Biosignature Suites: Using Connections between Microbes and Minerals to understand Biogenic Carbonates

A Data management plan created using the DMPTool

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Data Collected, Formats and Standards

Procedures for gathering samples and data, as well as maintaining their integrity are outlined in the project description section of our proposal. After each sampling trip, researchers will file out a sample database template, which will be integrated into the main FileMaker Pro Sample Database by Melim. Datasheets are created during each SEM session and during Melim's UNM visits, new photos and SEM data are transferred to her for integration. Spilde is responsible for the addition of geochemical data addition to the Sample Database. At periodic intervals, a copy of these databases will be transferred to UNM PI computers. Computers in the Northup lab that store data are backed up to an external disk.

Physical specimens consist of carbonate biothems and filtered water samples are stored in Spilde or Northup's labs until completion of analyses. At this time they are returned to the federal agency for museum curation or destroyed during analysis. Field notes will be scanned into pdf files, with a copy sent to Carlsbad Caverns National Park or other federal cave manager. SEM images will be saved in the tif format. Geochemical and other chemistry data are stored initially in excel files and transferred to the FileMaker Pro Sample Database to corresponding samples. The data in excel files will be converted to .csv files for archiving.

Data Storage and Preservation

Copies of images will be kept on each researchers local computer. Textual data, and data requiring collaborative effort will be saved to google docs, where it can be incrementally backed up and edited safely. Google docs, also tracks changes and provides a form of incremental backup.

Dissemination Methods

Information generated from this work will be disseminated through both electronic and other media to the public and other scientists. Our existing team website, http://www.caveslime.org, maintained by Northup, will post summaries of results, items of interest, and images. Students from the Science Writing class in the English Department have done class projects for the website, including scientist interviews, project descriptions, and background material for the public. Northup will continue development of the Cave Journey (www.caveslime.org/cavejourney), an interactive website designed for grades 5-12 that was developed under a previous Biodiversity EPSCOR grant. The website and activities designed by teachers were introduced in a New Mexico teacher workshop offered by EPSCOR and are currently being added to by a Carlsbad high school teacher who did a summer internship in Northup's lab last summer, funded by the SEIS program at UNM/Sandia National Laboratories.

Culturable Organisms will be added to a growing culture collection of cave organisms that we are building as part of the National Cave and Karst Research Institute. To handle the large number of types currently in culture, we are developing a protocol for lyophilization and long-term storage. We will make strains available

to other researchers where possible.

Gene Sequences: 16S SSU gene sequences will be added to NCBI's GenBank.

Policies for Data Sharing and Public Access

Our data will be licensed under the Creative Commons Attribution-ShareAlike license (http://creativecommons.org/licenses/by-sa/3.0/legalcode).

1. Our team has a relatively long track record of sharing our primary data in the following ways:

a. physical samples, most of which have been collected on federal lands, will be returned to appropriate agencies for curation in their collections when finished, when not destroyed by analyses.

b. scans of field notes are supplied to Carlsbad Caverns National Park (CCNP) after each field trip into the caves. We also fill out a Sampling Track Form for each trip into a CCNP cave. These are maintained by the Cave Resources Office at CCNP, whose staff share these data files with other researchers upon request, as they are public documents.

c. The thousands of images generated on the scanning electron microscope (SEM) are maintained in an archival database (LoboVault) and an outreach database, the Imagery Data Extraction Collaboratorium (IDEC). We have pioneered the incorporation of images into this archival database, which is maintained at http://repository.unm.edu/handle/1928/525 as part of the University Libraries at the University of New Mexico. As part of this effort, Melim and Northup worked with the University Libraries faculty to create morphotype photos that illustrate the various keywords used in the metadata. We will continue to add to this archival database, which is freely available. Currently, we have over 800 images in the archive, including 476 from a previously NSF-funded project.

d. IDEC, which was created as part of a grant from the Alliance for Information Science and Technology Innovation (AISTI), whose mission is to disseminate and share information, is a website whose intention is to showcase SEM and other imagery (Figure 2). A comment feature is available to help create an environment in which new knowledge can be discovered. The site also includes lesson plans and photo albums suitable for use in secondary school classrooms. The site also offers the possibility of other scientists uploading albums of photos. Currently, IDEC contains only microscopy images, but we plan to expand the photo scale.

Roles and Responsibilities

Data Owners: Melim, Northup, Boston, Spilde, Crossey

Data Managers: Melim will have overall responsibility for SEM Database and Sample Database files.

Other Contributors: Undergraduate and graduate student researchers will input data into Filemake Pro Databases.