Amino acids in shungite matter of Precambrian sedimentary rocks of Karelia

S.N. SHANINA AND YE.A. GOLUBEV

Institute of Geology, Syktyvkar, Russia (shanina@geo.komisc.ru)

Amino acid composition of Karelian shungites (Shunga, Zazhogino and Nigozero deposits) of the Onega area from Palaeoproterozoic with various carbon contents (from 3 up to 98 %) was investigated.

It was established, that the general contents of amino-acids in calculation on percentage of organic matter increase with concentration decrease of organic carbon. The lowest concentrations of amino-acids were established in rocks with the migratory organic matter (0.0005 mg\gr$C_{org}$). In shungite rocks containing sedimentary organic matter, amino acid contents were increased by 1–2 order (0.002–0.02 mg\g$C_{org}$).

In the area of Shunga deposit the group composition of amino acids for sedimentary and mixed organic matter look as follows: aliphatic ≈ hydroxil. In migration organic substance the relation varies: aliphatic > hydroxil. In sedimentary shungite of Zazhogino deposit the group composition of amino-acids is submitted substantially by aliphatic differences (60 %), and in migratory-clastic shungite substance of Nigozero deposit the concentration of amino acids containing acid groups is increased: aliphatic > acid > hydroxil. Among individual amino acids increased contents of serine, glicine and alanine are characteristic. In a sample with the least content of organic carbon (lidite, Shunga deposit) was established high tyrosine quantity and presence of lisine (basic amino acid) which is absent in high-carbon shungite.

Additional researches of sedimentary shungite remains (Zazhogino deposit) after bitumoid extraction have shown that more than 60% of amino-acids were removed from a sample as a result of extraction by chloroform and methanol-benzene. Content of amino acids up to extraction is 0.075 mg\g, after extraction – 0.029 mg\g. This fact allows us to believe that the significant part of amino acids in shungite structure includes in bitumoid organic matter.

Our results well coordinate with previous data about distribution of bitumoids in shungite rocks (Solov'eva *et al*., 2000). The more content of carbon in shungite, the less amount of bitumoids it contains, and accordingly amino acids. Amino acids in shungite matter of sedimentary origin are the best kept; with increase of carbon contents the quantity of amino acids sharply decrease, but does not disappear totally. That is connected with originality shungite structure formed nanoporous fullerene-like carbon particles.

References

Solov'eva A.B., Rozhkova N.N., Glagolev N.N. and Zaichenko N.L. (2000) *Geochemistry International* **38** 685–688.

Fluid composition in veins of the Outokumpu drilling site, Finland

L. SHARIF, J. KOLB AND F.M. MEYER

Institute for Mineralogy and Economic Geology, RWTH Aachen University, Wuellnerstr. 2, 52062 Aachen, Germany. (sharif@iml.rwth-aachen.de)

The Outokumpu drilling site is located in the vicinity of the Outokumpu ore deposit in SW Finland. The Proterozoic Outokumpu formation, consisting of mica schist with black schist interlayers, serpentinite, skarn rocks, and pegmatitic gneisses, is thrust over an Archaean basement. The borehole (2.5 km deep) transects the Outokumpu formation and was intended to encounter the Archaean basement.

Core samples with quartz and carbonate veins were taken in order to study fluid inclusions. The wallrocks were metamorphosed in the amphibolite facies. Three different vein types can be discerned: (i) quartz-filled with a biotite-rich alteration halo, (ii) quartz-filled without alteration zone, and (iii) carbonate-filled with an Mg-Hbl alteration zone. The quartz veins show variable sizes in length and thickness ranging from a few mm to several cm, which range from lenses and thin to relatively large veins. The type (iii) veins have a smaller thickness of a few mm.

The investigated fluid inclusions in the quartz veins are primary and pseudosecondary showing one to three phases containing vapor and/or liquid. These inclusions occur together on intragranular trails, in clusters, or as single inclusions in quartz. Locally, pure gas inclusions form intragranular trails. Transgranular trails which indicate secondary inclusions are rare. They also consist of mixed aqueous and carbonic inclusions.

The lowest measured homogenization temperature (Th) is at about 250°C but most of the measured Th are in the range of 300-400°C. The eutectic temperatures (Te) have values of about -22°C and final melting temperatures (Tm) of about –12°C which indicate a salinity of 15–19 wt.% NaCl eq. in the aqueous solution. The Te for gas inclusions have values of about -56°C and a Th of 26°C which points to a CO_2-rich composition.

The minimum formation temperatures around 300-400°C and the alteration mineralogy (Hbl, Bt) suggest a formation of the hydrothermal quartz veins at conditions of the lower amphibolite facies. This saline and carbonic fluid composition is typical for metamorphic rocks.

The investigation of the fluid inclusions provides a documentary of the fluid development and the possible hydrothermal mobilisation/remobilisation of the Outokumpu ores during later metamorphism.