**Extremophiles Research for Lunar Outpost**. Xinbo Lin[1],Ju Gao[1],Shimin Xiang[1],Lujun Wang[1],Zhiwei Lv[1],Xiang Zhang[1],Ying Huang[1],Dinghua Huang[2], [1]Graduate student of Earth Science College, China University of Geosciences (Wuhan), [2]Professor of Research Center for Space Science & Technology, China. University of Geosciences (Wuhan), Hubei, CHINA 430074. hdhua@cug.edu.cn. +86 027 67884711.

We hope to build an artificial recycling ecosystem like the "Biosphere 2", and it is a self-sufficient ecosystem. We know that the lunar soil is not suitable for plants currently. Some European scientists have proved that microbes can improve anorthite soil condition which is similar to the lunar soil, thus make tulips grow better. Therefore, this is an ideal way to transform lunar soil, and then solve the problem of food supply and plant growth. Therefore, our main consideration was how to use some extremophiles on the earth to improve the lunar soil condition, making it more conducive for plants.

In order to find such kind of microbes, we need to focus on the microecosystem of extremophiles on the earth with the approach of analogue research. Several areas have been well researched, such as Antarctic Dry Valleys, Chile's Atacama Desert and Rio Tinto River in Spain, etc. And we chose Tengger Desert in Ningxia of China as the research region. The Following is the surface environment Contrast among Tengger Desert, the Lunar[1] and Atacama Desert (Tab.1).

Tab.1 The surface environment among Tengger Desert, Lunar, Atacama Desert

| Area / Environment Factor | Tengger Desert | Atacama Desert | Lunar |
|---|---|---|---|
| Radiation | Strong | Strong | Strong |
| Temperature | -29.6℃—39℃ | Not mentioned | -155—100℃ |
| Gravity（g） | 1 | 1 | 0.17 |
| Magnetic Field | Normal | Normal | Irregular weak magnetic field |
| Atmospheric Pressure（Pa） | Normal | Normal | High vacuum |
| Surface Materials | Sand and some Shattered rocks | Shattered rocks, hard-packed soil, and soft sands | Igneous |
| Annual Precipitation | 50-100mm | 15-25mm | Almost none in local |
| Life | Low | Lifeless | NO |

Precipitation is very little in Tengger desert areas，with an annual precipitation of 50-100 mm, average annual temperature of 7.8 ℃, the maximum temperature of 39 ℃, the lowest temperature of -29.6 ℃, annual evaporation of 3000-3500 mm, solar radiation of 150 kcal/cm$^2$, an average annual wind speed of 4.1 m/s[2]. Sandstorms were severe in this area, vegetation is sparse, biological soil crust can be seen by the edge of the desert, in this situation, only few drought-enduring plants can survive. We chose Tengger desert because its extreme environment is more similar to lunar surface environmental conditions. In order to study the basic features of extremophiles in the Tengger desert (drought, large temperature differences, strong radiation, etc.), and its environment-related factors, samples were collected here for tests. After a preliminary

study，some conclusions can be found that cultured microbes can live under the conditions of poor nutrition, also it can play a certain role in the transformation of soil environments.

Furthermore, we would like to do some researches on microbes in order to find some species which could play a certain role in lunar soil. We are preparing for more experimental studies，such as collecting samples in Tengger desert to culture microbes in the conditions of simulated lunar soil, high vacuum, zero gravity, or sending extremophiles into space for trial.

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**References:**

1. Xiao Fugen, Pang Hewei, *Introduction to Lunar Geological Morphological Features and Lunar Environment.* Spacecraft Environment Engineering(in chn), 2003(6),20:p.5-14

2. Liu Lichao, Li Shouzhong,et al. *Effect of Microbiotic Crust on Evaporation Process in Vegetated Area in Shapotou Region*. Journal of Desert Research(in chn), 2005(3),25:p.192-195