Fault Reactivation Potential in the Gippsland Basin, Australia: Implications for CO_2 Storage

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Geomechanical analysis of the offshore Gippsland Basin was undertaken by the CO_2CRC as part of the Latrobe Valley Carbon Dioxide Storage Assessment (LVCSA). The study aimed to constrain the geomechanical model (in situ stresses and rock strength data), and to evaluate the risk of fault reactivation and failure of intact rock. The risk of fault reactivation in the Gippsland Basin was calculated using the FAST (Fault Analysis Seal Technology) technique, which determines fault reactivation risk by estimating the increase in pore pressure required to cause reactivation within the present-day stress field. The stress regime in the Gippsland Basin is on the boundary between strike-slip and reverse faulting: maximum horizontal stress (~ 40.5 MPa/km) > vertical stress (21 MPa/km) ~ minimum horizontal stress (20 MPa/km). Pore pressure is hydrostatic above the Campanian Volcanics of the Golden Beach Subgroup. The maximum horizontal stress orientation is NW-SE (139ºN).

Fault reactivation risk in the Gippsland Basin was calculated using two fault strength scenarios; cohesionless faults ($C = 0$; $\mu = 0.65$) and healed faults ($C = 5.4$; $\mu = 0.78$). High-angle faults striking NE-SW are unlikely to reactivate in the current stress regime. High-angle faults oriented SSE-NNW and ENE-WSW have the highest fault reactivation risk. Additionally, low-angle faults (thrust faults) striking NE-SW have a relatively high risk of reactivation. The highest reactivation risk for optimally oriented faults corresponds to an estimated pore pressure increase (Delta-P) of 3.8 MPa (~548 psi) for cohesionless faults and 15.6 MPa (~2262 psi) for healed faults.