Colony forming units (CFUs) of water samples from Mariana and Kermadec trenches grown in 3 media from R/V Falkor FK141109, FK141215, and R/V Thompson TN309, 2014 (Mariana Perspectives project)

Website: https://www.bco-dmo.org/dataset/720977
Data Type: experimental
Version:
Version Date: 2017-12-14

Project
» Patterns of Microbial Community Structure Within and Between Hadal Environments (Mariana Perspectives)

Contributors	Affiliation	Role
Bartlett, Douglas	University of California-San Diego Scripps (UCSD-SIO)	Principal Investigator
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Related Publications
- Parameters
- Instruments
- Deployments
- Project Information
- Funding

Coverage

Spatial Extent: **N**:12.7 **E**:-170 **S**:-36 **W**:145
Temporal Extent: 2014-04-10 - 2014-12-21

Dataset Description

This dataset includes counts of colony forming units (CFUs) from seawater samples from the Mariana and Kermadec trenches from April, November, and December 2014.

NOTE: sample RG10 in this dataset is equivalent to RG09 in the event log, due to at-sea recording error. RG10-2 is equivalent to RG10 in the event log.

Methods & Sampling

This data set is associated with PI Douglas Bartlett (NSF OCE-1536776) and R/V Thomas G. Thompson from Apr. 10 - May 20 to the Kermadec Trench adjacent to New Zealand and Schmidt Ocean Institute R/V Falkor cruise FK141109 from Nov. 9 - Dec. 9, 2014, and FK141215 from Dec. 15-21, 2014 to the Mariana Trench. During the cruises, sediment and water samples were collected. Additional details can be found at: https://schmidtocean.org/cruise/expanding-mariana-trench-perspectives/ and https://scripps.ucsd.edu/labs/dbartlett/contact/challenger-deep-cruise-2014/

Seawater (40-120 L per sample) was serially filtered through 3.0 (47 mm diameter), 0.2 (47 mm or Sterivex), and 0.1 µm (142 mm) polycarbonate filters using a peristaltic pump. Filters were then placed into a sucrose

buffer (Rusch et al., 2007) and frozen at -80°C. DNA was extracted from whole filters using a protocol previously described (Fuhrman et al., 1988; Tarn et al., 2016). Negative controls using blank filters were extracted in concomitance with every extraction performed.

Microbes were cultured at 4°C on agar plates at 0.1 MPa or in transfer bulbs (Samco, Thermo Fisher Scientific) at either 0.1 MPa or high pressure. Enrichments from the Kermadec Trench were conducted using 2216 Marine Medium (2216; BD DifcoTM), A1 Medium, or a seawater minimal medium, while those from the Mariana Trench were conducted in 2216 only. For incubations at high pressure the media was inoculated, mixed with gelatin at a final concentration of 4%, transferred into bulbs, and incubated at the desired pressure (Yayanos, 2001). Kermadec Trench samples were incubated at 100 MPa while those from the Mariana Trench were incubated at in situ pressure (40-110 MPa). After ~2 months colony forming units (CFUs) were calculated and representative isolates identified via PCR using the primers 27F and 1492R.

Data Processing Description

BCO-DMO Processing:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- split counts and standard deviation in to separate column (can't use ± symbol)
- changed hypen to 'nd' for no data-
- reduced Latitude and Longitude precision to 4 decimal places
- added cruise_id, cruise_name, station, date and time deployed and recovered, and local/UTC flag - from ship deployment log datasets

[table of contents | back to top]

Data Files

File
CFU.csv (Comma Separated Values (.csv), 3.63 KB) MD5:8e32e44219dd786e3445e25b6b2f6bf0 Primary data file for dataset ID 720977

[table of contents | back to top]

Related Publications

Fuhrman JA, Comeau DE, Hagstrom A, Chan AM. Extraction from natural plankton microorganisms of DNA suitable for molecular biological studies. Appl Environ Microbiol. 1988;54: 1426-1429.
Methods

Rusch, D. B., Halpern, A. L., Sutton, G., Heidelberg, K. B., Williamson, S., Yooseph, S., ... Venter, J. C. (2007). The Sorcerer II Global Ocean Sampling Expedition: Northwest Atlantic through Eastern Tropical Pacific. PLoS Biology, 5(3), e77. doi:10.1371/journal.pbio.0050077
Methods

