BIOGENIC STRUCTURES FROM A HYPERSALINE LAKE IN THE BAHAMAS. Byrne, Monica, Wellesley College, 106 Central St., Wellesley, Mass. 02481-8266, mbyrne@wellesley.edu; Morris, Penny A., University of Houston-Downtown, Houston, Tx. 77002; Wentworth, Susan J., Thomas-Keprta, Kathie, Lockheed Martin Space Operations, Houston, Tx. 77058; Brigmon, Robin L., Westinghouse Savannah River Company, Aiken, So. Carolina 29808; McKay, David, NASA-Johnson Space Center, Houston, Tx. 77058.

Introduction: Storr's Lake, an inland hypersaline lake on San Salvador Island, Bahamas, contains calcium carbonate-rich lithified mats of filamentous microorganisms, diatoms, associated photosynthetic and chemotrophic bacteria, and trapped sediment [1]. In addition, 16S rRNA analyses, conducted by Dr. Robin Brigmon of the Westinghouse Savannah River Company, indicate the presence of five sulfur-reducing genera of bacteria.

These microbes are potential modern-day analogs to some ancient stromatolitic structures. The goals of this study are to to identify unique compositional and biogenic features, possibly correlating some of these with some of the sulfate-reducing bacteria.

Methods: Samples of the stromatolitic material were prepared for scanning electron microscopy analysis by either air drying, chemically or critically point dried. Subsequent to this process the samples were fractured, coated with platinum, and examined with a JEOL 6340 Field Emission Gun Scanning Electron Microscope (FE-SEM), and light element electron dispersive x-ray spectrometer (EDS).

Results and Discussion: Our FE-SEM analysis indicates a range of microbial life forms on the fractured stromatolite surfaces. Spheroidal features are the most common, with four distinct populations, characterized by their highly uniform intrapopulation sizes: large (mean size 5.5 μm), medium (mean size 2.0 μm), small (mean size .55 μm) and tiny (mean size .13 μm). The surface textures range from smooth and taut to wrinkled and shrunken. The large spheres (Fig. 1) and medium spheres' populations (Fig. 2) are isolated from each other and the other two smaller populations. Most of the large spheres have uniform surface indentations. Most of the medium spheres are clustered together in aggregates of three or four. The small and tiny spheres are closely associated with each other. They are also commonly embedded in biofilm (Fig. 3). The biofilm, alternately viscous and brittle according to degree of mineralization, is composed of thick filaments and web-like film.

Diatoms and long, hollow tube-shapes that may be cyanobacteria sheaths are also present (Figs. 4,5). These structures are plentiful, but not as common as the spheres.

The EDS analysis conducted are both inconsistent and inconclusive. However, the predominant cations detected in the large and medium-sized spheres are calcium. Some of the large and medium-sized spheres, in addition to calcium, are enriched with magnesium. The tiny spheres are similar in composition, although some also contain silicon. Phosphorous, an important component of biological structures such as DNA, is not present.

Conclusions and Further Work: The large, medium and small spheres may represent the mineralized (or fossilized) remains of coccoid microbes, including a sulfur-reducing bacteria, *Desulfococcus. Defulfococcus* is one of the microbes identified by 16S rRNA. The size and shape of bacteria can be significantly altered during fossilization, therefore all of these may represent a single genus or species such as *Desulfococcus,* or they may represent several different genera and species [2]. The smallest spheres may represent biogenically mediated precipitates [3]. They could be nanobacteria, or they may represent solid, abiotic precipitates [4]. It is unlikely that they are wholly inorganic due to their intimate association with the small spheres and biofilm [3]. We suggest that all features described here are likely biogenic or biogenically influenced. Further chemical analysis may provide additional insights into the origin of the tiny spheres.

Water on the Martian surface may have formed subtidal pools formed that are similar to Storr's Lake. Stromatolites, which are essentially bacterial colonies on an enormous scale, could be the first step in life's mass aggregation in any environment where bacteria-like organisms live.

References: [1]Neumann et al.(1991)*GSA NE Sect. 23* 108.[2]Francis et al.(1978) *Precambrian Res. 7* 377-383.[3]Gerdes et al.(2000) *Sedimentology 47* 279-308.[4]Southam et al.(1999) *Earth Science Rev. 48* 251-264.

