

# Palaeo and In-Situ Stress Analysis of the Perth Basin: Implications for subsurface fluid flow

Alastair Stark, Rosalind King<sup>1</sup>, Rowan Hansberry<sup>1</sup>, Khalid Amrouch<sup>2</sup>

<sup>1</sup> Centre for Tectonics Resources and Exploration (TRaX), Department of Earth Sciences, The University of Adelaide, SA 5005, Australia

<sup>2</sup> Centre for Tectonics Resources and Exploration (TRaX), Australian School of Petroleum, The University of Adelaide, SA 5005, Australia

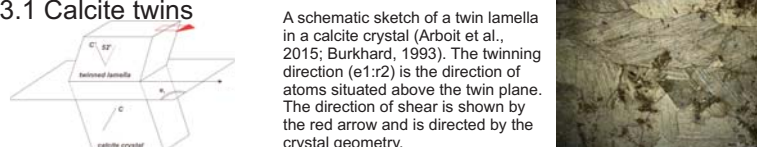
**1.0 The importance of understanding subsurface flow lies in the application for industry:**

- Geothermal
- Conventional and unconventional hydrocarbon applications
- Epithermal mineral deposits
- Nuclear waste storage
- Water resources

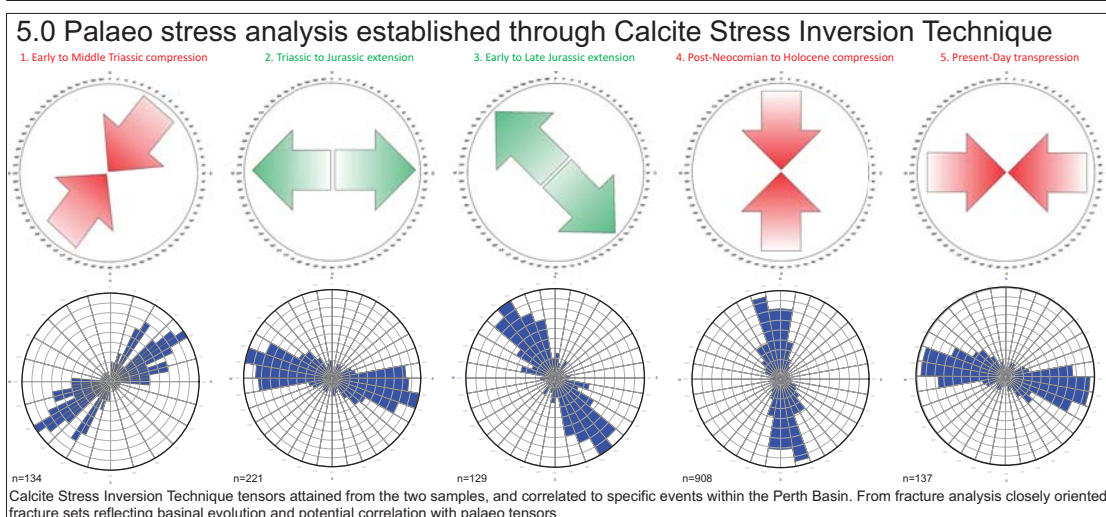
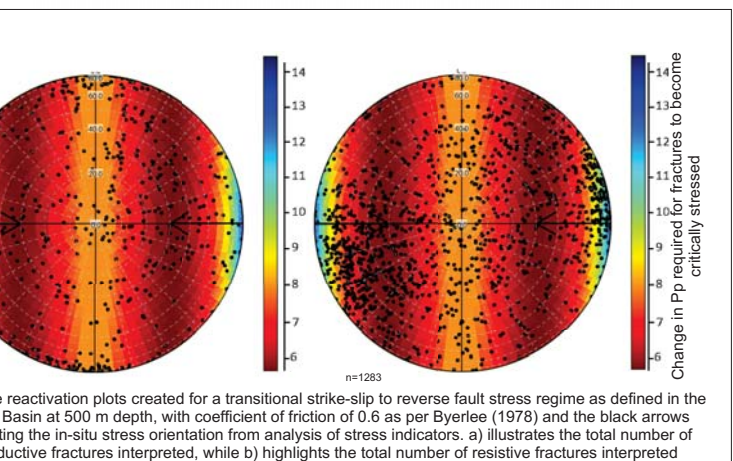
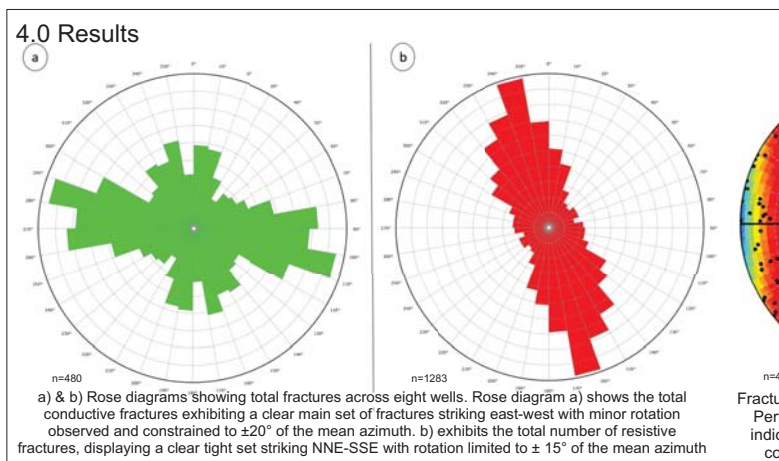
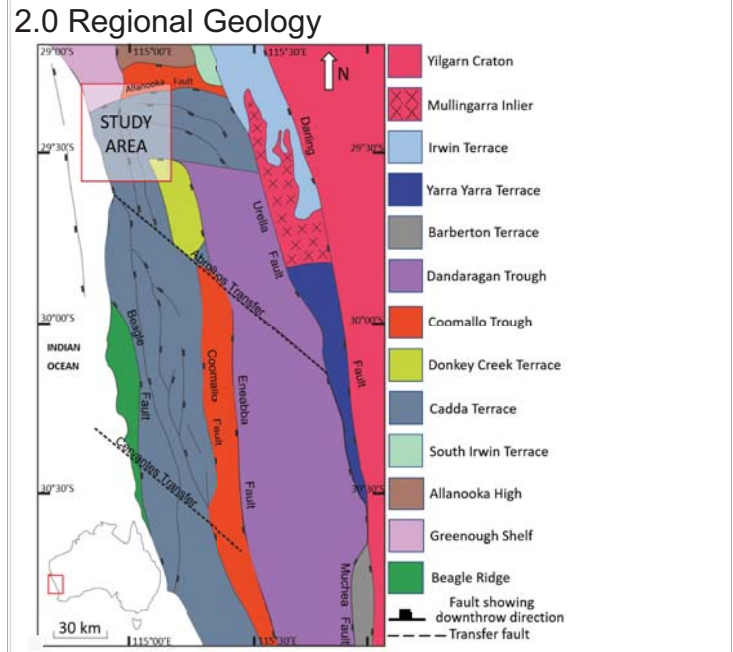
**3.0 Methods**

