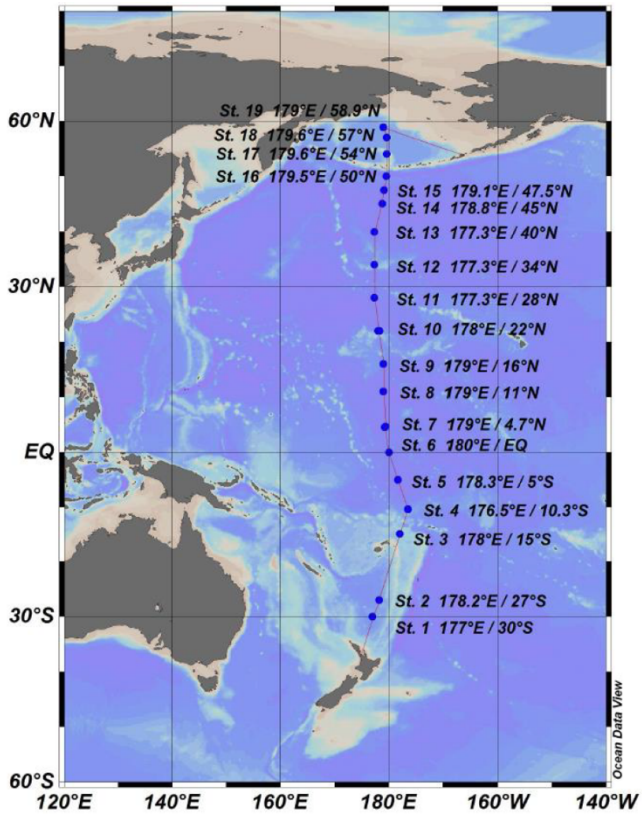
CRUISE REPORT: P14N

(Updated JUN 2019)



Highlights

Cruise Summary Information

Section Designation	**P14N** (SO248, BacGeoPac)
Expedition designation (ExpoCodes)	**06SN20160501**
Chief Scientists	**Meinhard Simon / ICBM**
Dates	2016-05-01 — 2016-06-03
Ship	r/v Sonne
Ports of call	Auckland, NZ — Dutch Harbour, USA
Geographic Boundaries	58° 53' 60" N 176° 59' 57" E 176° 28' 31" W 30° 0' 3" S
Stations	19
Floats and drifters deployed	0
Moorings deployed or recovered	0

Contact Information:
Meinhard Simon
University of Oldenburg
Institute for Chemistry and Biology of the Marine Environment
Carl von Ossietzky Str. 9-11 • 26129 Oldenburg • Germany
Phone: 0441-798-5361 • Fax: 0441-798-3438 • Email: m.simon@icbm.de

Report assembled by Jerry Kappa, UCSD/SIO

Links to Select Topics

Shaded sections are not relevant to this cruise or were not available when this report was compiled.

Cruise Summary Information	Hydrographic Measurements
Description of Scientific Program	**CTD Data:**
Geographic Boundaries	Acquisition
Cruise Track (Figure)	Processing
Description of Stations	Calibration
Description of Parameters Sampled	Temperature Pressure
Bottle Depth Distributions (Figure)	Salinities Oxygens
Floats and Drifters Deployed	**Bottle Data**
Moorings Deployed or Recovered	Salinity
	Oxygen
Principal Investigators	Nutrients
Cruise Participants	Carbon System Parameters
	CFCs
Problems and Goals Not Achieved	Helium / Tritium
Other Incidents of Note	Radiocarbon
Underway Data Information	**Lowered Acoustic Doppler Current Profiler (LADCP)**
Acoustic Doppler Current Profiler (ADCP)	**References**
Navigation Bathymetry	
Thermosalinograph	
XBT and/or XCTD	
Meteorological Observations	
Atmospheric Chemistry Data	
Underway pCO_2	
Data Processing Notes	**Acknowledgments**

