Application of X-ray computed tomography, NQR and Mössbauer in studies of fossil wood

Gainov R.R.[1,2], Khassanov R.R.[2], Vagizov F.G.[2], Golovanevskiy V.A.[3], Pen'kov I.N.[1]

[1]Kazan Federal University, Kazan (Russia)
[2]Curtin University of Technology, Kent St., Bentley, Perth (Australia)
g_ramil@mail.ru

The samples under the study represent the fossil wood from the sediments of the Sarmanovskii ore-formation (Permian deposits of the Volga-Ural region) in their original local geochemical environment. The combined application of X-ray micro-tomography, nuclear quadrupole resonance (NQR) and Mössbauer techniques allows to evaluate the evolution of the geological processes in these sediments [1, 2].

X-ray computed topographic 3D images of the fossil wood demonstrate presence of a zonal structure characterized by an inhomogeneous mineral composition. The wood cells were found to be filled by copper and minor iron minerals as shown by the NQR and Mössbauer studies. More detailed studies show that there are original copper sulfides of the non-stoichiometric family $Cu_{2-x}S$, ($0 < x < 1$), which have been sealed inside the external "envelop" from CuS and other compounds, and, as the consequence, preserved in the close to the original ultra-dispersed state at the central part of the clusters. These non-stoichiometric $Cu_{2-x}S$ compounds reflect the initial geological processes of the ore-formation due to their bacterial sulfate-reduction nature in the early diagenesis stage. Based on the studies made, it appears feasible to consider the original binary Cu sulfides as mineral-indicators which show the evolution of geological processes in sediments.

The results of studies are presented and discussed.

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

REFERENCES

1. *Khassanov R.R.* Substitution of plant residues for copper sulfides in Permian deposits of Viatka-Kamian copper-bearing zone / R.R. Khassanov, R.R. Gainov, E.S. Varlamova, A.F. Islamov // Uchenye Zapiski Kazanskogo Universiteta. Seriya Estestvennye Nauki. – 2009. – V.151. – No.4. – P. 162-169 (in Russian with English title and abstract).

2. *Khassanov R.R.* Mineralization of fossil wood, as revealed using X-ray computed tomography, NQR and Mössbauer spectroscopy / R.R. Khassanov, R.R. Gainov, O.P. Shilovskiy, R.I. Khamadiev, V.A. Golovanevskiy, F.G. Vagizov // Submitted to J. Phys. Chem. C.