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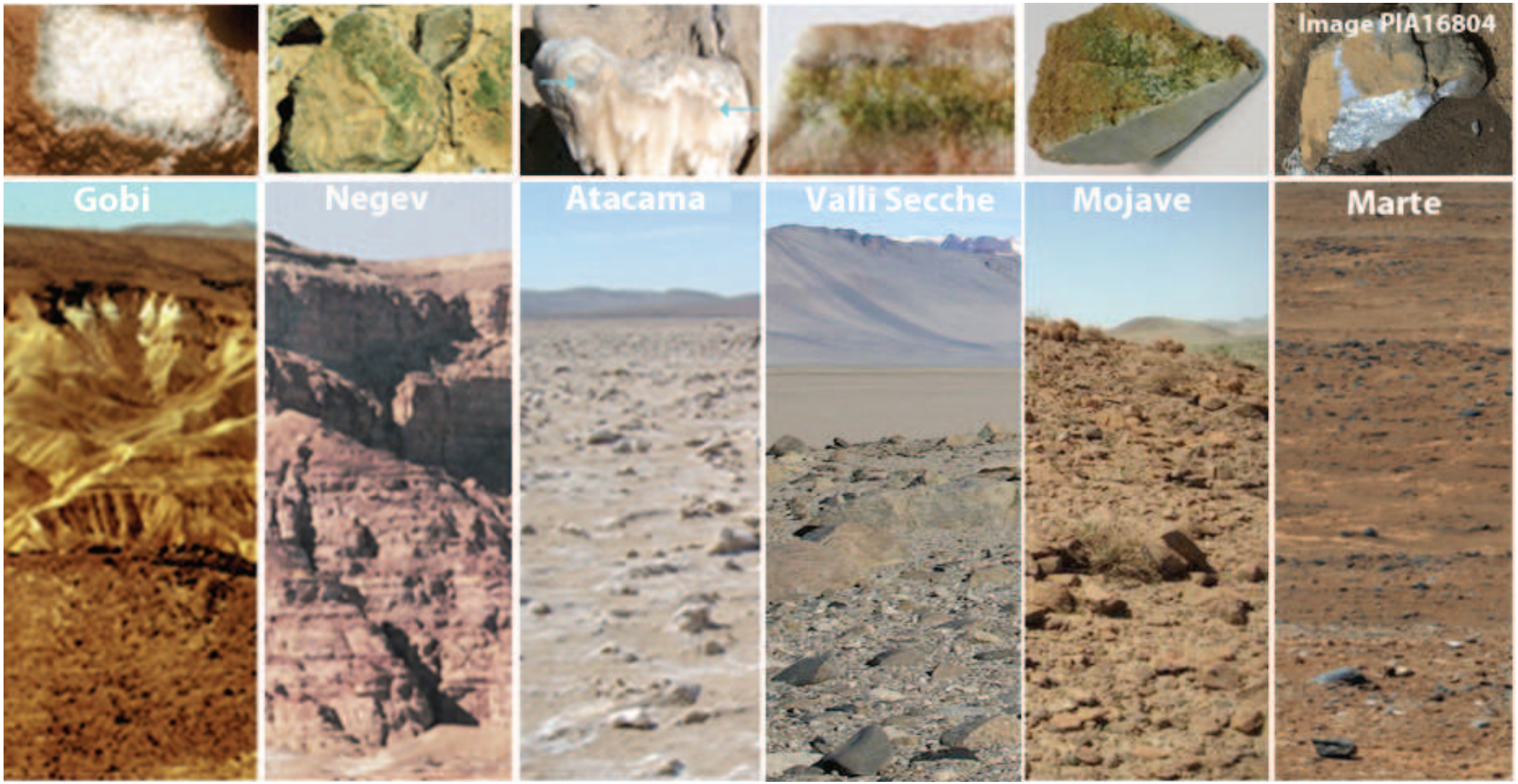
Department of Biology