RV SONNE SO248
Cruise Report / Fahrtbericht

Auckland, New Zealand: May 1st, 2016

Dutch Harbor, USA: June 3rd, 2016

SO248 – BacGeoPac

Functional diversity of bacterial communities and the geometabolome in the central and north Pacific

Meinhard Simon
Institute for Chemistry and Biology
of the Marine Environment (ICBM)
University of Oldenburg

TOC / Inhaltsverzeichnis

1. Cruise summary / Zusammenfassung 2

1.1 Zusammenfassung 2
1.2 Summary 4

2. Participants / Teilnehmer 6

2.1 Principal investigators / Leitende Wissenschaftler 6
2.2 Scientific party / wissenschaftliche Fahrtteilnehmer 8
2.3 Crew / Mannschaft 9

3. Narrative of the cruise / Ablauf der Forschungsfahrt 10

4. Aims of the Cruise / Zielsetzung der Forschungsfahrt 13

4.1 General aims 13
4.2 Major topics of investigations on board 14

5. Agenda of the cruise / Programm der Forschungsfahrt 16

5.1 Cruise track 16
5.2 Station work 16
5.3 Underway measurements 18

6. Settings of the working area / Beschreibung des Arbeitsgebiets 19

7. Work details and first results / Beschreibung der Arbeiten im Detail einschließlich erster Ergebnisse 21

7.1 Oceanographic Measurements - New Deepwater-CTD Rosette 21
7.2 Bio-optics 26
7.3 Bacterioplankton cell numbers, biomass production and turnover rates of labile substrates 31
7.4 Mesocosm experiments 33
7.5 Extracellular peptidase and polysaccharide activities 34
7.6 Bacterioplankton biogeography and bacterial algal interactions 35
7.7 Population structure and divergence in the Roseobacter group 36
7.8 Microbial abundance, diversity and activity in Pacific deep sea sediments 38
7.9 Metagenomic, metatranscriptomic and metaproteomic analysis of bacterial communities in the epipelagic water column and surface sediment 42
7.10 Dissolved Organic Matter 44
7.11 Dark ocean microbial biogeography 45
7.12 Prokaryotic leucine incorporation measurement under in situ pressure conditions with an in situ microbial incubator 49
7.13 The role of Archaea in the oxygenated water column 51
7.14 Plastic and microbial communities 53
7.15 Under way measurements by FerryBox 54
7.16 Meteorology data on aerosol and water vapor 55

8. Acknowledgements / Danksagung 57

9. References / Literaturverzeichnis 58

10. Abbreviations / Abkürzungen 61

11. Appendices / Anhänge 62

A) Participating Institutions / Liste der teilnehmenden Institutionen 62
B) Station List / Stationsliste Tables A1 and A2 63
C) List of stations and parameters investigated in the dark ocean 101