Tarn, J., Peoples, L. M., Hardy, K., Cameron, J., & Bartlett, D. H. (2016). Identification of Free-Living and Particle-Associated Microbial Communities Present in Hadal Regions of the Mariana Trench. Frontiers in Microbiology, 7. doi:10.3389/fmicb.2016.00665
Methods

Yayanos, A. Aristides (2001). Deep-sea piezophilic bacteria. Marine Microbiology, 615–637. doi:10.1016/s0580-9517(01)30065-x https://doi.org/10.1016/S0580-9517(01)30065-X
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Trench	site name	unitless
Collection_method	collection method: CTD; RG=Rock Grabber; Lego = Leggo Lander; El = ??	unitless
Media_type	2216 Marine Medium (2216; BD DifcoTM); A1 Medium; seawater minimal medium	unitless
Bulb_CFUs_mL_LoPress	colony forming units counted from transfer bulbs maintained at low pressure (0.1 MPa)	Colony forming units/milliliter
Bulb_CFUs_mL_LoPress_stdev	standard deviation of CFU bulb low pressure count	Colony forming units/milliliter
Plate_CFUs_mL_LoPress	colony forming units counted from agar plates maintained at low pressure (0.1 MPa)	Colony forming units/milliliter
Plate_CFUs_mL_LoPress_stddev	standard deviation of CFU plate low pressure count	Colony forming units/milliliter
Bulb_CFUs_mL_HiPress	colony forming units counted from transfer bulbs maintained at high pressure	Colony forming units/milliliter
Bulb_CFUs_mL_HiPress_stdev	standard deviation of CFU bulb high pressure count	Colony forming units/milliliter
Depth	cellection depth	meters
Latitude	latitude; north is positive	decimal degrees
Longitude	longitude; east is positive	decimal degrees
Type	sample type: seawater or sediment	unitless
cruise_id	cruise identifier; R2R official code	unitless
cruise_name	project specific cruise identifier	unitless
STATION	station identifier	unitless

LANDER	deployment or dive identifier: UW=underway - collected with...; CTD = CTD profiler; RG = Rock Grabber; Lego = Leggo lander; EL = ??	unitless
local_or_UTC	time zone	unitless
DATE_DEPLOYED	date of deployment (yyyymmdd)	unitless
TIME_DEPLOYED	time of deployment (hhmm)	unitless
DATE_RECOVERED	date of recovery (yyyymmdd)	unitless
TIME_RECOVERED	date of recovery (hhmm)	unitless
LATITUDE_log	latitude from deployment log; north is positive	decimal degrees
LONGITUDE_log	longitude from deployment log; east is positive	decimal degrees
MULTIBEAM_DEPTH	target depth as measured by multibeam	meters

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Rock grabber
Generic Instrument Name	Bottom Sediment Grab Samplers
Dataset-specific Description	Rock samples were collected using a Van Veen style grab on a free vehicle lander.
Generic Instrument Description	These samplers are designed to collect an accurate representative sample of the sediment bottom. The bite of the sampler should be deep enough so all depths are sampled equally. The closing mechanism is required to completely close and hold the sample as well as prevent wash-out during retrieval. Likewise, during descent the sampler should be designed to minimize disturbance of the topmost sediment by the pressure wave as it is lowered to the bottom.

Dataset-specific Instrument Name	
Generic Instrument Name	CTD - profiler
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	
Generic Instrument Name	Leggo Lander
Generic Instrument Description	The "Leggo Lander" is a lander system that primarily relies on syntactic foam for buoyancy and uses iridium GPS, radio signal, strobe light and flag for surface recovery, and acoustics for underwater monitoring and instrument control. The lander has a timer with 5 control settings for various operations. It routinely measures pressure (depth) throughout its dive and temperature on the seafloor. The lander payloads include a pressure-retaining seawater sampler plus 2 liter Niskin bottle, and a camera/battery/light system that also includes a 30 liter Niskin bottle and a sea cucumber trap. With the camera payload it travels down or up the water column at about 39 meters per minute (~ 4.5 hours for a descent to the Challenger Deep at ~10,920 m). (Description obtained from the R/V Falkor FK141215 post-cruise report (PDF))

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

[table of contents | back to top]

