Geophysical Research Abstracts
Vol. 13, EGU2011-3440-1, 2011
EGU General Assembly 2011
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δ18O shifts in water in contact with high volumes of CO_2 gas

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In CO_2 injection projects, for instance in enhanced gas recovery (EGR), it is of vital importance to monitor the fate of injected CO_2 in the subsurface, in order to gain better understanding of the development of the geochemistry of the host reservoir. Injected CO_2 usually has different isotopic compositions than the water already present in the reservoir, respectively. Therefore, when CO_2 mixes with H_2O during CO_2 injection, an isotope exhange can be expected, with a shift in the isotope values towards the more dominantly present end member values of the CO_2 gas. In several studies, δ13C has proven to be a well detectable and promising parameter in such monitoring schemes. However, so far δ18O of both water and CO_2 is only beginning to be used as a key parameter in CO_2 monitoring. It is assumed, that the varying amounts of CO_2 gas in relation to the water can provoque different oxygen isotope shifts in the reservoir water.
Laboratory experiments were set up in order to achieve a better basic understanding in δ18OH_2O-CO_2 interactions. Experiments were carried out at room temperature, low pressures (1400 mbar) and a CO_2:H_2O mole ratio of 617:1. First data show that within hours to days a significant negative δ18OH_2O shift can be observed. This shift can be significantly enhanced in a dynamic environment induced by a shaker. These results indicate, that as long as enough CO_2 has been in contact with water, for a long enough period of time, δ18OH_2O data can serve as an indicator of past and present CO_2-H_2O contact. Furthermore, extrapolation of δ18O and CO_2-H_2O mole ratio data also holds promise to evaluate the amount of CO_2 that has been in contact with reservoir fluids. Future research will demonstrate if these changes can be detected on field scale.

This study was conducted as a part of the R&D programme CLEAN, which is funded by the German Federal Ministry of Education in the framework of the programme GEOTECHNOLOGIEN.