1. Cruise summary / Zusammenfassung

1.1 Zusammenfassung

Der Pazifische Ozean zwischen den subpolaren Regionen der nördlichen und südlichen Hemisphäre strukturiert sich in biogeografische Provinzen, die sich hinsichtlich der Wassermassen, Hydrografie, Nährstoffe und Planktongemeinschaften unterscheiden. Sie zeigen auch große Unterschiede im Chlorophyll und der Primärproduktion, von ultraoligotrophen Bedingungen im südpazifischen Wirbel bis hin zu eutrophischen Verhältnissen in der nordpazifischen Polarfront- und der subarktischen Region und der Beringsee. Bisher ist noch unbekannt, inwiefern die Unterschiede dieser biogeografischen Provinzen und der Wassermassen zwischen der Oberfläche und dem Meeresboden sich auch in der Zusammensetzung und den funktionellen Eigenschaften der prokaryontischen Mikrobengemeinschaften und des Pools der gelösten organischen Substanz (DOM) widerspiegeln. Aus diesem Grund war das Ziel der Forschungsexpedition SO248 BacGeoPac zu untersuchen, wie die generellen planktologischen und hydrografischen biogeografischen Muster sich in der Wachstums- und Substratdynamik, Biogeografie, Zusammensetzung und funktionellen Eigenschaften der prokaryontischen Mikrobengemeinschaften und in den chemogeografischen Mustern des DOM Pools zwischen dem Südpazifischen Wirbel und der Beringsee unterscheiden. Daher haben wir einen Transekt vom westlichen Rand des südpazifischen Wirbels bei 30°S bis in die Beringsee bei 59°N entlang des 180. Längengrades untersucht. Es wurden an 19 Stationen Proben genommen, davon an 11 Stationen über die gesamte Wassersäule bis zum Meeresboden und einer Tiefe von bis zu fast 6000 m Tiefe und an 8 Stationen bis in 1000 m Tiefe. Die Probennahme an den 19 Stationen umfasste die intensive Nutzung der Niskin-CTD-Rosette, bio-optische Charakterisierungen der euphotischen Zone, horizontale und vertikale Planktonnetzzüge, Sammeln von Mikroplastikpartikeln, Wasserprobennahme mit einer in situ Pumpe nahe der Oberfläche und Sedimentbeprobung mit einem Multicorer (MUC). Der Hauptfokus war auf die epipelagische und mesopelagische Zone gerichtet. Die Untersuchungen umfassten allerdings auch die Prokaryontengemeinschaften der bathy- und abyssopelagischen Zone und des Meeresbodens und die DOM-Verteilung und wie sie mit den aphotischen Wassermassen des Pazifiks korrelieren.

Um die funktionellen Eigenschaften der prokaryontischen Mikrobengemeinschaften besser zu verstehen war ein besonderer Fokus auf prozessorientierte Studien gelegt. Deshalb setzten wir Radioisotopen- und fluoreszenzmarkierte Modellsubstrate ein und führten Experimente mit stabilen Isotopen durch. Im südpazifischen Wirbel, in der nördlichen äquatorialen Gegenströmung und in der nördlichen Polarfrontregion wurden Mesokosmenexperiments durchgeführt, um die Reaktion der Bakteriengemeinschaften auf den Zusatz von verschiedenen Substraten zu prüfen. Im Äquatorialstrom und in der nördlichen Polarfrontregion wurden 24-Stunden Zeitserien untersucht, um die Reaktion der Bakteriengemeinschaften auf tageszeitliche Unterschiede in der Lichteinstrahlung, Primärproduktion, DOM-Versorgung und der Mortalität durch Grazing und Vireninfektion zu untersuchen.

Nach den Temperaturen und dem Salzgehalt der oberflächennahen Schichten konnten wir deutlich die Wassermassen und biogeografische Provinzen unterscheiden. Die Wassertemperaturen nahmen kontinuierlich zu vom südpazifischen Subtropischen Wirbel von 23° auf 30°C und weiter nördlich wieder ab auf 22°C am nördlichen Rand des nordpazifischen Subtropischen Wirbels. Die nordpazifische Polarfrontregion war durch starke Temperaturabnahme gekennzeichnet und in der Beringsee lag die Temperatur nur noch bei 4 bis 6°C. Der Salzgehalt zeigte große Unterschiede in den verschiedenen Provinzen, insbesondere in der äquatorialen Region und der nördlichen Polarfrontzone. Durch die Messungen mit der bis ins Abyssopelagial gehenden CTD konnten wir die Wassermassen des aphotischen Pazifiks gut identifizieren.

In den permanent geschichteten Provinzen lag das tiefe Chlorophyllmaximum zwischen 60 und 120 m mit der tiefsten Position in den beiden subtropischen Wirbeln. Im äquatorialen Auftriebsgebiet war es angehoben auf 70 m. Prominente Phytoplanktonblüten existierten nur nördlich von 40°N, vor allem aber nördlich von 50°N. Nördlich von 5°N waren zwischen 200 und 1700 m Tiefe ausgeprägte Sauerstoffminimumzonen vorhanden mit Restkonzentrationen von Sauerstoff von noch etwa 15% der Oberflächenwerte.

