Lithium isotope variation in rivers and lakes on the Tibetan Plateau

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We report lithium abundances and isotope ratios for lakes, tributaries, and large rivers (Indus, Yarlung Tsangpo and Yellow River) on the Tibetan Plateau. In rivers we found solely calcium-bicarbonate waters, whereas lakes with sodium-chloride and sodium-sulfate waters could be distinguished. The chemical composition of the rivers primarily reflects weathering of rocks in carbonate-rich catchments. In contrast, lake water chemistry is affected by evaporation and crystallization of minerals. This is indicated by a high level of mineralization and an electric conductivity of more than 10 mS/cm, which classifies them as salt lakes. The δ^7Li of lake waters varies between +7.0 and +25 relative to L-SVEC. The δ^7Li of rivers in the south range from +4.0 to +9.0 and the Yellow River in the NE gives a δ^7Li ~ +18. The variation of δ^7Li in the water samples is, in general, consistent with fractionation of isotopically light lithium in secondary clay minerals during weathering in the catchments [1,2]. However, at the lake Tashi Namtso a systematic isotopic difference between inflow and lake provides evidence for lithium isotope fractionation in the lake. In this example a strong pH change from about 8.2 to 9.8 is observed at the transition from river to lake waters. It is suggested that formation of clay minerals at the transition cause an additional isotopic shift by ~10 ‰. In the large rivers of the southern Tibetan plateau low δ^7Li are consistent with a transport-limited weathering regime, whereas the rather high δ^7Li of the Yellow River favour a weathering-limited transport regime. The results support that riverine lithium isotopes are a powerful proxy for the intensity of silicate weathering in a catchment [3] rather than silicate weathering rates [4]. However, in some areas lithium isotope compositions of the tributaries are affected by sulfate-rich thermal waters. How much this alters the weathering budget of the large rivers is difficult to estimate because evaporates and hot springs, which are important players in the terrestrial lithium cycle, are yet to be constrained.

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Prospective shale gas zones in the Kimmeridgian and Tithonian strata of Polish Lowlands

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Kimmeridgian strata in the Norwegian and North Seas are considered to be responsible for hydrocarbon generation of large petroleum conventional accumulations [1]. Although exploration of these strata in Poland did not record commercial accumulation of petroleum, the preliminary studies [2] reveal generation of oil and gas in areas, where the Upper Jurassic strata were covered by thick Cretaceous rocks. In the present study we determinate areas and depth intervals of possible shale gas accumulation in these strata.

Results and disscusion

A total of 482 core samples: 242 from the Kimmeridgian and 240 from the Tithonian strata from 40 wells of central part of Polish Lowlands were analysed. Rock-Eval pyrolysis reveals total organic carbon (TOC) contents from 0.14 to 9.6 wt% in the Kimmeridgian samples and from 0.19 to 12.5 wt% in the Tithonian samples. The highest values were recorded in the Upper Kimmeridgian and Lower Tithonian strata (TOC, up to 12.5 wt%, usually above 2 wt%). Rock-Eval, biomarker and kerogen elemental composition data evidence domination of the oil-prone Type-II kerogen in this most prospective sequences. Organic matter mostly is immature or early mature. 1-D modelling of the petroleum generation processes [2] reveal that in selected deeply buried structures in the Łódź Trough, the Upper Jurassic source rocks reached maturities corresponding to peak of oil window (0.7 - 1.0% Ro).

Conclusion

Intense sampling and Rock-Eval analyses enabled authors to designate a ca. 60 m thick marly shale complex at the border of Kimmeridgian and Tithonian strata in Łęczyca–Koło area as the most prospective for shale gas exploration.

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