SPACE LIFE SCIENCES SYMPOSIUM (A1)
Astrobiology and Exploration (6)

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EXPERIMENT METEORITE ON FOTON-M4 SATELLITE: SPORE-FORMING THERMOPHILIC BACTERIUM SURVIVE ENTRY INTO THE EARTH'S ATMOSPHERE

Abstract

Transport of microorganisms in space is an important issue from theoretical (origin of life on Earth) and practical (planetary protection) points of view. One of the key conditions of the hypothesis of lithopanspermia is that microorganisms situated within meteorites could survive hypervelocity entry from space through Earth's atmosphere. So far all experimental proves of this possibility are based on the tests with sounding rockets which do not reach the transit velocities of natural meteorites. We explore the survival of spore-forming thermophilic anaerobic bacterium Thermoanaerobacter siderophilus placed within 1.4-cm thick basalt discs fixed on the exterior of space capsule (the METEORITE experiment on FOTON-M4 satellite). After 45-days of orbital flight, landing module of the space vehicle was returned to the Earth. The temperature during the atmospheric transit was high enough to melt the surface of basalt. Thermoanaerobacter siderophilus survived the entry; viable cells were recovered from 4 of 24 wells loaded with this microorganism. Identity of the strain was confirmed by 16S rRNA gene sequence and physiological tests. This is the first report on survival of a life form within artificial meteorite after entry from space orbit through Earth's atmosphere at velocity that closely approach to velocities of natural meteorites. Characteristics of artificial meteorite and living object applied in this study can serve as positive controls in further experiments on testing of different organisms and conditions of interplanetary transport.