Deployments

FK141109

Website	https://www.bco-dmo.org/deployment/629311
Platform	R/V Falkor
Report	https://datadocs.bco-dmo.org/d3/data_docs/Mariana_Perspectives/FK141109_Cruise_Report_JDC_2015-01-12.pdf
Start Date	2014-11-09
End Date	2014-12-09
Description	The very deepest reaches of the sea are one of the planet's last true frontiers. That's mostly because a lack of support for needed technological advancements and vehicles has severely limited access to depths beyond 7,000 meters. But the situation is finally beginning to change, and SOI is helping push the process forward. In November, the institute collaborated with a group of biologists and geologists working aboard R/V Falkor to conduct a new study of one of the deepest places in the world. The team deployed SOI's new full-ocean-depth landers—frames equipped with cameras, sensors and sample collection devices that return to the surface automatically after a set time on the seafloor—as well as three other landers, in the Mariana Trench's Sirena Deep, near Guam. The work, at depths down to almost 11,000 meters, will help answer enduring questions about the biology of such alien zones, including who lives there and how they survive the massive pressure. The research should also improve understanding of the processes that control earthquake and tsunami formation, among others geological goals. Original cruise data are available from the NSF R2R data catalog (Cruise DOI: 10.7284/900733) **Methods & Sampling** The subsetted data includes both FK141109 and FK141215.

TN309

Website	https://www.bco-dmo.org/deployment/536488
Platform	R/V Thomas G. Thompson
Start Date	2014-04-10
End Date	2014-05-20
Description	Original data are available from the NSF R2R data catalog

FK141215

Website	https://www.bco-dmo.org/deployment/684236
Platform	R/V Falkor
Report	http://dmoserv3.whoi.edu/data_docs/Mariana_Perspectives/Bartlett-final-FK141215-cruise-report.pdf
Start Date	2014-12-15
End Date	2014-12-21
Description	During this cruise the Leggo lander was deployed multiple times and drops 1 and 3 recovered seawater samples that were analyzed. Additional details can be found at: https://schmidtocean.org/cruise/expanding-mariana-trench-perspectives/ and https://scripps.ucsd.edu/labs/dbartlett/contact/challenger-deep-cruise-2.... More information is available in the post-cruise and final expedition reports (PDF). Original cruise data are available from the NSF R2R data catalog

[table of contents | back to top]

Project Information

Patterns of Microbial Community Structure Within and Between Hadal Environments (Mariana Perspectives)

Coverage: Challenger Deep, Mariana Trench

Award Abstract from NSF:
The deepest portion of the ocean is present in ocean trenches, whose steep walls descend from approximately 4 miles down to depths that in some cases are close to 7 miles below the seawater surface. At these locations Earth's crust is recycled. Perhaps not surprisingly given their remoteness, deep ocean trenches are the least understood habitats in the ocean. The researchers participating in this project are working to characterize the microbes present in two of the deepest trenches present on Earth, both in the Pacific Ocean, the Kermadec Trench located north of New Zealand, and the Mariana Trench, located east and south of the island of Guam. Most of the Mariana Trench is located within the United States Mariana Trench Marine National Monument. Relatively little is known about the diversity and adaptations of the microorganisms in deep ocean trenches. An unknown fraction of the microbes present have descended from shallow waters above and are unlikely to participate in any nutrient cycles in the deep sea. Others are adapted to near freezing temperatures and up to pressures greater than 10e7 kilograms per square meter (16,000 pounds per square inch). These latter microbes perform important roles recycling organic matter. But who are they? This project is contributing to the training of diverse undergraduate and graduate students participating in research, additional undergraduate students learning about microbes inhabiting extreme environments in a web-based class, and additional graduate students and postdoctoral scientists participating in an advanced training course being offered in Antarctica.

Experiments being performed include direct counts of prokaryotes and viruses in seawater and sediments, analyses of the abundance and phylogenetic breadth of culturable heterotrophic bacteria at a range of pressures, measurements of bacterial community species diversity and richness both within and across seawater and sediment samples, as well as within and across the two trench systems, measurements of microbial activity as a function of pressure and the identification of high pressure-active cells. The data generated from these analyses are being integrated into the results of additional chemical, geological and biological measurements performed by others as a part of the National Science Foundation funded Hadal Ecosystems Studies Project. Two of the working hypotheses are that prokaryote numbers and diversity are generally positively correlated with surface productivity and proximity to the trench axis and that bacterial taxa exist which are endemic to specific trenches, present in multiple trenches and more widely distributed in deep-sea environments.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536776

[table of contents | back to top]