IRON-SULFUR BRINES AS HYPOTHETICAL ECOSYSTEM ANALOGUES OF EARLY MARS AND ICY WORLDS. M. V. Tarasashvili[1,2,3], marika.tarasashvili@btu.edu.ge; N. G. Aleksidze[†], N. G. Doborjginidze[1], dobo78@gmail.com; N. G. Gharibashvili[1,4], Tusa.ghari@gmail.com . [1]Georgian Space Research Agency, 4 Vasil Petriashvili Street, 0179, Tbilisi, Georgia; [2]Business and Technology University, 82 Ilia Chavchavadze Avenue, 0162, Tbilisi, Georgia; [3]Javakhishvili Tbilisi State University; 1, Ilia Chavchavadze Avenue, 0179 Tbilisi, Georgia; [4]Spase Farms Ltd, 14 Merab kostava Street, 0108, Tbilisi, Georgia.

Introduction: Some experimental studies have shown that types of brines can form and persist from the equator to high latitudes on the surface of Mars [1, 2], also the ability of organisms to actively metabolize and grow in high salt water at low temperature at partial exposure to the unshielded solar short radiation triggered the theoretical basis for investigating habitability in icy ocean worlds [3, 4], however the problem remains disputable, which underlines an importance of the further scientific discussions regarding brines as biomarkers and/or biosignatures.

Material and Methods: For the preliminary assessment of the brines and their potential habitability, an analogue environment has been investigated (Fig. 1).

Figure 1. Tsagveri brines are very rich in microbial communities, which can potentially serve as an analogues for the spectroscopic investigations of possible habitability of the likelihood systems on Mars and Icy Worlds.

Chemistry and microbiology of Tsagveri brines: Extremophiles have been obtained from the iron-rich slopes of Tsaghveri (41° 47′ 54″ N, 43° 28′ 57″ E), Georgia, known for its icy volcanic springs (0ºC – 4ºC, *pH*~4.4; bivalent Iron 12-18mg/L) containing high concentrations of Iron and Sulfur compounds; Concentration of other ions in mg/L is: Mg^{2+} (34-120), Ca^{2+} (36-112), Na^{+} (750-1150), SO_4^{2-} (70-244), HCO_3^{-} (2400-4400), Cl^{-} (42-95).

Major species identified were: *Acidithiobacillus ferroxidans, Thiobacillus ferroxidans, Gallionella, Spirillum desulfuricans, Sporovibrio desulfuricans, Shewanella oneidensis, Beggiatoa, Thiorthrix, Ferribacterium; Rhodoferax ferrireducens* and some others. Interestingly, these extremophiles have been reported to be able to survive in simulated conditions of Mars [5].

Brines as biosignatures: Colored patterns visible on Fig. 1. also provides the insights for the validity of spectroscopic investigation of the brines as of possible analogues of extraterrestrial environment suitable for the origin and development of life;

Spectra have been obtained from the clear silicagel saturated by bacterial colonies and control [6], frozen at -43˚C (Martian permafrost, Icy moon surface).

Obtained results: In vivo absorption maximums for various extremophiles inoculated within clear silicagel were as follows: 1. B chl a, 850–910nm, purple sulfur bacteria; 2. B chl a, 350, 805–810nm, all green bacteria, 3. B chl b, 1020–1035nm, all purple-red bacteria; 4. B chl c, 745–760nm, purple-red non-sulfur bacteria; 5. B chl d, 725–745nm, green sulfur bacteria; 6. B chl e, 715–725nm, brown iron and sulfur bacteria; 7. B chl g, 320-550nm, heliobacteria and some iron bacteria.

By comparing obtained absorption spectra to that of inorganic background mineral signature, significant differences have been found; The data not only have the potential to reveal the environment in which the organic matter was generated, but could potentially indicate specific domains of life and therefore serve as biosignatures and serve as statistical standards for the instruments and methods developed for the analysis of brine-analogue environments in Solar system and beyond.

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