

## Thermodynamic study for CO<sub>2</sub> storage in deep saline aquifers

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Storage of CO<sub>2</sub> in deep saline aquifers is one proposed option to limit the continuing buildup of greenhouse gases in the atmosphere. To reduce the capture costs, co-injection of CO<sub>2</sub> and H<sub>2</sub>S is proposed. To predict the sequestration capacity and the fate of injected gases as well as for other geochemical applications, it is necessary to study the thermodynamic properties and phase equilibria for the CO<sub>2</sub> sequestration-related systems at temperatures up to 200 °C and pressures up to 600 bar.

A new thermodynamic model, on the basis of statistical associating fluid theory equation of state, is developed to represent the phase equilibria and thermodynamic properties for CO<sub>2</sub>-H<sub>2</sub>O-NaCl, H<sub>2</sub>S-H<sub>2</sub>O-NaCl, and CO<sub>2</sub>-H<sub>2</sub>S-H<sub>2</sub>O-NaCl systems. The parameters of pure components are obtained from the fitting of their saturated vapour pressure and liquid density data, and the cross parameters are obtained from the fitting of the phase equilibrium data of H<sub>2</sub>S (CO<sub>2</sub>)-H<sub>2</sub>O-NaCl system.[1-4] With the available parameters, the phase equilibria and thermodynamic properties for CO<sub>2</sub>-H<sub>2</sub>S-H<sub>2</sub>O-NaCl are predicted. The prediction shows that the solubility of the H<sub>2</sub>S-CO<sub>2</sub> mixture increases with increasing pressure, decreasing concentration of NaCl and decreasing temperature. The mixture of H<sub>2</sub>S-CO<sub>2</sub> is more soluble than pure H<sub>2</sub>S under certain conditions and also more soluble than pure CO<sub>2</sub>.

This thermodynamic model will be further implemented into a dynamic model to investigate the process of gas diffusion and dissolution in brine and the process of mineral dissolution and precipitation with dissolved CO<sub>2</sub> and H<sub>2</sub>S. It is expected that the coupling of the dynamic model with the thermodynamic model will provide reliable long-term predictions pertaining to geochemical carbon sequestration, such as sequestration capacity, CO<sub>2</sub> leakage, the mechanics of CO<sub>2</sub> trapping, and environmental impacts, etc.

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## Detrital zircon provenance of late Ordovician-Silurian sandstones in the Lower Yangtze foreland basin of South China

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The Lower Yangtze foreland basin is situated northwest of the early Paleozoic (ca.460–400Ma) Wuyi orogenic belt in South China [1]. In this basin, the upper Neoproterozoic-Ordovician strata are composed of shelf carbonates, slope limestones as well as mudstones [2]. Significant changes of lithofacies, and depositional environment took place during latest Ordovician–Silurian, which were coincident with the timing of the Wuyi orogeny. In order to demonstrate the basin development was in response to the orogenic event, seven sandstone samples were collected from upper Ordovician and Silurian strata. U–Pb ages of 604 detrital zircon grains yield remarkable peaks at ca. 2500Ma, 1200–900Ma, 860–740Ma and 458–425 Ma. The early Paleozoic zircons (458–425 Ma) correspond to the granitic rocks within the Wuyi orogenic belt to south or southeast, suggesting exhumation of syn-orogenic rocks. Besides, the Precambrian zircons (ca. 2500Ma, 1200–900Ma, 860–740 Ma) are most likely recycled from pre-orogenic strata in the Wuyi orogenic belt due to their similarity in age distribution [2]. The predominant Neoproterozoic (860–740Ma) zircons indicate the Yangtze basement had been involved in the orogenic belt. The youngest zircons at the top of the succession yield a maximum depositional age of ca. 425 Ma.

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