Die bisher erhobenen mikrobiellen Parameter spiegelten die verschiedenen Wassermassen und teilweise auch die biogeografischen Provinzen gut wider. Die endgültige Interpretation der Daten wird jedoch erst möglich sein, wenn alle anderen Proben hinsichtlich der Zusammensetzung und funktionellen Eigenschaften der Prokaryontengemeinschaften mit aktuellen Methoden (next generation sequencing, Metagenomik, -transkriptomik, -proteomik) und die Zusammensetzung des DOM Pools analysiert und ausgewertet worden sind,

Erste Ergebnisse der Prokaryontenabundanz in den obersten 100 m, analysiert mittels Durchflusszytometrie an Bord, zeigten zwischen 2 und 22×10^5 Zellen ml^{-1} mit kontinuierlich zunehmenden Werten von Süden nach Norden. Die bakterielle Biomassproduktion, gemessen mittels der Aufnahme von ^{14}C-markiertem Leucin, war in den obersten 100 m am höchsten in der südlichen und nördlichen äquatorialen Gegenströmung und sehr viel niedriger in den anderen Provinzen. Die Wachstumsraten der gesamten Bakteriengemeinschaft kovariierten mit der bakteriellen Biomasseproduktion mit höchsten Werten von 1 bis >2 pro Tag und viel geringeren Werten in den anderen Provinzen. Vorläufige Ergebnisse der extrazellulären hydrolytischen Enzymaktivitäten von verschiedenen Biopolymeren zeigten charakteristische Muster der verschiedenen Provinzen.

Da ein erheblicher Teil der Prokaryonten und insbesondere Archaeen in der Tiefsee chemoautotroph sind wurde die CO_2-Dunkelfixierung gemessen. Höchste Raten wurden in der äquatorialen Region gemessen, aber in einigen Regionen weiter nördlich erreichten einige Werte zumindest 50% der äquatorialen Maxima. Werte in 1000 m Tiefe waren normalerweise, aber nicht immer, höher als in 2000 m.

Das Oberflächensediment entlang des Transektes zeichnete sich durch recht unterschiedliche Strukturen und Texturen aus. Die Bakterienabundanzen an der Sedimentoberfläche lagen zwischen 10^8 und 10^9 Zellen cm^{-3} und in 20 cm unter dem Meeresboden sehr viel niedriger. Die Werte in beiden Tiefen nahmen nördlich des Äquators kontinuierlich zu.

Nach den vorläufigen Daten, die wir während der Forschungsfahrt bereits erheben konnten, sind wir sehr zuversichtlich, dass die BacGeoPac-Forschungsfahrt sehr erfolgreich war und dass wir die Ziele dieser umfangreichen Untersuchung erreichen werden.

Die meisten Untersuchungen wurden im Rahmen des durch die DFG geförderten Sonderforschungsbereichs Roseobacter (TRR51) durchgeführt.

