Spatial microbial community structure of a shallow-water hydrothermal system

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Marine shallow-water hydrothermal systems are extreme environments, characterized by discharge of hot and often acidic fluids with elevated concentrations of reduced compounds. Steep physico-chemical gradients on small spatial scales lead to the formation of various microniches for microbial communities. In contrast to deep-sea hydrothermal systems, the sun light in shallow systems results in a combination of photoautotrophic and chemoautotrophic primary production. Despite the comparably easy accessability of shallow-water hydrothermal systems, little is known about the spatial microbial community structure and its relationship to physico-chemical conditions.

Here, we present data for the system off Milos island, one of the most hydrothermally active regions in the Mediterranean Sea. A combined approach of gene- and lipid-based techniques (ARISA and intact polar lipids) with porewater geochemistry data was applied along a temperature gradient to investigate the spatial microbial community structure.

Supported by statistical analyses, ARISA data revealed significant changes of the bacterial community structure along the temperature gradient and depth profiles from hydrothermally unaffected areas towards the vent orifices. Intact polar lipid results are consistent with the ARISA data and clearly differentiate samples from close to the vent outlet from those in less affected areas. Changes from phospho- and betaine lipids within the top layer of the unaffected area to glyco- and ornithine lipids in the hydrothermally influenced sediment layers show a change from photoautotrophic algae to a bacteria-dominated community.

Statistical analyses revealed that changes in the microbial community structure were mostly related to spatial heterogeneity in pH and sulfide and less to temperature.

The innovative approach to combine gene- and lipid-based methods proved to be very useful to describe the spatial microbial structure.

Biogeochemical features of the behavior of arsenic in Sherlovogorsk mining district of the Zabaikalsky Krai (Russia)

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As a result of multiyear research (2002-2012 gg.) conducted in Sherlovogorsk mining district of the Zabaikalsky Krai, the peculiarities of biogeochemical behaviour As in the components of the landscape. Shows the sources of his income, concentration, regularities of the spatial distribution of the soil, especially biological capture and accumulation in plants.

The spatial distribution of arsenic (As) on the territory of the region is due to the regularities of the development of the second phase of formation of Sherlovogorsk of ore-magmatic system, which is associated with the formation of tin-polymetallic Deposit.

All of the components of landscapes Sherlovogorsk ore district has considerably enriched with As. It is established, that in natural soils background of the site content As in 6 times exceeds MPC and in 2 times - soil Clark. On the territory of the fields maximum Clark concentration (CC) in the soil (the ratio of the average content in the soil to the soil Clark) is 1183, and the excess of MPC in 1005 times. In техноземе career-dumping landscape respectively QC=340, and the excess of MPC in 289 times. Sherlovogorsk ore area can be identified as arsenic biogeochemical province.

The main form of location As in soils is the residual. In the permafrost meadow-forest, in gravelly low-power soil, Chernozem without carbonates, in the chestnut carbonate soil more than 50% As fixed in a stationary position in the oxidation products arsenopyrite, first of all skorodit and other arsenates.

Capture As different plants varies considerably. Herbaceous plants and shrubs more intensively involve As in biological Cycling, than shrubland. Of wood and shrub of plants Crataegus sanguinea Pallas and Betula pendula Roth do not have гипераккумуляцией As, in contrast to the bushes: Pentaphylloides fruticosa (l.) O. Schwarz, Pentaphylloides parvifolia (Fischer ex Lehm.) Sojak and Artemisia gmelinii Weber ex Stechm. In them, just as in the grassy plants of natural-technogenic landscape detected toxic and critical concentration As (more than 5 mg/kg).

For the majority of the studied plants tend maximum capture As roots and leaves, by the end of the vegetation period is marked its accumulation in these bodies. Minimum contents As found in fruits and seeds.

The obvious hubs, As are herbaceous plants: Potentilla acervata Sojak, Aconogonon angustifolium (Pall.), Gallium verum L. and subshrubs - Artemisia gmelinii Weber ex Stechm.

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