METEORITE IMPACT GLASS AS A VIABLE MICROBIAL SUBSTRATE. H. M. Sapers[1,2,3], A. Pontefract[1,2], J. Ronholm[3,4], I. Raymond[3], G. R. Osinski[1,2], L. G. Whyte[3]. [1]Centre for Planetary Science and Exploration (*Centre for Planetary Science & Exploration C/O Faculty of Science Room 191, Western Science Centre Western University 1151 Richmond Street London, Ontario, Canada N6A 5B7)*, [2]University of Western Ontario, [3]McGill University, [4]Health Canada, Bureau of Microbial Hazards

Introduction: Impact events are the only ubiquitous geological process in the Solar System and impact structures represent the dominant geological landform amongst the majority of the terrestrial planets. The habitability of subaerial [1] and submarine natural glasses [2] suggests that meteorite impact glasses are potential habitats for microorganisms. The destructive effects of impact events are well studied; however, impact events may have beneficial effects particularly for microbial life e.g. [3]. Impact events create novel microbial niches and substrates such as chemically and energetically diverse impact glass providing not only a novel microbial habitat on present day Earth, but furthermore, a potential preservation environment for microbial trace fossils of early Earth and possibly other planets such as Mars.

Studies of impact glasses hosted within glass-bearing breccias of the Ries impact structure, Germany, have revealed the presence of conspicuous tubular structures with complex morphologies and chemical signatures interpreted as the first trace fossils preserved in impact materials [4]. Here we show that impact glass is a viable microbial substrate in a Mars analogue environment.

Gymsum Hill Spring: The polar environment of Axel Heiberg Island is an important Mars analogue and the perennial, hypersaline cold springs on the Island serve as proxies for putative Martian subsurface brines [5]. The Gypsum Hill spring system is a well studied [6] perennial cold springs located on in the Expedition Fjord area of Axel Heiberg Island.

Gypsum Hill (GH) is a microaerophilic (0.05 – 0.2 ppm dissolved O_2), hypersaline (8-9 % salinity), cold spring (-0.5 – 6.6 ^{o}C) e.g. [7] located in the Canadian high Arctic. Previous studies have determined diverse active microbial communities in the spring [8]. These studies isolated predominantly psychrotolerant, facultative anaerobes that grow at salt concentrations at least as high as the *in situ* salinity from the GH springs. Sequencing studies indicate that the microbial community of GH is primarily sustained by chemolithoautotrophic primary production performed by sulfur-oxidizing bacteria [9].

Methodology: As part of a larger study, sterilized duplicate samples of impact glass from glass-bearing impact breccias from the Ries impact structure were incubated in Gypsum Hill Spring. Samples were retrieved from the Spring following a 4-month incubation. Microbe-substrate interactions were assessed through scanning electron microscopy. Total DNA was extracted from each sample. Regions V1-3 of the 16S and V region of the 23S rRNA genes were amplified followed by 454 pyrosequencing using GS-FLX+ chemistry. DNA could not be extracted from negative controls.

Microbial colonization: SEM imaging revealed rod-shaped cells attached to the substrate with wire-like extensions of extrapolymeric substance-like material. Intimate physical associations between cells and substrate are consistent with colonization. Sequence results indicate the community is dominated by *Thiomirospira,* an obligate chemolithoautotrophic sulpher oxidizer, consistent with the known community structure of the spring. These results indicate that the impact glass is not only acting as a physical substrate for microbial colonization, but also plays a metabolic role.

Conclusion: We have shown the first empirical evidence for impact glass clasts to support microbial colonization. Impact structures have become paramount in the search for habitable environments on Mars [10,11]. Understanding the potential of impact materials to harbor life is fundamental to the interpretation of impact environments and their habitability beyond Earth. Not only does impact glass represent a novel niche for current microbial colonization on Earth, but furthermore, the potential for chemolithoautorphic metabolism to be preserved in impact glass has significant implications for life on early Earth as well as the search for life on other planets.

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