Geophysical Research Abstracts
Vol. 20, EGU2018-860, 2018
EGU General Assembly 2018

Does CO_2 leakage through faults make geological storage unviable? – Lessons from a natural analogue of a failed storage site

Johannes Miocic (1), Stuart Gilfillan (2), Andrea Schröder-Ritzau (3), Neil Burnside (4), Stuart Haszeldine (2), and Christopher McDermott (2)

(1) Institute of Earth and Environmental Sciences, University of Freiburg, Freiburg, Germany (johannes.miocic@geologie.uni-freiburg.de), (2) School of Geosciences, University of Edinburgh, Edinburgh, United Kingdom, (3) Institute of Environmental Physics, University of Heidelberg, Heidelberg, Germany, (4) School of Engineering, University of Glasgow, Glasgow, United Kingdom

The success of Carbon Capture and Storage, the only industrial scale technology available to reduce carbon dioxide CO_2 emissions from fossil fueled power plants and large industrial point sources to the atmosphere, is highly dependent on the security of the subsurface CO_2 storage sites. To be effective as a climate change mitigation tool, return of the captured and stored CO_2 through leakage to the atmosphere must be below 0.01% per year of that injected. Structural elements, including faults and fractures, are potential migration pathways for fluids from the storage reservoir to the surface. Should unplanned migration form a storage site occur, knowledge of the rates at which CO_2 may flow along fault zones is critical. The flux of fault related CO_2 leakage has been investigated by numerous studies, however none so far have examined a comparison to an associated subsurface reservoir. Here, we present the results of a study examining a naturally occurring, faulted, CO_2 reservoir in eastern Arizona which has a >500,000-year paleo-record of leakage. At the study site, travertine deposits, which form when CO_2 rich waters migrate to the surface, are located along faults. Using U-Th methods, we determined the age of these deposits and are able to show that travertine ages systematically vary along a single fault and that individual travertine mounds have lifespans of up to 300,000 years. The total volume of CO_2 required to have leaked to the atmosphere to form the travertine deposits was calculated using travertine rock volume. Combining leaked volumes with travertine ages allows to determine leakage rates. We show that whilst the total volumes of leaked CO_2 are high, the annual leakage rates are less than 0.01% of the gas volume retained within the subsurface reservoir. This shows that CO_2 leakage rates at this natural geological storage site, which would be deemed of too high risk for engineered storage, are below the threshold that would make geological storage unviable.