SHOCK RECOVERY EXPERIMENTS CONFIRM THE POSSIBILITY OF TRANSFERRING VIABLE MICRO-ORGANISMS FROM MARS TO EARTH.

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Introduction: With regard to the impact and ejection phase we tested the case for the transfer of microorganisms from Mars to Earth. Using a high explosive set-up thin layers of bacterial endospores of *Bacillus subtilis*, of the lichen *Xanthoria elegans* and of the cyanobacterium *Chroococcidiopsis sp.* embedded between two plates of gabbro were subjected to 10, 20, 30, 40 and 50 GPa which is the pressure range observed in Martian meteorites [1]. The actual shock pressure was determined from refractive index measurements of the shocked plagioclase based on calibration data from [2]. Shock and post-shock temperatures were calculated on the basis of data in [3] and [1]. The survival rates of the microbes were quantitatively determined using various biological and microscopic methods [e.g., 4].

Results: The bacterial endospores, the lichen and the cyanobacterium do survive in the shock pressure range observed in Martian meteorites although the survival rates are exponentially decreasing with increasing shock pressure. The symbiotic subsystems of *lichen* display different survival rates: The mycobionts survive up to 50 GPa at a rate of 0.002 % whereas the photobionts only reach a upper pressure limit of 31 GPa with a survival rate of 0.18 %. The endospores of *Bacillus subt.* survive up to 42 GPa with a rate of 0.02 %. *Chroococcidiopsis sp.* survived only at 10 GPa with a rate of 0.39 %. The results are surprising in view of the relatively high shock and post-shock temperatures calculated for the applied pressures in gabbro. The temperature increase after shock compression at 20 °C increases from ~5 °C to 110 °C, 470 °C, and 760 °C at 10, 31, 42 and 50 GPa, respectively.

Conclusions: Our studies revealed different degrees of shock metamophism for the different petrographic types of Martian meteorites [1]: 5 to 20 GPa for the nakhlites, 26 to 33 GPa for chassignite, and orthopyroxenite, and 20 to 55 GPa for the shergottites. Although *Bacillus subt*. and the *Xanthoria elegans* are actually capable of surviving in all types of Martian host rocks, the most favorable and most sufficient host rocks for the transfer of life from Mars to Earth are ultramafic rocks such as pyroxenites (nakhlites) which not only display the lowest degree of shock but also suffer the least from post-shock heating.

References: [1] Fritz, J. et al. 2005. *Meteoritics & Planetary Science*, in press. [2] Stöffler D. et al. 1986. *Geochim. Cosmochim. Acta* 50:889-903. [3] Artemieva, N. A. and Ivanov, B. A. 2004. *Icarus* 171:84-101. [4] Horneck G. et al. 2001. *Icarus* 149:285-293.