AstRoMap

AstroMap Rome, ASI 19-20 November 2014

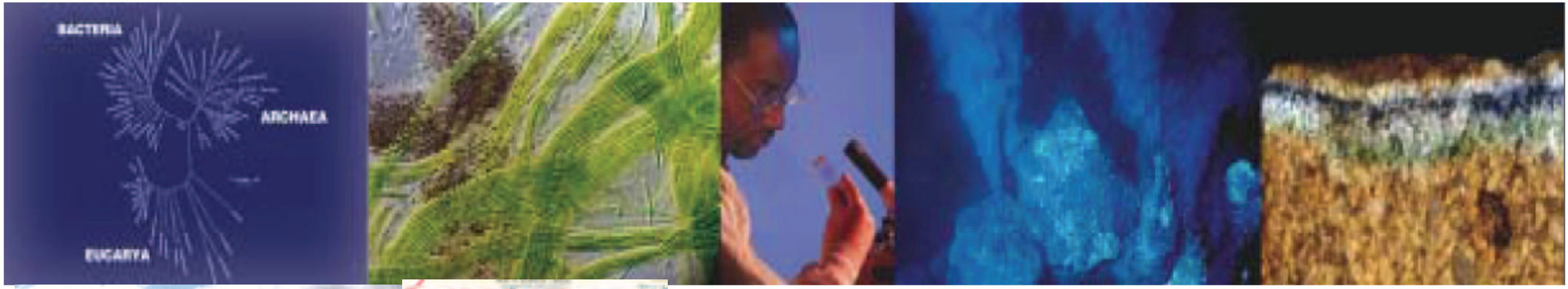
Life in Extreme Environments



Goal 5. Evolution, Environment and the Limits of Life.

Understand the evolutionary mechanisms and environmental limits of life.

Determine the molecular, genetic, and biochemical mechanisms that control and limit evolution, metabolic diversity, and adapatation of life



Science 24 September 1976

Edolithic Blue-Green Algae in the Dry Valleys: Primary Producers in the Antarctic Desert Ecosystem

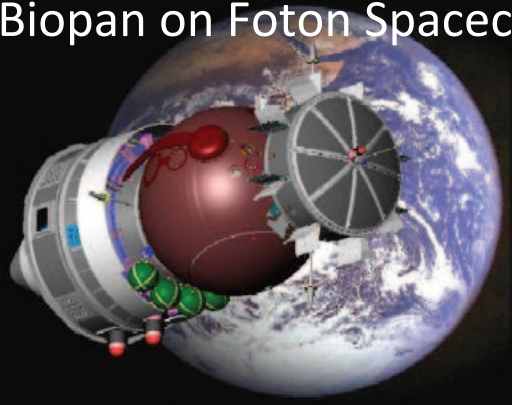
E. Imre Friedmann and Roselii Ocampo-Friedmann

