EPSC Abstracts,
Vol. 4, EPSC2009-355-2, 2009
European Planetary Science Congress,

Photosynthesis activity of frozen cyanobacteria, snow alga and lichens as pre-tests for further on studies with simulation of Mars equatorial latitude temperatures

J.-P.P. de Vera (1), D. Möhlmann (1), T. Leya (2)

(1) DLR, German Aerospace Centre Berlin, Institute of Planetary Research, Berlin, Germany (jean-pierre.devera@dlr.de / Fax: +49-(0)30-67055303), (2) Fraunhofer IBMT, CCCryo (Culture Collection of Cryophilic Algae), Potsdam-Golm, Germany

Abstract

Numerous photosynthesising microorganisms are able to survive simulated and real space conditions [1] [2] [3] [4]. In case of lichens many tests after space exposure have shown their maintenance of physiologic activity, their unaffected photosynthesising activity and their capacity to germinate and grow after being exposed directly to space parameters as there are the spectra of UV radiation, ionizing space radiation and vacuum [3]. This has been shown e.g. by the 10 days space experiment “Lithopanspermia” on BIOPAN 6 / FOTON M3 [4]. Further on studies on the exposure platform EXPOSE / ISS may lead to new answers on the question, if there will be a stronger effect on the exposed microorganisms after long duration experiments. In mean time other tests under Martian conditions with the use of Mars soil simulants, an artificial composed Mars atmosphere and temperature and humidity diurnal profiles equal to equatorial latitude night- and day cycles temperature as well as the simulation of a UV-radiation spectrum on Mars with a limited quantity of water supply have shown photosynthesising activity during this mentioned simulation [5]. Some effects were detectable in relation to low temperature far below the zero Celsius degree point. A number of experiments with snow alga and cyanobacteria in addition to the investigated lichens were performed under frozen conditions down to -30° C. The results are indicating a reduced but still existing photosynthetic activity in water ice. Differences can be observed according to the different analysed species and different applied temperature profiles. Questions arise, if the investigated species are able to use water from thin melted water layers in the ice surrounding the cells because of the presence of anti-freezing proteins or by still existing veins in the ice with liquid water supply for organisms. In case of future Mars simulation tests it is to be planned to analyse the effect of salty or acidic water under very low temperatures on halophytic cyanobacteria. The reason for these planned analyses is because of the recent results obtained by the Phoenix lander on Mars which indicate that droplets of liquid brines have been observed under very low temperatures and where physical model calculations support the conclusion that a high salty concentration might maintain the water liquid even in polar regions on Mars. Probably the results of these investigations will also give answers on the questions why no evolution of photosynthesising organisms had taken place 3.5 to 3.8 billion years ago on Mars whereas it is supposed to be the time of first appearance of photosynthesising cyanobacteria on planet Earth. Consequences seem to be possible also for smaller icy and (at least partially) ice covered bodies in the solar system, like asteroids.

References

[1] de Vera, J.P. et al. (2003) *International Journal of Astrobiology* 1 (4), 285-293

[2] de Vera, J.P. et al. (2004) *Adv. Space Res.*, 33, 1236-1243.

[3] de Vera, J.P. et al. (2008) *Origin of Life and Evolution of Biosphere* 38, 457-468.

[4] de la Torre et al. (2009) *Icarus*, submitted

[5] de Vera, J.P. et al. (2009) *Astrobiology*, submitted