

Experimental investigations on TSR in a mineral buffered system with fixed H_2 and H_2S fugacities

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The importance of thermochemical sulfate reduction (TSR) has been recognized for petroleum reservoirs, e.g. the formation of sour gas provinces [1] or natural dry gas [1], as well as for sulfide ore deposits [2]. In spite of this importance, the process is not well understood and the extrapolation of many experimental results to natural systems is often questionable because key chemical variables, e.g. the H_2 fugacity (fH_2), were not controlled at geologically reasonable values [3].

In this study experiments with synthetic n-octane, Na_2SO_4 and H_2O as reactants were conducted in gold capsules at 300 and 350°C, 350 bar for 24 to 336 h in order to elucidate fundamental mechanisms of TSR. Furthermore, the influence of elemental sulfur on the reaction rates and progress was investigated. The pyrite-pyrrhotite-magnetite (PPM) mineral assemblage was used to control the chemical environment, with respect to fH_2 and fH_2S , at geologically reasonable values during the experiments. Gaseous and highly volatile organic compounds were measured by gas chromatography.

CO_2 data, the C_1/CO_2 ratio and the C_1 to C_5 distribution were used to identify TSR. Regarding the experiments with a run duration of 168 h, the experiment with n-octane, Na_2SO_4 and H_2O at 300 °C did not show evidence for TSR, whereas the same assemblage at 350 °C clearly showed the effect of TSR. At both temperatures, the addition of elemental sulfur led to an enhanced oxidation of the hydrocarbons, which is clearly visible by significantly increased CO_2 values and the formation of organosulfur compounds.

The results of this study are discussed with regard to possible reaction mechanisms and are compared to data provided by Seewald [3] who investigated the stability of different hydrocarbons in the PPM-water system.

- [1] Worden & Smalley (1996) *Chem. Geol.* **133**, 157–171.
- [2] Powell & Macqueen (1984) *Science* **224**, 63–66.
- [3] Seewald (2001) *GCA* **65**, 1641–1664.

Variability of Nd and Sr isotopes in alkaline rocks of the Polar Siberia: A consequence of plume-lithosphere matter mixing

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The Maymecha River basin in the Polar Siberia is a unique area where numerous alkaline ultramafic massifs are spatially and temporally confirmed to the flood tholeiitic and alkaline volcanism. Their forming is usually connected with a rifting breakup of Siberian craton by a global action of Asian superplume at 250 ± 3 Ma. Arndt *et al.* [1] are proposed two plumbing systems to explain geochemical and isotopic features of rocks in this province. Our new and early-published data [1, 2] allow us to suggest any model of magmatism based on different degrees of mantle-crust interaction during the plume uplift.

The volcanic and plutonic sequences are characterized by the wide rock variety from tholeiitic to alkaline series. The role of alkaline and ultramafic units is successively increasing in the upper (for the cross section) and central (to the Guli giant pluton) parts of the Maimecha region corresponding to the geophysical model of plume system uplift in lithosphere. The ϵNd vs ϵSr plot for the bulk rock composition demonstrates a tendency to increase ϵNd and to decrease ϵSr values from the bottom to up volcanic section and towards the Guli centre with a shorting of differentiation between isotopic parameters of tholeiitic and alkaline rocks. The full coincidence of rocks compositions is corresponding to ϵNd (+5) and ϵSr (–15) values and is responsible to that of initial plume source type of PREMA. The obtained variation of Nd and Sr isotopic data in studied rocks can be explained by different degrees of lower (LC) or upper (UC) crust matter participation in the melting of plume with the proportion between LC and UC from 1:1 to 1:10. In this case we don't need to assume few mantle sources for tholeiitic and alkaline magmas so their isotopic parameters show a successive change of values according to their spatial position. It is more accompanied with a model of thermal interaction between hot mantle plume and continental crust of the Siberian craton.

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- [1] Arndt *et al.* (1998) *Contrib. Miner. Petrol.* **133**, 297–313.
- [2] Kogarko *et al.* (1999) *Dokl. Earth Sci.* **364**, 88–90.