Extremophiles and Astrobiology

Limits of life as we know it

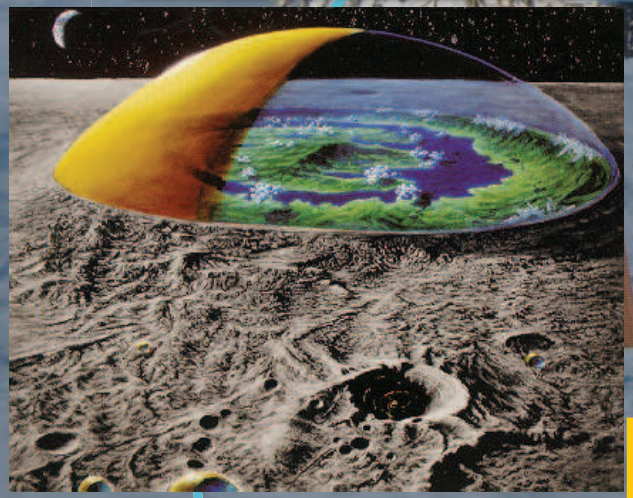
Life beyond Earth

Biopan on Foton Spacecraft

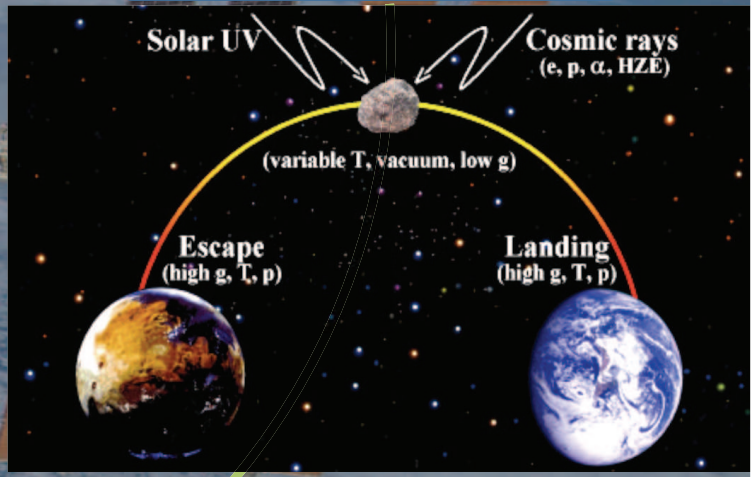


Search for Life in the Solar System (Mars)

Lithopanspermia hypothesis



EXPOSE on ISS



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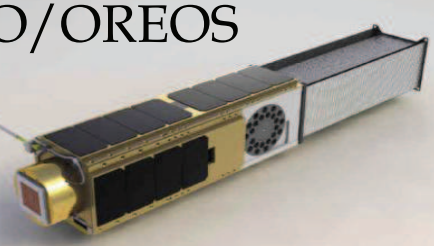


Life support Systems

ISRU

Planetary protection

Limit of life as we know it

BOSS: Biofilm Organisms Surfing Space

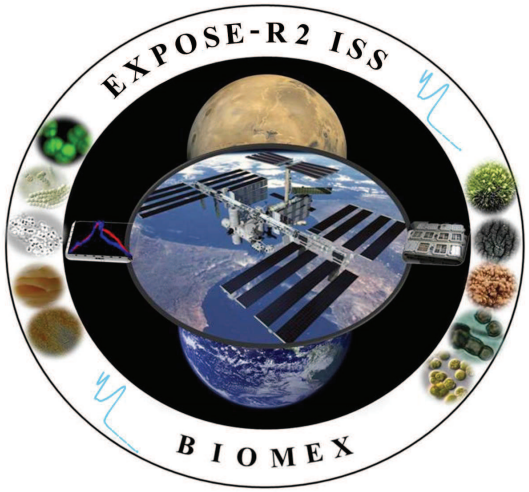
Aim: testing if microbial biofilms are more resistant to the environmental conditions in space and on Mars than planktonic counterparts.

EXPOSE- R2 space mission (ESA ILSRA 2009)

ISS on July 24th, 2014

Science Team Coordinator : Petra Rettberg

ASI -BOSS_Cyano : *Chroococcidiopsis* (PI D. Billi)



Search for Life on Mars

BIOMEX : BIOlogy and Mars-EXperiment

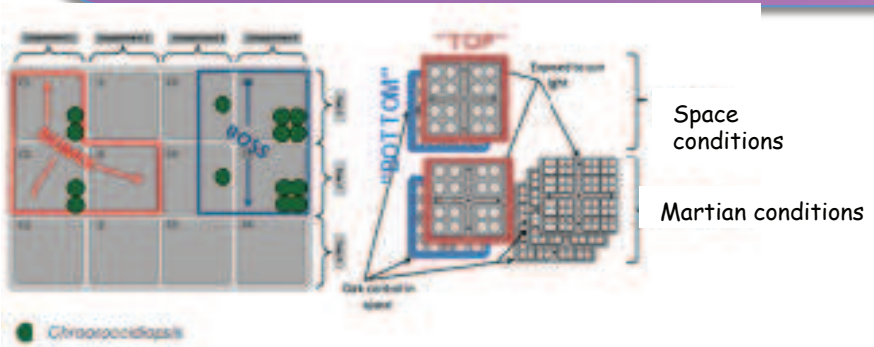
Aim: testing the resistance and stability of biomolecules and the endurance of extremophiles under space and Mars-like conditions (with Lunar and Mars analogues).

