

Metagenome sequence analysis of filamentous microbial communities obtained from geochemically distinct geothermal channels reveals specialization of three aquificales lineages. - DTU Orbit (09/11/2017)

Metagenome sequence analysis of filamentous microbial communities obtained from geochemically distinct geothermal channels reveals specialization of three aquificales lineages.

The Aquificales are thermophilic microorganisms that inhabit hydrothermal systems worldwide and are considered one of the earliest lineages of the domain Bacteria. We analyzed metagenome sequence obtained from six thermal "filamentous streamer" communities (~40 Mbp per site), which targeted three different groups of Aquificales found in Yellowstone National Park (YNP). Unassembled metagenome sequence and PCR-amplified 16S rRNA gene libraries revealed that acidic, sulfidic sites were dominated by *Hydrogenobaculum* (Aquificaceae) populations, whereas the circum-neutral pH (6.5-7.8) sites containing dissolved sulfide were dominated by *Sulfurihydrogenibium* spp. (Hydrogenothermaceae). *Thermocrinis* (Aquificaceae) populations were found primarily in the circum-neutral sites with undetectable sulfide, and to a lesser extent in one sulfidic system at pH 8. Phylogenetic analysis of assembled sequence containing 16S rRNA genes as well as conserved protein-encoding genes revealed that the composition and function of these communities varied across geochemical conditions. Each Aquificales lineage contained genes for CO₂ fixation by the reverse-TCA cycle, but only the *Sulfurihydrogenibium* populations perform citrate cleavage using ATP citrate lyase (Acl). The Aquificaceae populations use an alternative pathway catalyzed by two separate enzymes, citryl-CoA synthetase (Ccs), and citryl-CoA lyase (Ccl). All three Aquificales lineages contained evidence of aerobic respiration, albeit due to completely different types of heme Cu oxidases (subunit I) involved in oxygen reduction. The distribution of Aquificales populations and differences among functional genes involved in energy generation and electron transport is consistent with the hypothesis that geochemical parameters (e.g., pH, sulfide, H₂, O₂) have resulted in niche specialization among members of the Aquificales.

General information

State: Published

Organisations: Novo Nordisk Foundation Center for Biosustainability, CFB - Core Flow, University of New Mexico, Montana State University, Joint Genome Institute, Ehime University, University of Illinois, Portland State University, Los Alamos National Laboratory

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Number of pages: 25

Publication date: 2013

Main Research Area: Technical/natural sciences

Publication information

Journal: *Frontiers in Microbiology*

Volume: 4

Article number: 84

ISSN (Print): 1664-302X

Ratings:

BFI (2017): BFI-level 1

Web of Science (2017): Indexed yes

BFI (2016): BFI-level 1

Scopus rating (2016): CiteScore 4.16 SJR 1.731 SNIP 1.172

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 1

Scopus rating (2015): SJR 1.878 SNIP 1.208 CiteScore 4.15

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 1

Scopus rating (2014): SJR 1.861 SNIP 1.16 CiteScore 3.76

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 1

Scopus rating (2013): SJR 1.751 SNIP 0.951 CiteScore 3.56

ISI indexed (2013): ISI indexed no

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 1

Scopus rating (2012): SJR 1.415 SNIP 0.725 CiteScore 2.78

ISI indexed (2012): ISI indexed no

Scopus rating (2011): SJR 0.626 SNIP 0.187

Web of Science (2011): Indexed yes

Original language: English

Electronic versions:

fmicb_04_00084.pdf

DOIs:

10.3389/fmicb.2013.00084

Source: dtu

Source-ID: n::oai:DTIC-ART:pubmed/387907695::31342

Publication: Research - peer-review › Journal article – Annual report year: 2013