- Calcite Stress Inversion Technique used to analyse two sample taken from cross cutting calcitic veinlets
- Stress Magnitude Calculations as to establish present-day stress regime
- In-situ stress orientations were established from Borehole breakouts and Drilling-Induced Tensile Fractures
- Natural fractures were identified using Formation Micro Imager (FMI) logs
- Fracture reactivation plots, as to ascertain the change in pore pressure require to cause fractures to reactivate

**3.1 Calcite twins**



A schematic sketch of a twin lamella in a calcite crystal (Arboit et al., 2015; Burkhard, 1993). The twinning direction (e1:r2) is the direction of atoms situated above the twin plane. The direction of shear is shown by the red arrow and is directed by the crystal geometry.



**6.0 Conclusions**

- Transpressive fault stress regime ( $\sigma_{Hmax} > \sigma_V \approx \sigma_{Hmin}$ )
- The mean regional  $\sigma_{Hmax}$  orientation in the study area is  $089.9^\circ N$
- Fractures observed are also optimally aligned to reactivation in reverse fault stress regimes (<500 m) and deep strike slip fault regimes (>550 m)
- Polyphase deformation has occurred as established through Calcite Stress Inversion Technique
- Natural Fracture networks have evolved throughout time reflecting basin evolution

**Future research**

Due to large volumes of work conducted in the area, a review paper regarding the collation of all previous works is encouraged particularly if tied in with new palaeo stress tensors to solidify both palaeo and well known *in-situ* stresses