

ASTROBIOLOGY INVESTIGATION ON THE NEW VOLCANIC ISLAND - SURTSEY. E. I. Borowska¹, N. E. Zalewska², M. D. Syczewski³ C. D. and, J. Ciężela⁴

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Introduction: Lava tubes are natural caves carved by basaltic pahoehoe magma river flowing down the volcanic slopes. While progressing downhill lava gradually cools off and forms hardened crust on the surface underneath which molten lava continues to flow. The similar fate is correlated with volcanic islands. The same processes were possible on Mars when volcanic eruptions intensive and created new geological forms. We suggest that subsurface lava tubes and other volcanic forms on Mars, similarly as Earth's analogues, may or could in the past sustain diverse microbial community [1]. These new ecosystems and investigation of new habitats is therefore an imperative necessary to discover how pioneering microorganisms modify the encountered harsh volcanic environment and facilitate coevolution of other microorganism and creation of microbial consortia and mutualistic and symbiotic microbial interactions. A wide range of chemolithotrophs and lithoautotrophs, and other extremophiles could find there a shelter from the inhospitable Martian surface [2]. Volcanic formations environment on Earth is a promising place to investigate potential life on Mars. Another point of view for more likely signs of life, on Earth and Mars both can be investigation of new lava forms on volcanic islands.

Migration of elements during rock-forming and rock-transforming processes creates new minerals and deposits, which eventually may facilitate/promote abiogenesis and creation of the habitable "micro" world. Due to these predicted/expected similarities in the rock transformation processes the investigation of the primeval, volcanic environments like these of the lava tubes and volcanic islands becomes important [3]. Modifications of rock's structure can facilitate water deposition between mineral's crystals, which may aid cryptoendolithic growth of microorganisms under the surface. In addition, rocks in the lava formations form ambient environments where primitive and extremophilic organisms may thrive and further transform minerals building the rocks, what creates new, accessible mineral deposits and therefore more favorable environment for other, more developed, life forms. Because of their pristine nature lava caves/tubes and volcanic islands provide conditions for development of unique microbial diversity. The eerie

new potential environment to colonize on Earth is a small volcanic island on the Atlantic Ocean – Surtsey, which was formed in volcanic eruption and has risen above the surface in 1963. Its location in the Vestmannaeyjar archipelago [4]. Through 15 islands it is observed the unique basaltic formation and evolutionary new environment to colonize by organisms as microorganisms and their higher forms. There is still little knowledge about spreading organisms on Surtsey, which is the youngest island on the mentioned archipelago, whereby it makes that environment potentially one of the best places to study colonization by different type of organisms. Additionally, we aim at discovering the strategy that microorganisms adapt to form biofilms and colonizing new places (from air and ocean), including primary metabolism which may be analogous to the subsurface of Mars. The implementation of innovative research methodology from versatile scientific fields is a necessary interdisciplinary approach to demonstrate how first organisms began symbiotic life under extreme conditions like the ones encountered in different lava tubes. The same fate was possible on Mars when volcanic eruptions intensive and created new geological forms.

Herein we would like to present possible probes and examination of volcanic formations and lava tubes investigation above and underwater both. The main goal of the experimental in the laboratory set up part is to confirm evolution of primitive organisms, which form biofilms for its protection. The Surtsey Island create a peculiar place as an analog to investigate evolution on the new volcanic areas and astrobiology approach in research.

References:

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