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Structural and Hydrogeochemical Characterization of Fault Zones Leaking CO_2-Charged Fluids: The Salt Wash and Little Grand Wash Fault Zones, Emery and Grand Counties, Utah

The Little Grand and Salt Wash fault zones provide an excellent opportunity to study a system that is leaking naturally-sourced CO_2 gas. These faults are influencing the flow of fluids. This is evidenced by CO_2-charged springs and geysers, an oil seep, and numerous travertine and tufa deposits that are found along the trace of the faults. This research characterizes the sources, flowpaths, and chemical evolutions of the groundwaters, and CO_2-rich gases in the area and describes the role of the faults in transporting these fluids to the surface. The faults cut a north plunging anticline of sandstones, shales, and siltstones. This should generate a fault seal by the mechanisms of clay-shale smear and cataclasis. Well log, geochemical, and geologic surface data indicate the CO_2 reservoirs have been cut by the faults at depth. This provides a conduit for the vertical migration of CO_2-rich fluids to the surface, but not for horizontal flow across the fault plane. Even though lateral cross-fault migration may be impeded, this study clearly indicates that there are possible migration pathways for the escape of CO_2-rich fluids from faulted subsurface aquifers, including aquifers faulted by ''low-permeability'' faults with clay gouge. Our conceptual model is that the CO_2-rich fluids migrate upwards along the faults and charge shallower groundwater systems, which then leak to the surface. This study clearly indicates that in the event of injecting CO_2 gas into deep aquifers, careful design and monitoring for leakage must be considered.