1.2 Summary

The Pacific Ocean between the subpolar regions of the northern and southern hemisphere stretches over distinct biogeographic provinces which differ with respect to water masses, hydrography, nutrients and plankton communities. They also differ greatly with respect to chlorophyll *a* and primary production, from ultra-oligotrophic conditions in the south Pacific gyre to eutrophic nutrient regimes in the north Pacific polar frontal and subarctic region and the Bering Sea. So far, it is unknown how the differences in these biogeographic provinces and water masses between the surface and sea floor are reflected by the composition and functional properties of prokaryotic microbial communities and the dissolved organic matter (DOM) pool. Therefore, the aim of cruise SO248 BacGeoPac was to investigate how the general plankton- and hydrography-related biogeographic patterns are reflected in the growth and substrate dynamics, biogeography, composition and functional properties of the prokaryotic microbial communities and in the chemogeography patterns of the DOM pool between the south Pacific gyre and the Bering Sea. Hence, we sampled a transect from the western edge of the south Pacific gyre at 30°S to the Bering Sea at 59°N along the 180th longitudinal degree. At 19 stations samples were collected, at 11 stations throughout the water column to the seafloor at depths of up to almost 6000 m and at 8 stations to 1000 m depth. Sampling included extensive CTD-casts, bio-optical characterization of the euphotic zone, horizontal and vertical plankton net tows, collection of microplastic particles, in situ pump deployments in near surface waters and sediment sampling with a multicorer MUC. The major focus was on the epipelagic and mesopelagic zones. However, we also included in our investigations the bathypelagic, abyssopelagic and sea floor-associated prokaryotic communities and DOM patterns and how they relate to the water masses of the dark Pacific.

To better understand the functional properties of the prokaryotic microbial communities in the different biogeographic provinces a special focus was on process studies. Therefore we applied radio- and fluorescently labelled model substrates and stable isotope tracer experiments. Further, mesocosm experiments were carried out in the south Pacific gyre, the north equatorial counter current and the north Pacific polar frontal region to examine the response of the bacterial communities to various substrate amendments. In the equatorial upwelling region and the north Pacific polar frontal region 24 hour time series were conducted to assess the response of the bacterial communities to diurnal changes in irradiance, primary production, DOM supply and mortality by grazing and virus infection.

According to temperature and salinity in the near-surface layer we could clearly identify the water masses and biogeographic provinces. Water temperatures steadily increased from the south Pacific gyre to the Pacific equatorial current from 23° to 30°C and further north decreased again to 22°C at the northern edge of the North Pacific Subtropical Gyre. The north Pacific polar frontal region was characterized by a strong decrease in temperature and in the Bering Sea temperature ranged between 4° and 6°C. Salinity exhibited strong differences in the various biogeographic provinces, in particular in the equatorial region and the north Pacific polar frontal region. From the deep CTD casts we could identify the characteristic water masses in the deep Pacific.

In the permanently stratified warm provinces the deep chlorophyll maximum was situated between 60 and 120 m with the deepest extension in both subtropical gyres. In the equatorial upwelling it was uplifted to 70 m. Prominent phytoplankton blooms were only established north of 40°N and in particular north of 50°N. North of 5°N between depths of 200 and 1700 m extensive oxygen minimum zones were established with remaining oxygen concentrations of only about 15% of surface values.

The microbial parameters assessed reflected well the different water masses and partially the biogeographic provinces. Final interpretation of the data, however, is only possible when we will have analyzed and evaluated all the samples of the composition and functional properties of the prokaryotic communities, applying state of the art analyses (next generation sequencing, metagenomics, -transcriptomics, -proteomics) and the composition of the DOM pool.

First results of the prokaryotic abundance in the upper 100 m, assessed by flow cytometry on board, ranged between 2 and 22×10^5 cells ml^{-1} with continuously increasing values from south to north. Bacterial biomass production, assessed by incorporation of ^{14}C-labelled leucine, in the upper 100 m was highest in the south and north equatorial counter currents and much lower in the other provinces. Community growth rates covaried with the bacterial biomass production with highest values of 1 and >2 per day and much lower in other provinces. Preliminary results of extracellular hydrolytic enzyme activities of various biopolymers exhibited distinct patterns for the various provinces.

As quite a few prokaryotes and in particular Archaea in the deep sea are chemoautotrophic CO_2 dark fixation was assessed. Highest rates were measured in the equatorial region but in some regions further north values reached 50% of the equatorial maxima. Values at 1000 m were usually, but not always, higher than at 2000 m.

