Are Japan Sea gas hydrate chimneys an analogue for potential microbial habitats on Mars and other planets?

*Glen Snyder[1], Naizhong Zhang[2], Stephen Bowden[5], Yoshihiro Kakizaki[3], Naoto Takahata[4], Kentaro Tanaka[4], Yuji Sano[4], Ryo Matsumoto[1]

1. Gas Hydrate Research Lab, Meiji Univeristy, 2. Earth-Life Science Institute, Tokyo Institute of Technology, 3. Dept. Earth and Planetary Sci., Univ. Tokyo, 4. Atmophere and Ocean Research Institute, Univ. Tokyo, 5. School of Geosciences, Univ. Aberdeen, Scotland

Japan Sea methane hydrates have recently been shown to host microbial life encased in spheroidal microdolomite, which opens the possibility that hydrate accumulations may also provide suitable habitats for microbial life elsewhere (Snyder et al., SciRep,2020). The presence of methane in the atmosphere of other planets such as Mars opens the possibility that significant amounts of gas hydrate are also present in the subsurface which could host such life. We look at the body of published data collected on the Japan Sea gas chimneys and hydrates over the past 15 years and discuss the geophysical and geochemical similarities and differences that this unusual environment may have with other potential microbial habitats in the solar system. The development of gas chimneys appears to be important in providing a suitable environment for rapid accumulation of massive hydrate, which in turn plays an integral role in developing a suitable habitat for microbes within gas hydrate fluid inclusions. Similar spheroidal microdolomites have been recorded in fossil seep sites and could presumably be preserved on other planets which underwent methane seepage either recently or in the distant past.

Keywords: gas hydrate, microdolomite, microbial life, Japan Sea, stable isotopes, methane

