



Viable Microbial Diversity from Permafrost Deposits in Kluchevskaya Volcanoes Group of Kamchatka Region.

Zoya A. Tsygankova (1,2), Vera S. Soina (1), David A. Gilichinsky (2)

(1) Department of Soil Biology, Faculty of Soil Science, Moscow State University; (2) Institute of Physicochemical and Biological Problems in Soil Science, Russian Academy of Sciences, Pushchino

Kamchatka region is the unique extreme habitat, where cryogenic processes spread over the volcanic rocks and deposits which underwent freezing after high temperature influence. Besides, Kamchatka permafrost in contrast to ancient Antarctic and Arctic permafrost deposits is characterized by comparatively high freezing temperatures (-1°C - 4°C), and not prolonged exposure to freezing (the age of Kamchatka permafrost, which is defined as the time of stay at subzero temperatures is about 30 years). Presented data is the first attempt to characterize the biological activity and diversity of viable heterotrophic microbial communities of frozen volcanic rocks and deposits after thawing. The samples were aseptically taken from the boreholes drilled at the depths of 2-14 m. on Kluchevskaya Volcanoes group area in 2002 – 2004. Microorganisms were isolated by standard techniques developed for soils. The morphology of isolated strains was examined by phase contrast microscopy. Viable count of soil bacteria (CFU per 1 gram of soil - CFU/gdw) was estimated by plating on a wide range of nutrient rich, poor, rich diluted agar-solidified and selective media and incubation aerobically at $+4^{\circ}\text{C}$, $+20^{\circ}\text{C}$, $+35^{\circ}\text{C}$ and $+55^{\circ}\text{C}$. The viable number of microorganisms in all examined samples varied not significantly (10^2 – 10^4 CFU/gdw). Meanwhile the total cell number detected by direct counting with epifluorescence microscopy was higher and varied from 10^4 to 10^5 cells/gdw. Both total and viable amount of bacteria in thawing volcanic rocks and deposits is regarded as the minimal number of microorganisms in all investigated permafrost environments after thawing. The data can be explained both by poor initial microbial colonizing of cooling down volcanic

rocks and specific physiological state of microorganisms initiated by wide temperature influence from $+200^{\circ}\text{C}$ – 300°C up to -1°C – 4°C . The library of isolated bacteria is comprised of 200 bacterial cultures, including both spore-forming and non spore-forming bacteria. Bacterial isolates were mostly mezophilic or psychrotrophic strains, and 10% of isolates were represented by aerobic thermophilic or thermotolerant microorganisms. Presented data verify the ability of bacteria to survive under various extreme factors such as critical temperature drop in environment, and make more evident the possibility to search signs of life on extraterrestrial bodies.

This study was supported by Russian Foundation for Basic Research (Project 04-04-48257).