16S rRNA Sequences from cathode-oxidizing lithoprophic isolates (COLI) from Catalina Harbor Marine sediments

Website: https://www.bco-dmo.org/dataset/636859
Data Type: experimental
Version: 28 Jan 2016
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Project
» Passing electrons through marine sediments: Cultivation and characterization of microbes that utilize extracellular electron transports (PassElectronsThruMarSed)

Program
» Center for Dark Energy Biosphere Investigations (C-DEBI)

Contributors	Affiliation	Role
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Dataset Description

16S rRNA Sequences from cathode-oxidizing lithoprophic isolates (COLI) from Catalina Harbor Marine sediments.

Related Publications:

Rowe, A.R. et al. 2015. Marine sediments microbes capable of electrode oxidation as a surrogate for lithotrophic insoluble substrate metabolism. Frontiers in Microbiology (5). doi:10.3389/fmicb.2014.00784

Methods & Sampling

The microbes isolated during this work were originally enriched from Catalina Harbor sediments from electrodes poised at reducing or electron donating redox potentials. Isolates are obtained from these enrichements based on the oxidation of elemental sulfur, elemental iron, or amorphous FeS. Approximately 30 isolates from 8 phylotypes were obtained. Ribosomal 16S sequences were obtained for all isolates using direct 16S rRNA amplification from pure culture DNA extracts. The universal bacterial primers 27F (5'-AGAGTTTGAT CCTGGCTCAG) and 1492R (5'-GGTTACCTTGTTACGACTT) were used. Approximately 20–40 ng of PCR product from each isolate were purified with a DNA Clean Concentrator Kit (ZymoResearch, Irvine, CA), and Sanger sequencing was per- formed viaGenewiz (La Jolla,CA) or BeckmanCoulter Genomics (Danvers, MA).

Data Processing Description

These nearly full length sequences were quality checked and assembled using Geneious 7.1© (Biomatters, New Zealand). Alignment of sequences against the Silva database was performed using the SINA aligner (v 1.2.11) (Pruesse et al., 2012; Quast et al., 2013). Nearest cultured representative microbes were also obtained through the Silva database (Quast et al., 2013). Maximum-likelihood estimation trees were constructed from alignments of sequences and nearest neighbors using RaxML (v.8) (Stamatakis, 2014) to assign taxonomy. A identity of 97% was used to designate a specific genera for a given sequence. All full length sequences have been deposited to Genbank (accession numbers KM088025-KM0 88033).

BCO-DMO Processing:
- separated location into lat and lon columns;
- converted degrees and decimal minutes to decimal degrees;
- replaced commas with semi-colons;
- replaces spaces with underscores;
- modified parameter names to conform with BCO-DMO naming conventions.

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Data Files

File
COLI_16S_rRNA.csv (Comma Separated Values (.csv), 1.54 KB) MD5:63067760504e8eae34b5519f96e2157e Primary data file for dataset ID 636859

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Parameters

Parameter	Description	Units
accession_num	NCBI accession number.	dimensionless
species	Species name.	dimensionless
lat	Latitude. Positive values = North.	decimal degrees
lon	Longitude. Negative values = West.	decimal degrees
method	Description of sequencing method.	dimensionless
accession_link	Hyperlink to NCBI.	dimensionless

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Deployments

CH_Sediment_Rowe

Website	https://www.bco-dmo.org/deployment/636875
Platform	Catalina Harbor
Description	Marine sediments were collected from Catalina Harbor (33° 25.23′ N, 118° 19.42′ W; February, 2013)

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Project Information

Passing electrons through marine sediments: Cultivation and characterization of microbes that utilize extracellular electron transports (PassElectronsThruMarSed)