EXPOSE- R2 space mission (ESA ILSRA 2009)

ISS on July 24th 2014

Science Team Coordinator : Jean-Pierre de Vera

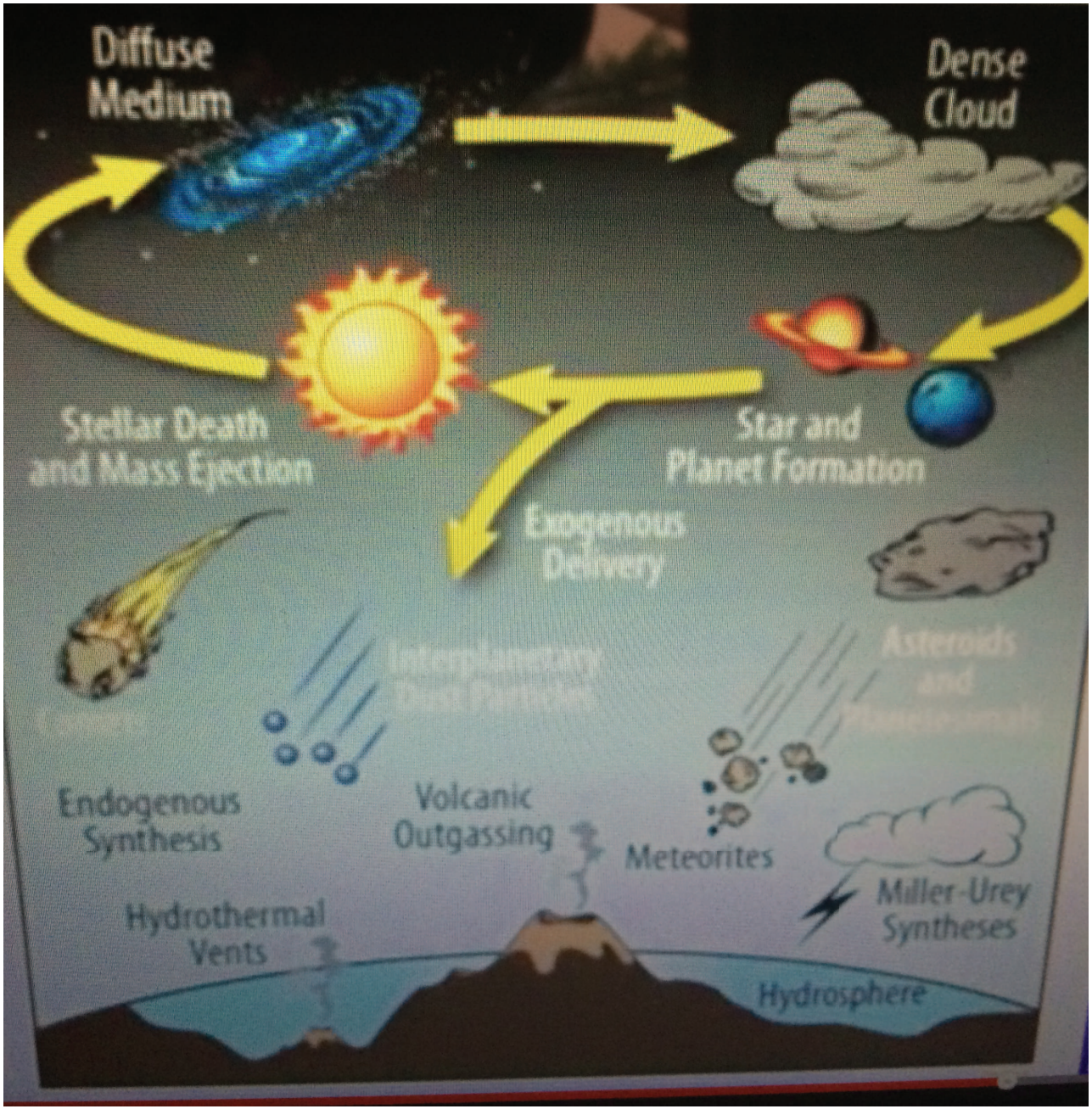
ASI- BIOMEX_Cyano : *Chroococcidiopsis* (PI D. Billi)



