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SATURATED AND TRIAROMATIC STEROIDS OF AQUAGENE ORGANIC MATTER OF THE CAMBRIAN KUONAMKA FOMATION (EASTERN SIBERIAN PLATFORM)

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The black rocks enriched in organic matter (OM) of the Cambrian Kuonamka Formation accumulated in the eastern Siberian platform. The present research is continuation of study of organic geochemistry of clayey, siliceous, and carbonate rocks (29 samples) taken from a 48.5-m-thick exposure on the Molodo River. This section is heterogeneous. The rocks differ in OM content that varies from 1 to 21%. They have specific content and distribution of relict chemofossils too (Parfenova et al., 2004, Kontorovich et al., 2005). The aim of this research was to study the geochemistry of steroids of the Botomian, Toyonian, Amgian aquagene OM. High-molecular compounds were analyzed on a 5972 series (Mass Selective Detector) mass spectrometer at temperatures between 150 and 310 °C.

The distribution of C_{27}, C_{28}, C_{29}, and C_{30} steranes in the OM of the Kuonamka rocks is constant usually. The steranes are dominated by ethylcholestanes C_{29} (>40 rel.%) in all rocks except for the highly carbonaceous black shales that have the content of organic carbon (C_{org}) > 15% (on average) and C_{29} < 40%. The concentrations of ethylcholestane increase from 32 to 54 rel.% with decreasing of the contents of C_{org} in the rocks. The concentrations of methylcholestane (C_{28}) are minimum and vary from 16 to 26 rel.% (average is 20 rel.%) in samples. The distribution of isomers and stereoisomers for regular and rearranged sterane homologues and their ratios were studied. These ratios depend neither on the OM concentration nor on the rock composition. It is interesting that the concentration of pregnanes (C_{21} and C_{22}) increases in the steroid fractions when the content of C_{org} increases in the rock, and sterane/pregnane ratio correspondingly decreases (fig. 1). All samples contain $C_{20\text{-}21}$ and $C_{26\text{-}28}$ triaromatic steroids (TAS). $C_{26\text{-}28}$ TAS is dominated by C_{28} hydrocarbon (HC). The relative contents of these HCs and the ratio of their isomers (S and R) do not depend on the OM content in rocks. But the content of the low-molecular-weight $C_{20\text{-}21}$ TAS containing no alkyl radicals vary. TAS-index ($TAS_{20\text{-}21}/(TAS_{20\text{-}21}+TAS_{26\text{-}28})$) has a positive correlation with the C_{org} content in the rock (fig. 1). As shown above, changes in OM content are accompanied by changes in relative concentration of low- and higher-molecular-weight saturated and aromatic steroids. In passing from highly carbonaceous shales to carbonaceous rocks, the sterane/pregnane ratio monotonously increases from 1 to 11 and TASI decreases from 0.49 to 0.02. The Cambrian age of the rocks excludes the participation of terrestrial OM in the

sedimentation. The OM of Kuonamka Formation is of planktonogenic-algal-bacterial nature. Obviously, the OM in the studied 50 m thick section was under similar PT-conditions throughout the geologic history. The different steroid compositions of the Kuonamka rocks might be related to different OM transformations during the diagenesis. It is possible that the low-molecular-weight steroids were formed of common biosteroids by bacterial degradation of them in sediments (by dealkylation of initial steroids).

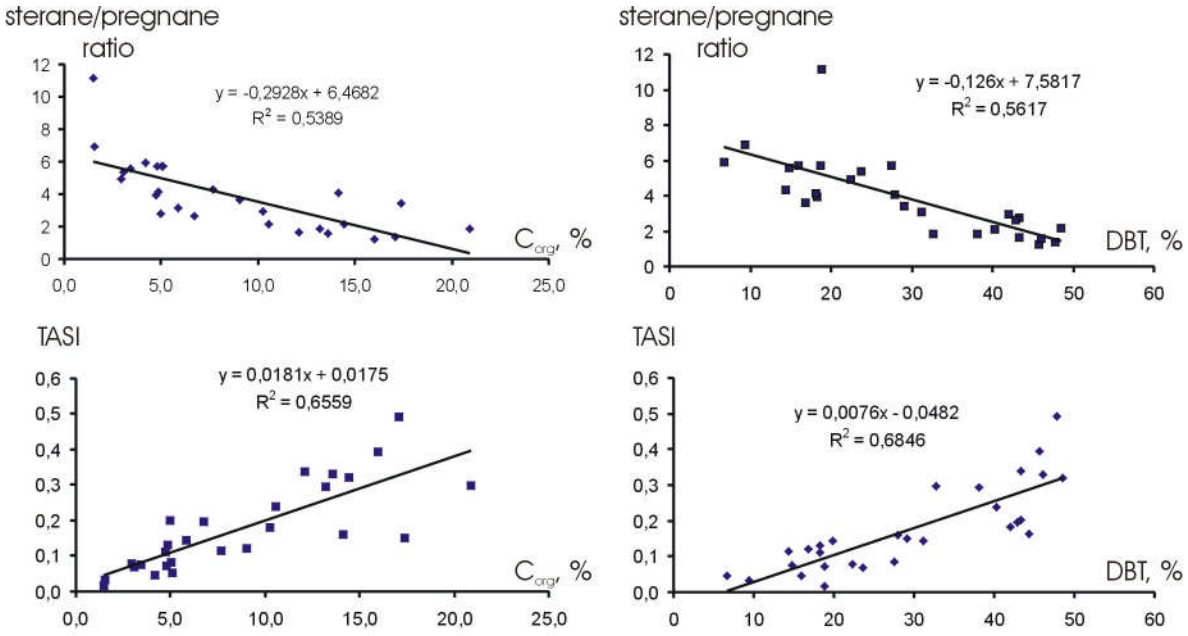

Figure 1. The dependences of sterane/pregnane ratio and TASI on C_{org} and DBT in bitumens of the Kuonamka Formation.

Sulfur-bearing compounds (dibenzothiophene and methyldibenzothiophenes – DBT) were analyzed on mass spectrometer and the relative contents of these chemofossils (∑DBT, %) were determined in group of aromatic molecules (Kontorovich et al., 2005). The high DBT contents in the Kuonamka rocks are related to the bacterial introduction of sulfur into the organic matter during diagenesis. We established the dependences between the sterane/pregnane ratio, TASI and ∑DBT (fig. 1). Thus, low-molecular-weight steroids are also likely the products of biochemical transformation of OM. The intensity of their formation is supervised by abundance of OM and bacterial sulfate reductions, hence by ph-Eh conditions in the sediments.

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