$\delta^{34}S$ and $\delta^{18}O$ analysis of Upper Permian sulphates of the Northern German Zechstein Basin

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Salt rocks of the Zechstein, Upper Permian, are regarded as possible host rocks for radioactive waste disposal in Germany. Most of these rocks consist of halite with anhydrite impurities, and some are anhydrite rocks. To characterize these rocks and to verify the ability of isotope gechemistry for stratigraphic classifications, $\delta^{34}S$ and $\delta^{18}O$ analysis of sulphates from different stratigraphic units were performed.

Altogether, 112 sulphate samples were collected from the Gorleben, Asse and Morsleben salt structures, of Northern Germany, representing the Zechstein Units z2 – z4. Powder samples were dissolved in NaCl solution and precipitated as $BaSO_4$ (modiefied preparation after [1]). The sulfur isotope ratios ($^{34}S/^{32}S$) were analyzed using continous flow elemental analyzer – isotope ratio mass spectrometry (EA-IRMS). For oxygen isotope ratio analysis ($^{18}O/^{16}O$), continous flow thermal combustion – isotope ratio mass spectrometry (TC/EA-IRMS) was used. Results for S are measured against VCDT, the reproducibility is < ±0.3‰ $\delta^{34}S_{SO4}$. The O isotopic composition was measured against VSMOW, the reproducibility is < ±0.5‰ $\delta^{18}O_{SO4}$.

The $\delta^{34}S$ results display an isotopic composition between 9.2 ‰ and 11.3 ‰, which is in good agreement with available data (e.g. [2, 3]). Within a stratigraphic unit, the values decrease for ca. 2 ‰ from basis to top, and increase at the basis of the adjacent unit for ca. 1.5 ‰ – 2 ‰. This repeating trend can be explained by cyclic inflow of fresh seawater and following evaporation in a marine basin.

The $\delta^{18}O$ isotopic composition shows distinct variations between 8.2 ‰ and 13.8 ‰, which also concurs with published data (e.g. [3]). The variations are more pronounced and display more sensitive short-term changes in evaporation conditions.

[1] Goldberg *et al.* (2005) *Precambrian Research* **137**, 223-241. [2] Kampschulte & Strauss (2004) *Chem. Geol.* **204**, 255-286. [3] Claypool *et al.* (1980) *Chem. Geol.* **28**, 190-260.