January 10, 2017

FK141215 Expedition Final Report

I. Overview.

Expedition FK141215 on board the RV Falkor operated by the Schmidt Ocean Institute sailed roundtrip from Guam to the Challenger Deep within the territorial waters of the Federated States of Micronesia, over the period of December 15 – 21, 2014. Four different untethered free falling/free ascending instruments (one with two different payloads) were deployed deep into the trench a total of seven times. The details of the data and samples obtained were provided shortly after the cruise in a post-cruise report (included). The significance of this short cruise is that it 1) demonstrated the utility of a new lander system at the deepest ocean depths (exceeding 10,900 m), 2) recovered imagery, animals and seawater from these depths, and 3) sound profilings of the water column were obtained, providing novel information on the ambient noise field of the Challenger Deep, including its geophony, biophony and anthropogenic noise. Much of the data generated during this cruise, including the post-cruise report can be found at
https://scripps.ucsd.edu/labs/dbartlett/contact/challenger-deep-cruise-2014/
As well as at the Schmidt Ocean Institute cruise website
https://schmidtocean.org/cruise/expanding-mariana-trench-perspectives/
The science party consisted of faculty, students and a postdoctoral researcher from Scripps Institution of Oceanography, the University of Guam, Woods Hole Oceanographic Institute, Hong Kong University of Science and Technology along with a writer and a documentary film producer.

II. General cruise data

The shipboard data set is stored at the Rolling Deck Repository.
http://www.rvdata.us/catalog/FK150728
The latitude/longitude position of instrument deployments and the Leggo Lander depths and temperatures are present in the post-cruise report. This report also includes a general description of all data obtained.
https://scripps.ucsd.edu/labs/dbartlett/contact/challenger-deep-cruise-2014/

III. Microbiological and general nutrient data

Microbiological data was obtained from the 2 liter Niskin bottle deployed with the Leggo Lander during its first drop into the Challenger Deep, from the seawater collected into the pressure-retaining seawater sampler used during the first Leggo drop, and from the 30 liter Niskin baited with jack mackerel and used to collect amphipods during the third drop of the Leggo Lander. This data, along with the general nutrient data obtained from the seawater collected in the 2 liter Niskin bottle during Leggo drop number 1 are all available in the excel sheet at
https://scripps.ucsd.edu/labs/dbartlett/contact/challenger-deep-cruise-2014/

This document includes viable and direct cell counts, nutrient data and the identification of bacteria obtained following growth at 4ºC on ZoBell 2216 Marine Medium or obtained from the pressure-retaining seawater sampler following flow sorting of cells, MDA amplification and 16S

rRNA gene screening. The results indicated hadal seawater direct cell counts of ~ 1 x 10^4 cells ml^{-1} and viable cell counts of ~ 1 x 10^3 cells ml^{-1}. Oddly enough fewer bacterial cell counts were obtained in the seawater sample from the baited Niskin bottle. The general nutrient data is reflective of prior values Bartlett's group has obtained for the Challenger Deep. The microbes capable of growth on nutrient rich seawater media at 4ºC belonged to the genera *Pseudoalteromonas* and *Psychrobacter*, and in the case of seawater from the baited Niskin bottle with amphipods, the bacterial genus *Shewanella* was also represented. The pressure-retaining sampler recovered *Aquibacter*, *Dechloromonas*, *Urania* and *Marinimicrobia* members. The cells recovered on plates are the types of microbes to be expected based on prior work. However, the culture-independent analyses of the microbes in the pressure-retaining sampler are intriguing and suggest that sampling without decompression during recovery may facilitate the recovery of additional types of microbes. Pure cultures of some of the microbes grown on plates at 4ºC are available from the Bartlett laboratory (dbartlett@ucsd.edu, 1-858-534-5233).

IV. Imagery.

The imagery generated by the Leggo Lander on this cruise is available at
https://scripps.ucsd.edu/labs/dbartlett/contact/challenger-deep-cruise-2014/
These consist of photos and videos of amphipods near the seafloor of the eastern portion of the Challenger Deep along with photographs of recovered amphipods.

V. Amphipod data

The amphipods collected in the eastern portion of the Challenger Deep at a depth of 10,929 m have been used for various analyses in the laboratory of Professor Pei-Yuan Qian. This includes mitochondria sequencing (published), metagenome-based reconstruction of a bacterial symbiont (submitted) and metatranscriptomics (submitted). The mitochondrial sequence data has been deposited into GenBank at the National Center for Biotechnology Information and can be found under the accession numbers KU558990 and KU558991 at:
https://www.ncbi.nlm.nih.gov/nuccore/KU558990
https://www.ncbi.nlm.nih.gov/nuccore/KU558991

VI. Amphipod availability

Representatives of the collected *Hirondellea gigas* and *Halice* species amphipods are available at the Scripps Institution of Oceanography Benthic Invertebrates Collection at:
https://sioapps.ucsd.edu/collections/bi/

Users can search for these specimens using catalog numbers C12056-12063, or using the expedition identifiers CD-14-01, CD-14-02, CD-14-03, CD-14-07, CD-14-10A, CD-14-10BCD, CD-14-11A, CD-14-11BCDEFG. They were all collected from the eastern portion of the Challenger Deep (11.368536° N 142.5875166° E, 10,929 m depth) on December 19, 2014 using the Leggo Lander with its camera payload equipped with jack mackerel as bait.

