MICROBIOLOGICAL REMEDIATION OF MARTIAN SOIL FOR FUTURE TERRAFORMATION OF THE PLANET. M. V. Tarasashvili[1] and N. G. Aleksidze[2], [1]Iv. Javakhishvili Tbilisi State University, 0162, I. Chavchavadze ave. 62/31, Tbilisi, Georgia. tsu.astrobiology@yahoo.com, [2] Iv. Javakhishvili Tbilisi State University, 0162, I. Chavchavadze ave. 1, Tbilisi, Georgia. nugzar_alekdidze@yahoo.com

Introduction: In order to survive in harsh Martian environment living organisms have to develop specific adaptations to cold anoxic conditions and intense radiation. Introduction of such forms of life to the "Red Planet" has to become precursor for the transformation of Martian soil and atmosphere in a way that planet becomes suitable for Earth-based life.

Growth of plant cover on planet Mars has been supposed by many scientists. However, our ongoing investigations leave small room for such an optimistic prognosis.

Since there is no real sample of natural Martian soil in hand, simulation of that (soil) is considered to be the only option for the performance of scientific investigations.

Materials and methods: Earth mineral matrixes of Martian analogy have been selected in order to diminish artificial chemise and increase natural properties of simulated Martian soil. Among hundreds of minerals Zeolite, basalt, kaolin, clay, sand (black and white) and hematite have been selected, adding oxides and silicates as natural products of their erosion and sulfates recalling certain geological history of the planet. Proportions of these minerals and substances are in accordance to the data as it was presented at [1] and [2].

Thus, we have obtained experimental Martial soil with pH~9.6 and conducted the experiments.

It was determined that minerals presented in the soil reveal clipping, so called "suffocating" properties and cause squeezing damage to plant seeds and root system. Also, other components such oxides are insoluble in water and have no mineral value for the plants. Sulfates cause dehydratation and plasmolysis in live tissues due to their hydrophilic properties.

Thus, investigations have shown the necessity for the microbiological remediation of Martian Soil since bacterial matrixes are capable of biochemical transformation of inorganic minerals into bio-organic substances and water production.

However, in microbiology experiments "Martian Soil" did not reveal bactericide properties therefore we have continued the experiments for its microbial Terraformation.

In light of this we have conducted series of the experiments in order to study survival of different autotrophs in simulated soil.

12 samples were collected from extreme environments found in Georgia, namely Ferro bacteria, Silica bacteria, Sulfur Bacteria, Mycobacterium, Cyanobacteria and several other species that are yet to be identified. The samples were then transferred onto imitated "Martian soil" at amount 0.1 ml each and stored in clear lab.

Environment temperature has been kept between 11 and 15 degrees Celsius and some of the bacteria obtained from cold-water underground springs have been stored in refrigerator at 4 Degrees Celsius. All bacteria were left in the dark in sterile test-tubes and results were observed every 2-4 months. Primary digital and microscope photography was used for data evaluation.

Results: ***Fig. 1*** shows formation of microbial hills in "Martian soil" – small ecosystems that are typical for soil autotrophs. Interestingly, similar structures are shown at pictures presented by Mars "Pathfinder" page [3].

Fig. 1. Formation of ecosystems - microbial hills in "Mars Soil".

Conclusion: In accordance to preliminary data we assume that microbial communities presented in some of the extreme environments are capable of water production in presence of Martian minerals and thus could be suitable for future microbial remediation of Martian soil.

Future work: We are recently conducting microbiological experiments for possible chemical transformations of Martian soil within our experimental chamber "Mars", which resembles expected radiation and climate of the "Red planet". In our future experiments in genetic engineering we are willing to obtain microorganisms (expectedly xero-anabiotic) that would be well adapted to harsh temperature and illumination variation on Mars.

References: [1] Rieder R. et.al. (1997) *The Chemical Composition of Martian Soil and Rocks Returned by the Mobile Alpha Proton X-ray Spectrometer. Sci.,* 278, 1771. [2] Newsom H.E. and Hagerty J.J. (1997) *Chemical Components of the Martian Soil. JGR, 102,* 1151-1154 [3] http://marsrovers.jpl.nasa.gov/