Dissolution experiments of trace elements from sandstone in the presence of CO2

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CO_2 geological storage in saline formations located deep underground has recently been focused as one of the means of greenhouse-gas reduction technology. In the process of the CO_2 geological storage, an impermeable formation is generally expected to be overlay above an aquifer, where CO_2 is injected; however, the possibility that the stored CO_2 migrates upward cannot be ruled out if a fracture, such as a fault, may exist in the impermeable formation. In that case, the stored CO_2 dissolves into groundwater, which results in the decrease in pH of the groundwater. This might cause the dissolution and the migration of the rock-forming elements in the groundwater. Importantly, such elements dissolved from rocks may represent the trace elements which affect human living environment. Therefore, the dissolution behavior of the trace elements including their rates should be studied, in case when the stored CO_2 unexpectedly dissolves into the underground water. In this study, we performed both batch and flow-through reaction experiments using sandstone soaked into CO_2-dissolved water to estimate the likely concentrations of the trace elements which may dissolve into groundwater. Several aliquots were taken during the 20 days- experiments, which were analyzed by ICP-AES/ ICP-MS for the 18 trace elements such as heavy metals and by ion chromatography for major elements. The concentrations of both major and trace elements tend to increase with time and with increasing temperature regardless of the presence of CO_2. The apparent dissolution rates supposed zero order reaction tend to be slightly larger in the presence of CO_2 compared to the reference experiments for both the batch and the flow-through systems. CO_2 dissolved water enhanced dissolution of the both major and trace elements in this study.