Description from C-DEBI:
One of the major questions in subsurface biology is understanding how microrganisms in the subsurface are “making a living”. However, there is a dearth of knowledge concerning the physiology of major microbial groups that likely dominate the subsurface, including the lithotrophic or “rock-eating” microbes. This, in turn, makes one of the major research goals of C-DEBI, identifying and assessing activity in the deep subsurface biosphere, extremely difficult for these processes (i.e. not identified via “meta-omic” based studies) and in many cases these metabolisms are probably overlooked. Through my C-DEBI fellowship I was able to develop techniques for electrochemical cultivation of lithotrophic microbes to help facilitate identification and further study of microbial groups with these abilities. As part of this work I targeted cultivation of several groups of facultative lithotrophs that are phylogenetically related to organisms that are genetically tractable, and I’m currently in the process of building draft genomes for these microbes. It is my goal to use these microbes as model systems for understanding and biochemically characterizing the physiology of lithotrophs that will lead to better genetic markers to identify these physiologies in the environment. The work done through this fellowship has currently resulted in one publication in “Frontiers in Microbiology” on the electrochemical cultivation and isolation of facultative lithotrophs and tracking the physiology of cathode oxidizing microbes is the publication that will be submitted this summer. One of the most exciting results from this work is that the majority of microbes isolated from the one marine sediment tested, appear to have different redox potential where they catalyze the oxidation of a cathode suggesting a variety of different protein pathways used. This highlights both the unknown nature of these processes and the diversity of potential lithotrophic metabolic pathways.

This project was funded by a C-DEBI Postdoctoral Fellowship.

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Program Information

Center for Dark Energy Biosphere Investigations (C-DEBI)

Website: http://www.darkenergybiosphere.org

Coverage: Global

The mission of the Center for Dark Energy Biosphere Investigations (C-DEBI) is to explore life beneath the seafloor and make transformative discoveries that advance science, benefit society, and inspire people of all ages and origins.

C-DEBI provides a framework for a large, multi-disciplinary group of scientists to pursue fundamental questions about life deep in the sub-surface environment of Earth. The fundamental science questions of C-DEBI involve exploration and discovery, uncovering the processes that constrain the sub-surface biosphere below the oceans, and implications to the Earth system. What type of life exists in this deep biosphere, how much, and how is it distributed and dispersed? What are the physical-chemical conditions that promote or limit life? What are the important oxidation-reduction processes and are they unique or important to humankind? How does this biosphere influence global energy and material cycles, particularly the carbon cycle? Finally, can we discern how such life evolved in geological settings beneath the ocean floor, and how this might relate to ideas about the origin of life on our planet?

C-DEBI's scientific goals are pursued with a combination of approaches:
(1) coordinate, integrate, support, and extend the research associated with four major programs—Juan de Fuca Ridge flank (JdF), South Pacific Gyre (SPG), North Pond (NP), and Dorado Outcrop (DO)—and other field sites;
(2) make substantial investments of resources to support field, laboratory, analytical, and modeling studies of the deep subseafloor ecosystems;
(3) facilitate and encourage synthesis and thematic understanding of submarine microbiological processes,

through funding of scientific and technical activities, coordination and hosting of meetings and workshops, and support of (mostly junior) researchers and graduate students; and
(4) entrain, educate, inspire, and mentor an interdisciplinary community of researchers and educators, with an emphasis on undergraduate and graduate students and early-career scientists.

Note: Katrina Edwards was a former PI of C-DEBI; James Cowen is a former co-PI.

Data Management:
C-DEBI is committed to ensuring all the data generated are publically available and deposited in a data repository for long-term storage as stated in their Data Management Plan (PDF) and in compliance with the NSF Ocean Sciences Sample and Data Policy. The data types and products resulting from C-DEBI-supported research include a wide variety of geophysical, geological, geochemical, and biological information, in addition to education and outreach materials, technical documents, and samples. All data and information generated by C-DEBI-supported research projects are required to be made publically available either following publication of research results or within two (2) years of data generation.

To ensure preservation and dissemination of the diverse data-types generated, C-DEBI researchers are working with BCO-DMO Data Managers make data publicly available online. The partnership with BCO-DMO helps ensure that the C-DEBI data are discoverable and available for reuse. Some C-DEBI data is better served by specialized repositories (NCBI's GenBank for sequence data, for example) and, in those cases, BCO-DMO provides dataset documentation (metadata) that includes links to those external repositories.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0939564

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