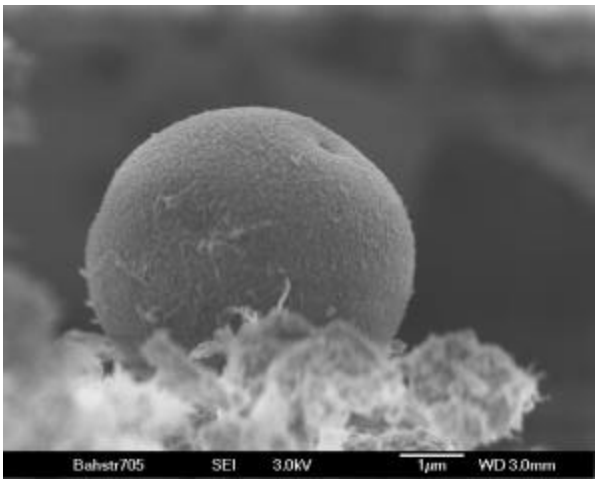

Figure 1. An example of one of the large spheres (mean size 5.5 μm). EDS analysis indicates elevated levels calcium, although some are enriched with magnesium.

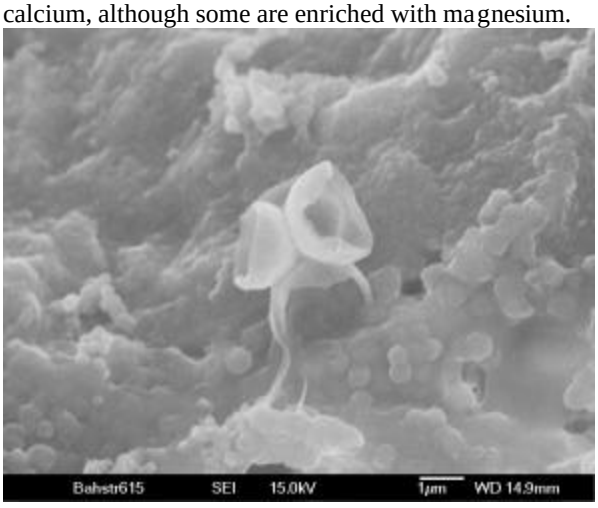

Figure 2. Medium-sized sphere with lysed cells.

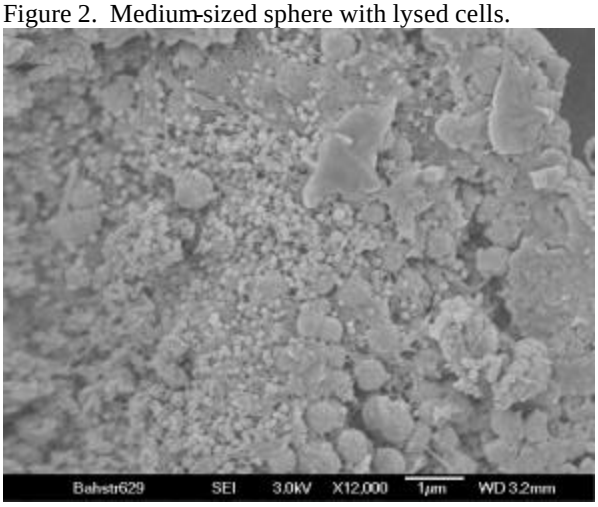

Figure 3. Examples of small and tiny-sized spheres. EDS analysis indicates elevated levels of calcium. Some spheres are enriched with magnesium. Notice extensive deposits of biofilms.

Figure 4. Diatom.

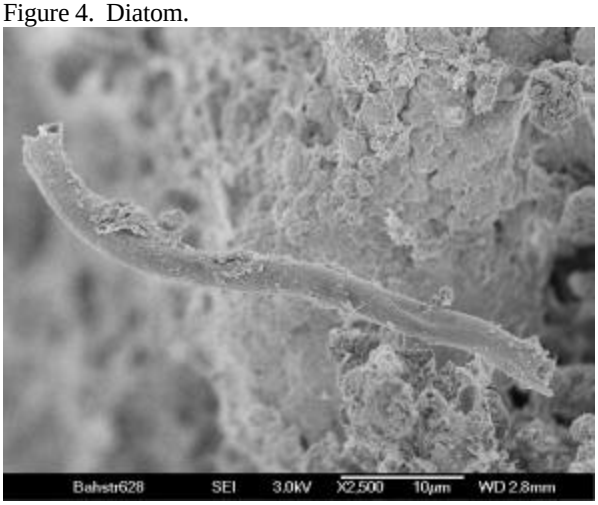

Figure 5. Remnant of cyanobacterial sheath.