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Structure and Functioning of Microbial Community of Mineral Springs in Central Asia

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Abstract

The microbial mats of different types of springs in Central Asia (Zabaikalye and Mongolia) are described. The species diversity of mat-formed phototrophic bacteria was determined. The rates of microbial destruction processes (sulfate reduction and methane formation) were measured. An important role of bacteria and algae in the formation of mineral water composition was shown.

Key words: bacterial processes, Central Asia, microbial mats, mineral springs

Introduction

Functional diversity of microbial communities depends on chemical composition of waters and rocks. The electrons acceptor contents, biogenous elements and other substances influence microbial diversity and microbial activity (Zavarzin, 1984). At the same time microorganisms play an active part in formation of qualitative and quantitative composition of natural waters, as a result of their high biochemical potential and large numbers. Aerobic and anaerobic, autotrophic and heterotrophic bacteria, fungi and algae take part in biogeochemical processes taking place in underground and surface waters. Microorganisms are the main catalysts of multistage processes of production, destruction and transformation of organic material, formation and consumption of gases and synthesis of secondary metabolites.

Geological history, geo-structural peculiarities of territory, chemical composition of rocks, geothermal and climatic conditions cause widespread mineral waters in Central Asia where various types of mineral spring have been determined. They are subdivided into nitrogen, carbonaceous and methane springs as well as hot, warm and cool groups (Tkachuk *et al*, 1962; Pinneker, 1980). Nitric springs form as a result of heat occurrence with infiltrated waters from 2-3 kilometers of the deep kainozoii breaks. The origin of carbonated mineral springs is connected with carbonate and silicate rocks in zones of young volcanic activity.

Hydro-chemical and microbiological research has been conducted in the mineral springs of Zabaikalye and Mongolia (Barkhutova *et al*., 1998; Abidueva *et al*., 1999; Barkhutova *et al*., 2003). The location of springs is shown in Fig. 1. Particular attention in this research has been paid to estimation of geo-chemical activity of microorganisms, to determination of physiological group numbers, and to the study of species diversity of bacteria and algae.

Methods

Samples were taken from 21 springs in Zabaikalye and Mongolia. Samples were taken from the spring basin (water body), from the brook running out from the spring and from giffon formed on the surface of the water. Water samples and silt were taken from 0.1-0.5m; samples of mat were taken from river sides and small lagoons. Water temperature was taken with an electric sensor thermometer "Prima", pH with portative precision pH-meter PRO, redox potential with a redox potential tester ORP and salinity with a portative tester-conduct-meter TDS-4. Concentrations of