Element accumulation in peat of the Vidrino highmoor

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Almost 90 years ago, V.I. Vernadsky [1] created the holistic doctrine of the Biosphere where he demonstrated the primacy of life as a geological force. Concentrative function of living matter plays a significant role in biomineralization, which is the process when living organisms assemble structures from naturally occurring inorganic compounds [2].

The purpose of this work was to investigate biomineral formation in peat and show an important role of living matter in element accumulation. The objects were peat of the Vidrino highmoor (south-east of the Baikal region, Russia).

The high concentrations of Zn and Cu (500-600 g/t) were determined in peat of the Vidrino highmoor in the layers of early Holocene (360-440 cm) which were formed in period 11-8.5BP. It was shown that authigenic sulfides of Zn and Cu with micron dimension (0.5-3 μm) were formed in the plant cells of sphagnum. Also particles of native silver (5-7 μm) were found out in the peat of the Vidrino highmoor and which were accumulated in cell membrane of sphagnum. The mechanism of silver micro-particles formation in the cell membrane of sphagnum was proposed in this work.

The obtained results show a considerable role of biogenic mineral formation in the investigated peat that is a very important result in discussion about genesis of ore formation in which the preference is given to physical and chemical processes and often the role of living matter is not considered. This research was supported by the RFBR grant 11-05-12038-ofi-m-2011 and grand OPTEC.

[1] Vernadsky (1926) The Biosphere. Leningrad. [2] Leadbeater and Barker (1995) Biomineralization and scale production in the Chrysophyta // In: Chrysophyte algae. Sandren, Smol, Kristiansen, eds., Cambridge, UK: Cambridge University Press.

A tool for exploring the impact of crustal contamination: The Magma Chamber Simulator

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The Magma Chamber Simulator is a new computational tool that quantifies the impact of simultaneous recharge, assimilation and crystallization on melt±solids±fluid in a magma-recharge magma-wallrock composite system. Enthalpy from magma cooling/crystallization and recharge heats wallrock (WR). When the fraction of anatectic melt attains or exceeds a critical percolation limit of ~0.05-0.15, assimilation begins. Magma cooling/crystallization, addition of recharge magma and anatectic melt, and WR heating continue until magma and WR reach thermal equilibrium. For each simulation step, thermodynamic and material balance assessment provides major/trace element and isotopic compositions, masses and temperatures of all phases in each part of the composite system. Initialization includes bulk composition, temperature and pressure of all subsystems, as well as relevant solid/melt and solid/fluid partition coefficients. Simulation of high alumina basalt intruding dioritic to granitic WR at 500-550°C and 0.1 GPa yields a large volume of dacitic melt at equilibrium temperatures of 950-975°C. Assimilation enhances pyroxene crystallization but suppresses plagioclase; this and addition of anatectic melt yield a melt body up to 5x larger than that generated by FC alone. Selected trace element and isotopic results for magma show that, at the equilibrium temperature, Sr isotopes are >0.708, with only 2% of Sr contributed by crust. Nd isotopes are <0.5126, with ≤11% of Nd from crust. In contrast, the total mass of anatectic melt assimilated is ~40%, highlighting the critical difference between mass of element and total mass of assimilated melt. Trace element results also illustrate that variations in mass of element and mass of magma melt can yield dilutions of incompatible element concentrations in contaminated magma, providing an explanation for systems that have "decoupled" trace element and isotopic signatures. Because the MCS predicts detailed phase abundance, mass and compositional information, exploration of a wide range of open-system problems in igneous petrology is possible.

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