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Using the Bongwana natural CO_2 release to understand leakage processes and develop monitoring

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Natural CO_2 leakage along the Bongwana Fault in South Africa is being studied to help understand processes of CO_2 leakage and develop monitoring protocols.
The Bongwana Fault crops out over approximately 80 km in KwaZulu-Natal province, South Africa. In outcrop the fault is expressed as a broad fracture corridor in Dwyka Tillite, with fractures oriented approximately N-S. Natural emissions of CO_2 occur at various points along the fault, manifest as travertine cones and terraces, bubbling in the rivers and as gas fluxes through soil. Exposed rock outcrop shows evidence for Fe-staining around fractures and is locally extensively kaolinitised. The gas has also been released through a shallow water well, and was exploited commercially in the past.
Preliminary studies have been carried out to better document the surface emissions using near surface gas monitoring, understand the origin of the gas through major gas composition and stable and noble gas isotopes and improve understanding of the structural controls on gas leakage through mapping. In addition the impact of the leaking CO_2 on local water sources (surface and ground) is being investigated, along with the seismic activity of the fault. The investigation will help to build technical capacity in South Africa and to develop monitoring techniques and plans for a future CO_2 storage pilot there.
Early results suggest that CO_2 leakage is confined to a relatively small number of spatially-restricted locations along the weakly seismically active fault. Fracture permeability appears to be the main method by which the CO_2 migrates to the surface. The bulk of the CO_2 is of deep origin with a minor contribution from near surface biogenic processes as determined by major gas composition. Water chemistry, including pH, DO and TDS is notably different between CO_2-rich and CO_2-poor sites. Soil gas content and flux effectively delineates the fault trace in active leakage sites. The fault provides an effective testing ground for field-based monitoring with results to date indicating the methods and technologies tested successfully detect leaking CO_2. Further work will investigate the source of the CO_2 and attempt to quantify CO_2 flux rates and detection thresholds.