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DETECTION OF MICROORGANISMS IN ANCIENT ICE WEDGES IN THE CENTRAL YAKUTIA (RUSSIA)

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The study of biodiversity and the properties of microorganisms in ancient permafrost is extremely important due to the observed trend to a warming climate. Permafrost provided through thousand and millions of years quite stable environment, which served a time capsule for the old microbial associations. At the present time, a number of facts prove the existence of viable microorganisms in permafrost.

This paper presents the results of a study of microbial associations in samples of relict ice wedges of the Mammoth Mountain. Mammoth Mountain Ice complex is located on the left bank of the Aldan River in the Central Yakutia. Neogene- Pleistocene alluvial sand sediments aged from about 12 million to several thousand years are exposed there. Ice wedges are formed as a result of repeated cycles of frost cracking and filling cracks with water and organic and mineral particles. Shape of the ice wedges is an evidence of absence of thawing during the time of their existence, and variety of microorganisms and bacteriophages have survived in this environment. These ice wedges may persist for thousands of years. They may include microorganisms that penetrated into the cracks in the form of suspensions. The main habitat of microorganisms in the ice wedges are soil particles which protect them from being damaged by ice crystals. A number of colony forming units (CFU) of heterotrophic aerobic bacteria have been identified, some of them are similar to microorganisms found previously in frozen ground and ice in the Arctic, and they vary within the $10^3 - 10^6$ CFU / ml. Corynebacteria is one of the dominant forms.

Electron Microscopic Detection of Microorganisms was made and confirmed the in situ presence of wide variety of bacterial forms in with the greatest diversity in the samples of ice wedges. The bacterial forms were grouped into the following groups: rodlike forms, rounded, convoluted cells, filamentary forms and aggregates of coccoid forms. According to comparative genomics of Actinobacteria coryneform bacteria are evolutionarily older forms. Exactly coryneform actinobacteria predominate in the composition of the microflora of the permafrost.

Besides Electron microscopy of the thawed material from ice wedges has shown presence of virus particles of different morphologies. Filamentous bacteriophages have been found in negative sites in the zone of active growth of spore-forming bacteria. Detection of virus particles in samples of relict ice wedges have probably become possible due to the induction of phages of lysogenic microorganisms during thawing. At the same time we can not exclude the possibility of virus adsorption on particles of relict dust at the time of the ice formation, therefore the viruses can be relict.

Also we made experiment for microorganisms migration in the frozen soil. This investigation was done in the sand from Mammoth Mountain where *Bacillus cereus* was found. We kept our samples in the freezing compartment about one month and there was no migration detected. Then we can make conclusion about the ancient age of that microorganisms.