VII. Deep Sound 2 data

This instrument recorded the pressure time series on four hydrophones, configured in an 'L' shaped array for the first deployment in the middle portion of the Challenger Deep, and in a vertical array for the second deployment, which occurred in the eastern portion of the

Challenger Deep. Both deployments proceeded to a depth of about 9,000 m. The data generated included salinity, temperature, depth, vehicle orientation, sound speed and raw acoustic data. It is available at
http://noise.phys.ocean.dal.ca/data.html

VIII. Presentations and publications

A. 2015 presentations describing results from this expedition

1. Bartlett

i. Microbiology and Biogeochemistry of the Deep Sea and the Deep Biosphere Workshop
Hadal Science and Technology Research Center
Shanghai Ocean University, Shanghai, China
June 22-23, 2015
Five lectures:
1. *Technologies associated with collecting deep-sea life*
2. *Microbial diversity in the deep sea*
3. *Microbial trophic dynamics as a function of depth*
4. *Deep subsurface microbiology*
5. *Genomics of piezophiles and other deep-sea microbes*

ii. Marine Molecular Ecology Gordon Research Conference
August 2-7, 2015
The Hong Kong University of Science and Technology, Hong Kong, China
Microbial Life in Hadal Trenches: Technology, Diversity and Function

iii. Deep-Sea Biology Symposium 2015
Aveiro, Portugal
Aug 31 – Sept. 4, 2015

iv. Bartlett DH, Tarn J, Kwan T and Peoples, L.
Microbial diversity in the Mariana and Kermadec Trenches

v. Toyo University, Itakaura and Asaka campuses, Japan
9/14/15: Lecture 1: *Microbiology of the Kermadec, Tonga and Mariana Trenches*
9/18/15: Lecture 2: *Progress and Future of Deep-Sea Microbiological Research and Development*

vi. Renssellaer Polytechnic Institute, Troy, New York
October 14, 2015.
Microbial Life in Ultra-Deep Ocean Habitats of the Piezosphere

vii. Ocean Worlds Meeting 2015
Location: National Geographic Society Hubbard Boardroom, Washington, DC
Date: October 23, 2015
Hyperpiezophile Research

viii. Sloan Foundation Deep Carbon Observatory workshop on extreme biophysics
Molecular Adaptation to Life at the Extremes
Carnegie Institution of Washington, Geophysical Laboratory
Greenewalt Building, 5251 Broad Branch Road NW, Washington, DC, 20015 USA
November 14, 2015
Overview on adaptation mechanisms of extremophiles

2. Barclay

i. Acoustics Week in Canada 2015, Halifax, Canada
October 7, 2015
Barclay, D. R., Bevans, D.A., and Buckingham, M.J.
Ambient Noise in the Challenger Deep
ii. Applied Ocean Sciences Seminar Series, Scripps Institution of Oceanography, La Jolla, CA USA, 2015
Bevans, D.A., Buckingham, M.J., Barclay, D.R.
Implosion Within the Challenger Deep

B. Publications (additional publications have been submitted or are in preparation)
i. Lan, Y., Sun, J., Bartlett, D. H., Rouse, G. W., Tabata H. G., and Qian, P.-Y. 2016. The deepest mitochondrial genome sequenced from Mariana Trench *Hirondellea gigas* (Amphipoda). Mitochondrial DNA Part B. Volume 1: 802-803, DOI: 10.1080/23802359.2016.1214549

IX. Outreach
A. Nine blogs: "Expanding Mariana Trench Perspectives", "Go Deep: The Start of a Great Adventure", "Getting Into The Zone", "Diving In", "In Full Swing", "Decoding the Secrets in Trench Water", "Christmas Comes Early on the Falkor", "Things that Go Boom in the Deep", and "There And Back Again".
https://schmidtocean.org/cruise/expanding-mariana-trench-perspectives/#cruise-log

B. Public Radio interview: "7 Miles Beneath The Sea's Surface: Who Goes There?" Morning Edition, National Public Radio. February 19th, 2015.
http://www.npr.org/2014/12/19/371670931/7-miles-beneath-the-sea-s-surface-who-goes-there

C. Book: Nestor, James. Deep: Freediving, Renegade Science, and What the Ocean Tells Us About Ourselves. (Paperback) May 5, 2015. Now in English, Chinese, German, Polish, Portuguese, and Italian. The last chapter of this book describes this expedition.
https://www.amazon.com/Deep-Freediving-Renegade-Science-Ourselves/dp/054448407X

D. Public school education: Cynthia Matzke used the footage and images collected on this cruise to conduct outreach to various groups around San Diego county, including a program for the Ruben H. Fleet Science Center's group of "SciTech Girls." The program is designed to encourage 4/5th grade female students in underserved schools by learning from women active in STEM careers. A 3-hour lesson plan was created called "Deep Space and Deep Sea: Exploring the Similarities and Differences" and students learned how research is conducted, about lander design and life in that region, and we conducted experiments showing the effects of increasing (and in space decreasing) pressure. The program was given in five schools and reached over 100 enthusiastic students.

E. Documentary film: Cynthia Matzke has also worked with others to develop a documentary film that includes information about this cruise. It is entitled "Spiral Pacific". A website description is available at
http://www.spiralpacific.org/

Sincerely,

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