From 2012- to 2014
Space and Martian simulations at DLR

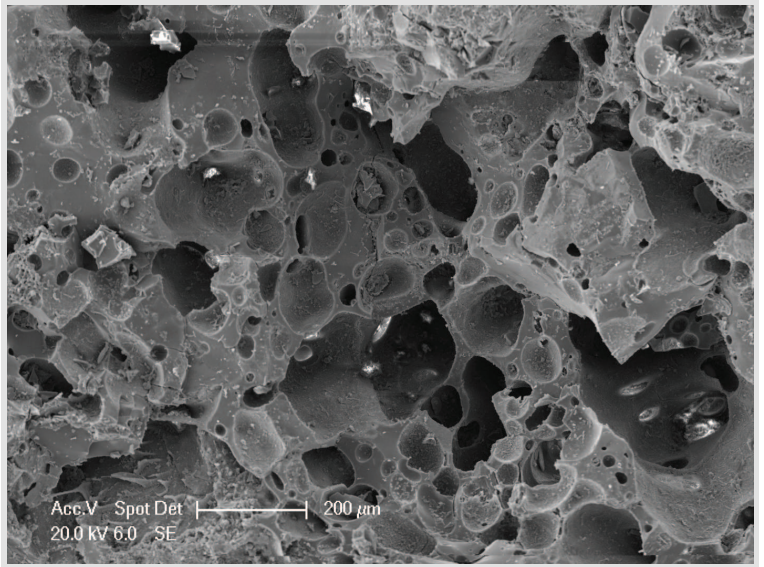
Meteorites and their possible role in the history of life on the Earth

HOW COSMIC IMPACTS MAY HELP CREATE SUITABLE HABITAT FOR LIFE



Impact cratering is an important and fundamental geological process in the Solar System (Charles Cockell)

Studies suggest that asteroid and cometary bombardment can shelter microbial life from damaging UVC by generating pores in rocks, thus providing new environmental niches for the evolution of life on Earth, when the ozone was not present in the atmosphere (in addition to stromatolites).

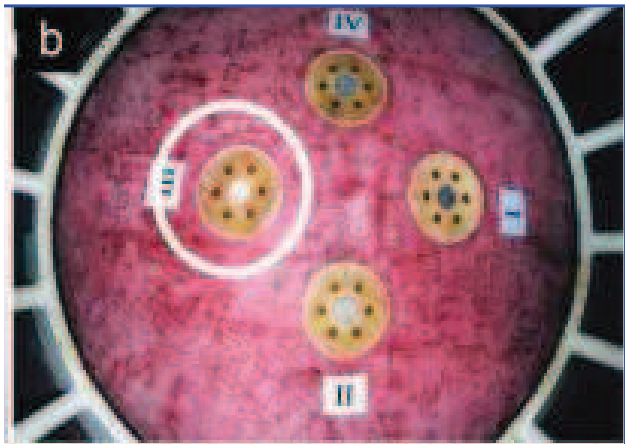


Crystalline rock that is altered or "shocked" by cosmic impacts can develop pores that can shelter microbial life. Credit: Casey Bryce

ESA STONE experiments (2005): impact metamorphism of the target basement Precam brian gneiss during an impact event 39 million years ago in what is today Devon Island in Nunavut, Canadian High Arctic.

The organisms grew within the glassy fracture-connected cavities formed during entry, and their rate of colonization was higher than the non- flight control.

Fusion crust trapped moisture and retained heat, acting, literally, as a microbial greenhouse.



