Soil Gas Sampling to Verify Geomechanical Probability of Fault Reactivation

Rogers, Claire[1], Maxwell N. Watson[2], Peter J. Van Ruth[2], R. R. Hillis[1] (1) Australian School of Petroleum, The University of Adelaide, Adelaide South Australia, Australia (2) CRC for Greenhouse Gas Technologies (CO_2CRC), South Australia, Australia

There is much evidence to suggest that recently reactivated faults act as permeable conduits for fluid flow. Soil gas sampling over faults which propagate to the near surface has been proposed as a method of verifying the migration of fluid along faults. Such fluid migration can test the geomechanical methodology used to determine the likelihood of fault reactivation. The likelihood of fault reactivation is assessed by determining the present day stress field from drilling data, constructing a 3-D model of the pre-existing faults and establishing the mechanical properties of the fault rocks in the area. This data is used to determine relative fault stability of differently oriented faults according to the Griffith-Coulomb failure criteria. Sediments in the Port Campbell Embayment in the eastern Otway Basin are highly faulted and traps in the area host several CO_2-rich gas accumulations The Port Campbell Embayment thus provides an ideal location to study potential fluid (CO_2) migration along faults. Seismic interpretation of the area indicates that the Boggy-Creek and Buttress CO_2-rich accumulations are bound by faults which extend near to the surface. The relative likelihood of fault reactivation is high for these faults. Sixty-seven gas samples were collected in the vicinity of the faults bounding the Boggy-Creek and Buttress accumulations.

The background concentration of CO_2 was determined to be 300-1000 ppm, with concentrations above this regarded as anomalously high. Seventy-five percent of anomalously high samples were associated with the surface locations of the faults. This finding suggests that these faults are acting as conduits for the flow of fluid (CO_2). However, isotopic analysis suggests that the CO_2 detected at the surface may be from a shallower source than the Buttress and Boggy-Creek CO_2 accumulations.