

## MICROORGANISM ISOLATED FROM DALANGTAN PLAYA (QAIDAM BASIN, PR CHINA) AND THEIR AMPLICATIONS FOR MARS POTENTIAL LIFE T. Huang<sup>1</sup>, L. Xiao<sup>1</sup>,

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### 1. Introduction

Dalangtan playa is the second largest salt playa (roughly 210 km<sup>2</sup>) in Qaidam basin, north-western China. Hyper saline deposition, extremely arid climate and relatively high UV radiation make Dalangtan a promising Mars analogue both for geomorphology [1], saline condition [2] and life preservation [3]. In this study, we reported microbes isolated from the surface and subsurface of Dalangtan Playa. In which, dominated *Bacillus* could be seen as a potential life style living on subsurface or lowland of Mars saline conditions.

### 2. Methodology

Field investigation and sampling were conducted. Physicochemical parameters as pH, salinity, moisture content and TOC were determined. X-ray diffraction of samples were analyzed. Microbial isolation with MGM media were conducted. Sequencing work and phylogenetic tree were constructed. Scanning electron microscope were used.

### 3. Results

Seven surface samples (D-S-1 to D-S-7) and samples from two vertical profiles (D-P-4 and D-P-6) were collected (Fig.1). The height of profile D-P-4 is 595 cm containing ten samples and D-P-6 685 cm containing thirteen samples.

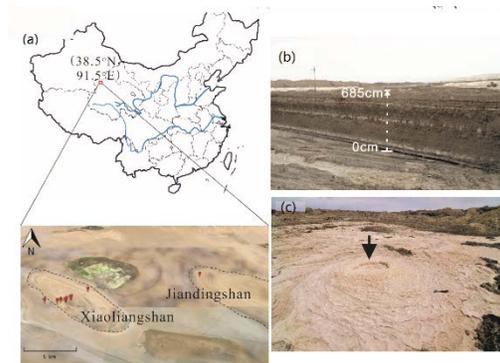


Fig.1 (a) China map and the location of sampling sites as marked with red landmarks. (b) Profile D-P-6, which were excavated by mining work with a height of 685 cm from bottom the topmost. (c) One of the surface sampling sites covered by salts evaporated from brine upwelling.

Salt mineral composition, pH and TOC values of surface samples were listed in Table 1.

Table 1. Physical and Chemical Characteristics of Surface Samples

| Sample | pH   | TOC<br>(w/w) | Salt Mineral Composition              |
|--------|------|--------------|---------------------------------------|
|        |      |              | (w/w)                                 |
| D-S-1  | 7.97 | 0.06%        | Halite 99%                            |
| D-S-2  | 8.90 | 0.03%        | Halite 51.3% and<br>Thernardite 45.5% |
| D-S-3  | 8.34 | 0.12%        | Halite 71.9% and Gypsum<br>11.4%      |
| D-S-4  | 8.30 | 0.07%        | Halite 79% and Gypsum<br>18.5%        |
| D-S-5  | 8.50 | 0.10%        | Halite 30.2% and Gypsum<br>34.0%      |
| D-S-6  | 8.27 | 0.09%        | Halite 98.1%                          |
| D-S-7  | 7.95 | 0.11%        | Halite 90.4% and Gypsum<br>6.1%       |

As to the profiles, samples were tested to be mildly alkaline to alkaline with pH values range from 7.93 to 9.48. A wide range of salinities were tested from 0.4% to 50%. Deposits of Dalangtan playa had a relatively low moisture content range from 0.079% to 12.45%.

Minerals of the subsurface samples were mainly composed by clays, carbonates, sulfates and halite. Fragmentary materials also displayed as associated with salt evaporates.

Twenty-three strains of bacteria were isolated from the surface and subsurface samples (Fig.2). And the bacteria showed over 98% affiliations to *Bacillus*, *Microbacterium*, *Nocardiopsis*,

*Oceanobacillus*, *Halobacillus*, *Gracilibacillus*, *Sediminibacillus* and *Thalassobacillus* within three orders (Bacillales, Micrococcales and Streptosporangiales) of two phyla (Firmicutes and Actinobacteria). In which, *Bacillus* was major genus accounting for 45%.

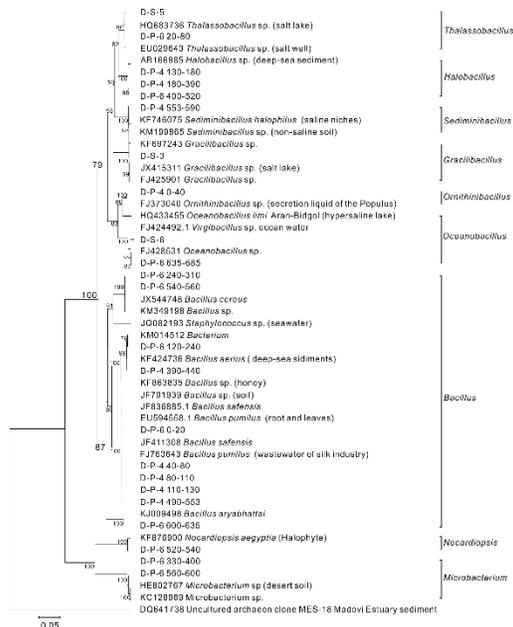


Fig.2 Phylogenetic tree for bacteria from Dalangtan Playa based on 16S rRNA gene sequences. Bootstrap values greater than 50% are shown. The scale bar represents 0.05 fix mutation per nucleotide position.

Four strains of moderately halophilic bacteria isolated from Dalangtan were chose to test growth rates in MGM media with a salinity gradient from 12% to 30% with the interval of 3%. As a result, *Thalassobacillus* sp. and *Ornithinibacillus* sp. preferred to medium with salinity of 12%, while *Oceanobacillus* sp. and *Halobacillus* sp. preferred to medium with salinity of 15%

Bacteria were observed under scanning electron microscope and most of them were displayed to be rod shaped with lengths ranged from 1 to 5  $\mu$ m. Micro particles of salts were observed on the surface of some bacteria.

#### 4. Discussion

Surface of Dalangtan Playa was mainly covered by salt evaporates as halite and gypsum. Mineral composition of subsurface were analyzed as clays, carbonates, sulfates and halite, associated with fragmental materials. The salinity of subsurface deposits was tested to be as high as 50% with moisture content as low as 0.079%. However, twenty-three strains of bacteria

were isolated in this extremely arid environment. In which moderately halophilic microbes accounts for ~50%, and 45% were *Bacillus* which can produce spores in tough environment to conquer hard time.

*Bacillus* have been studied as a target life forms in simulated Mars environment. Spores of *Bacillus subtilis* have been subjected to simulated Martian atmospheric pressure and composition for 19 days and resulted endogenous but not ethical impairment [4]. When exposed to simulated Mars Solar Radiation (254-nm UV light), *Bacillus subtilis* has also retained the possibility to initiate germination-associated metabolic processes and to produce biological signature molecules [5]. Moreover, when exposed to full Martian conditions (UV, low pressure, low temperature and CO<sub>2</sub> atmosphere) for 24 h, positive growth (16.7%) were still exhibited [6]. In addition, spores of *Bacillus pumilus*, which also isolated from Dalangtan deposits, was exposed to space condition and Mars simulated condition for 18 months, and survivals were detected under dark environments [7].

*Bacillus* among the other isolates were capable to live in Dalangtan Playa, the very arid and saline extreme environment. And experiments on *Bacillus* under Mars simulated condition showed their resistances to simulated Mars/Space conditions. Thus we suggest *Bacillus* could be seen as a potential life candidate for Mars life detection and astrobiology investigation.

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