Geochemical characterization of the hydrocarbons in Domanik Rocks, Tatarstan Republic

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On the basis of combined geological-geochemical analysis of the conditions of hydrocarbon generation and formation of basins, the total petroleum-generating potencial of domanic formation (DF) is estimated at 126 billion tons of liquid hydrocarbons. High-bituminous argillo-siliceous carbonate deposits of DF occurring within pale depressions and down warps in the east of the Russian platform are treated by many investigators as a main source of oil and gas in the Volga-Ural province.

In this study a special attention was turned to organic-rich rocks DF witch outcrop in the central part (Uratminskaya area 792, 806 boreholes) and in the west part (Sviyagskaya, 423) of the Tatarstan Republic.

The aim of the present paper is to characterize the organic matter: origin, depositional environments, thermal maturity and biodegradation-weathering effects.

Nowadays the most informative geochemical parameters are some biomarkers which qualitatively and are quantitatively defined from distributions of n-alkanes and branched alkanes.

Methodology used in this study included sampling, bitumen extraction, liquid-column chromatography and gas chromatography/mass spectrometry analyses. The bitumen was fractionated by column chromatography on silica gel. Non-aromatic or alifatics, aromatics and polar compounds were obtained.

Alifatic were analysed by gas chromatography/mass spectrometry Perkin Elmer. The hydrocarbons present in the sediments of DF and have a carbon numbers ranging from 12 through 38. The samples contain variably inputs from both terrigenous and non-terrigenous (probably marine algal) organic matter as evident in bimodal GC fingerprints of some samples. Pristane and phytane, also, occur in very high concentration in sample extracts. The relatively low Pr/Ph ratios, CPI and OEP<1 imply that the domanik organic matter was deposited in reducing environments.

Mass chromatograms show the distribution of regular steranes, iso-steranes, lower molecular weight C_{21} and C_{22} steranes (pregnanes) (m/z 217) and triterpanes (m/z 191). The biomarkers distribution of the domanic samples generally suggests a major marine phytoplankton contribution relative to terrigenous land plant source input. The marine affinity is evident from the relatively abundant C_{27} steranes, which are biomarkers for marine algal contribution to organic matter and low C_{29} sterane contens.

In this present study, samples are dominated by 5α, 14α, 17α (H)-20R and 5β, 14α, 17α (H)-20R steranes (biological configuration). The ratios of 20S/(20S+20R) for $\alpha\alpha\alpha C_{29}$

The legacy of plastic deformation and pre-existing microstructures during olivine serpentinization

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High-temperature crystal-plastic deformation of olivine is an inevitable consequence of asthenospheric mantle flow. In this environment olivine commonly yields by dislocation creep to form dislocation walls. Solid-state diffusion along these imperfections is faster than through the bulk crystal. At low temperatures, olivine serpentinization modifies the petrophysical and geochemical properties of the oceanic lithosphere. Under these conditions olivine generally fails to compositionally readjust via diffusion and re-equilibrates via dissolution-reprecipitation. Although plastic deformation and serpentinization are decoupled, we identified compositional readjustments expressed as striped zonings in partially serpentinized and deformed olivine grains from the Leka Ophiolite Complex (LOC), Norway. Combining focused ion beam sample preparation and (scanning) transmission electron microscopy reveals that every zone is immediately related to a subgrain boundary composed of edge dislocations. The zonings are a result of the Fe-Mg exchange potential between olivine and antigorite, where Fe enrichment or depletion is controlled by the silica activity imposed on the system by orthopyroxene and magnetite stability. Nanometer-sized serpentine precipitates along olivine dislocation walls and crystallographic relationships gained by electron backscatter diffraction (EBSD) suggest that hydration was also initiated along these intracrystalline imperfections. The legacy of pre-existing microstructures in the LOC is exhibited by localized occurances of parallel but highly misorientated olivine grains seperated by plastically deformed diopside lamellae. Microtomography combined with EBSD suggest that these areas are a consequence of a hydration-dehydration sequence to result in a complex pseudomorphism of primary mantle orthopyroxene to olivine and the cryptic survival of the primary microstructure.

Our observations provide new insights into the role of primary microstructures and crystal-plastic deformation on subsequent fluid-mediated reactions.