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A novel thermophilic methane-oxidizing bacteria from thermal springs of Uzon volcano caldera, Kamchatka

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Methane is a radiatively active trace gas, contributing significantly to the greenhouse effect. It is 26 times more efficient in absorbing and re-emitting infrared radiation than carbon dioxide. Methanotrophs play an essential role in the global carbon cycle by oxidizing 50-75% of the biologically produced methane in situ, before it reaches the atmosphere.

Methane-oxidizing bacteria are isolated from the various ecosystems and described at present. Their biology, processes of methane oxidation in fresh-water, marsh, soil and marine habitats are investigated quite well. Processes of methane oxidation in places with extreme physical and chemical conditions (high or low , salinity and temperature values) are studied in much smaller degree. Such ecosystems occupy a considerable part of the Earth's surface.

The existence of aerobic methanotrophs inhabiting extreme environments has been verified so far by cultivation experiments and direct detection of methane monooxygenase genes specific to almost all aerobic methanotrophs. Thermophilic and thermotolerant methanotrophs have been isolated from such extreme environments and consist of the gammaproteobacterial (type I) genera Methylothermus, Methylocaldum, Methylococcus and the verrucomicrobial genus Methylacidiphilum.

Uzon volcano caldera is a unique area, where volcanic processes still happen today. Hydrothermal springs of the area are extreme ecosystems which microbial communities represent considerable scientific interest of fundamental and applied character.

A thermophilic aerobic methane-oxidising bacterium was isolated from a sediment sample from a hot spring (56.1; 5.3) of Uzon caldera. Strain S21 was isolated using mineral low salt medium. The headspace gas was composed of CH4, Ar, CO_2, and O_2 (40:40:15:5). The temperature of cultivation was 50, pH 5.5. Cells of strain S21 in exponential and early-stationary phase were coccoid bacilli, about 1 μm in diameter, and motile with a single polar flagellum.

PCR and molecular cloning of a pmoA gene fragment have shown that strain S21 was moderately related to the genus Methylothermus; the closest organism is Methylothermus subterraneus.

The further studying of strain S21 will expand our knowledge of this group of organisms, important from the ecological point of view.