow time for this analysis was on the order of days to a week and manual interpretation was not required
- Similar analyses could be developed for multi-scale structural analysis

Thank you