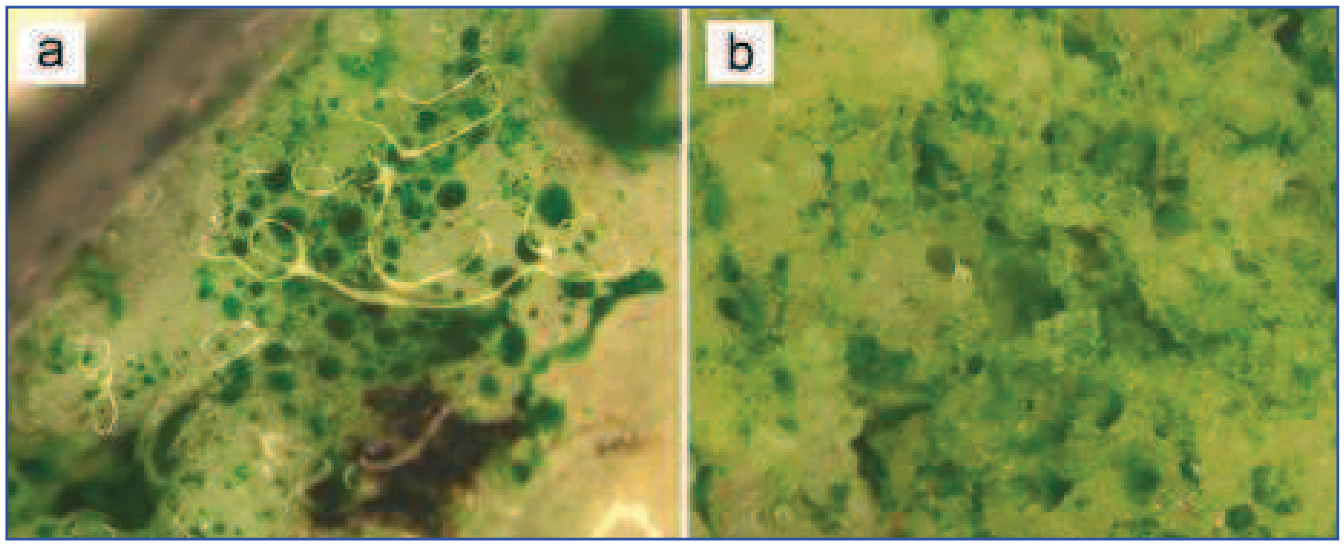


FIG. 2. Recolonization of the underside of the fusion crust by *Chroococcidiopsis* sp. following atmospheric entry. (**a**) Rock exposed to atmospheric entry. White lines are light reflected from glass surface. (**b**) Control non-flight rock. The panels are 2.5 mm in width.

EXPOSE-R space mission from March 11th, 2009 to Jan 21st, 2011

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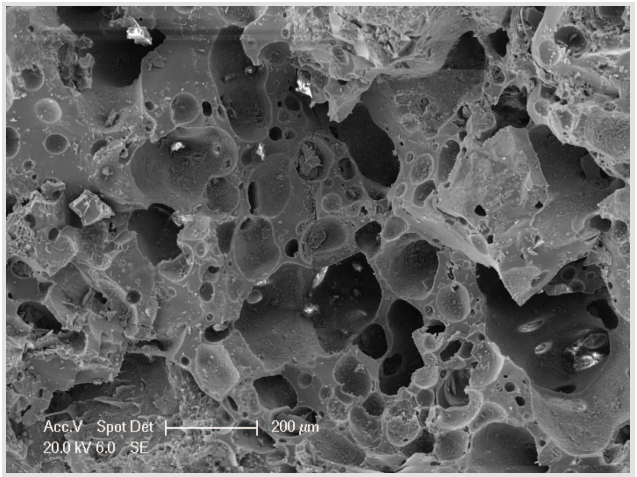

Crystalline rock that is altered or “shocked” by cosmic impacts can develop pores that can shelter microbial life. Credit: Casey Bryce

Cyanobacteria were soaked into the pore space of specifically designed discs of impact-shocked gneiss and integrated into the EXPOSE-R facility.