Abstract

The Bonneville Salt Flats (BSF) are a 30,000-acre expanse of approximately 90% table salt in northern Utah (1). There is currently no research published on the evidence of life on the salt flats, yet despite the fact that the salt flats appear barren and void of life, there may be a microscopic community capable of surviving the harsh conditions. In numerous other “extreme” and high saline environments, such as Antarctica (2,3) the Dead Sea (4), Great Salt Lake (5), and Atacama Desert (6), halophilic organisms were discovered and identified, leading to the possibility that there may be similar organisms on the BSF. If extremophiles can be found on the salt flats, they may be useful in certain biotechnological processes (7). Microbial life that can sustain itself on the salt flats may also provide insight into the potential for life on other planets.

To determine if there is life on the BSF, samples were taken from brine in October 2011 and salt crusts in August 2012 and placed in broth and plate culture to observe if there was growth. In conjunction with the environmental samples, uninoculated plates and broth were stored to serve as negative controls. The presence of numerous colonies on the inoculated plates (and absence of growth on control plates) indicated the salt flats are inhabited by microbial life. Further studies tested to determine the identities of the microbes inhabiting the BSF by extracting DNA from isolated samples. Purified DNA was then subjected to PCR amplification of the gene that codes for a 16S rRNA gene using either a 1HK and H589R or 8F and U1492 primer set. The resulting 16S rna sequence was evaluated with BLAST to determine the isolate identity.

The following results were obtained:

- Samples were collected from BSF at one of three sampling site varieties: crack, upwelling, or smooth surface.
- Salt crystals from each site were dissolved in either 23% MGM or modified R2A broth and plate culture to observe if there was growth. In conjunction with the environmental samples, uninoculated plates and broth were stored to serve as negative controls.
- Individual colonies were isolated from plates and distinguished by colony morphology.
- DNA was extracted and PCR was performed on purified DNA using either 1HK and H589R or 8F and U1492 primer sets.
- The resulting 16S rna sequence was evaluated with BLAST to determine the isolate identity.

Results

The colonies formed in varying time sequences, with new colonies appearing weeks after the original colonies have formed. Initial findings indicate that there is a greater number of cultivable microbes in the cracks and upwellings than the surface. The results from the first round of DNA sequencing are shown in table 2. The majority of the isolates were either Halorubrum or Haloarcula.

Conclusions

There is microbial life on the Bonneville Salt Flats.

Future Work

We continue to work on colony isolation and identification by selecting for growth of BSF isolates on different kinds of media. Culture independent methods are being developed to determine the identity of all microbial life inhabiting BSF including both cultivable and unculturable microbes.

Future goals include determining whether the species composition of BSF changes seasonally and whether the differences in the numbers of microbes we are finding between cracks, smooth surfaces, and upwellings provides clues about the origin of the microbes or overall viability of these communities.

Introduction

The Bonneville Salt Flats are a large expanse of sand and 115 miles west of Salt Lake City composed of approximately 90% table salt (1). Despite the barren appearance of the salt flats, there may be microorganisms present in the brine or salt crystals. Given that halophilic organisms have been found in other high saline environments, such as Antarctica (2,3) the Dead Sea (4), Great Salt Lake (5), and Atacama Desert (6), there may be similar organisms on the salt flats. Halophilic organisms can be used in a variety of biotechnological applications. Some halobacteria can produce large amounts of polyhydroxyalkanoates, a family of polyesters that can be used to produce plastic-like materials that support this research.

Methods

Samples were collected from BSF at one of three sampling site varieties: crack, upwelling, or smooth surface.

- Salt crystals from each site were dissolved in either 23% MGM or modified R2A broth and plate culture to observe if there was growth. In conjunction with the environmental samples, uninoculated plates and broth were stored to serve as negative controls.
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Results

The following figures show the three sampling sites plated onto the two different types of media used in this study. The table lists the closest relatives to each isolate.

<table>
<thead>
<tr>
<th>Table 2: DNA sequencing results from the first round of colony isolation and identification. These colonies were all grown on 23% MGM.</th>
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<tbody>
<tr>
<td>Isolate</td>
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<tr>
<td>Halorubrum sp.</td>
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<tr>
<td>Haloarcula sp.</td>
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<tr>
<td>Red Halophilic bacteria</td>
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<td>Red Halophilic bacteria</td>
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<td>Red Halophilic bacteria</td>
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References and Acknowledgments


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