The surface sediment along the transect exhibited quite variable structures and textures. Bacterial abundance at the sediment surface ranged between 10^8 and 10^9 cells cm^{-3} and much lower values at 20 cm below the seafloor. Values at both depths increased continuously north of the equator.

According to the preliminary data we were able to collect already during the cruise we are very confident that the BacGeoPac cruise was very successful and that we can reach the aims of this comprehensive study.

Most of the investigations were carried out in the frame work of the DFG-funded Collaborative Research Center *Roseobacter* (TRR51).

2. Participants / Teilnehmer

2.1 Principal investigators / Leitende Wissenschaftler

2.1.1 Project Proponents and Institutes

Prof. Dr. Meinhard Simon
Head Group Biology of Geological Processes / Aquatic Microbial Ecology
ICBM
Institut für Chemie und Biologie des Meeres
Carl von Ossietzky Universität Oldenburg
Carl von Ossietzky Str. 9-11, 26129 Oldenburg, Tel. 0441-798-5361, Fax: 0441-798-3438
m.simon@icbm.de

Prof. Dr. Thorsten Dittmar
Head, ICBM-MPI Bridging Group for Marine Geochemistry
ICBM
Institut für Chemie und Biologie des Meeres
Carl von Ossietzky Universität Oldenburg
Carl von Ossietzky Str. 9-11, 26129 Oldenburg, Tel. 0441-798-3602, Fax: 0441-798-3404
thorsten.dittmar@uni-oldenburg.de

PD Dr. Bert Engelen
Senior Research Scientist, Paleomicrobiology Group
ICBM
Institut für Chemie und Biologie des Meeres
Carl von Ossietzky Universität Oldenburg
Carl von Ossietzky Str. 9-11, 26129 Oldenburg, Tel. 0441-798-5378, Fax: 0441-798-3404
b.engelen@icbm.de

Dr. Thomas Badewien
Senior Research Scientist, Group Marine Sensor Systems
ICBM
Institut für Chemie und Biologie des Meeres
Carl von Ossietzky Universität Oldenburg
Schleusenstr. 1, 26328 Willhelmshaven, Tel. 04421-944-240, Fax: 04421-944-140
badewien@icbm.de

Prof. Dr. Irene Wagner-Doebler
Head Group Microbial Communication
HZI
Helmholtz Center for Infection Research
Inhoffenstr. 7, 38124 Braunschweig, Tel. 0531-6181-6080, Fax: 0531-6181-3096
Irene.Wagner-Doebler@helmholtz-hzi.de

Dr. Heike Freese
Senior Research Scientist, Department Microbial Ecology and Diversity
DSMZ
Leibniz Institute DSMZ - German Collection of Microorganisms and Cell Cultures
Inhoffenstr. 7B, 38124 Braunschweig, Tel. 0531-2616-360, Fax: 0531-2616-418
Heike.Freese@dsmz.de

Prof. Dr. Rolf Daniel
Head Department Genomic and Applied Microbiology
G2L
Goettingen Genomics Lab - Institute of Microbiology and Genetics
Universität Göttingen
Grisebachstr. 8, 37077 Göttingen, Tel. 0551-39-33827, Fax: 0551-39-12181
rdaniel@gwdg.de

Prof. Dr. Carol Arnosti
Department of Marine Sciences
UNC
University of North Carolina
3202 Venable and Murray Halls, CB 3300, Chapel Hill, NC 27599-3300, USA, Tel. 001 (919) 962, Fax: 001 (919) 962-1254
arnosti@email.unc.edu

Prof. Dr. Gerhard Herndl
Head Group Microbial Oceanography
UVI
Department of Limnology and Bio-Oceanography
Universität Wien
Althanstr. 14, A-1090 Wien, Tel. 0043(0)1-4277-76431, Fax: 0043(0)1-4277-46401
gerhard.herndl@univie.ac.at

2.1.2 Associated Principal Investigators and Institutes

Prof. Dr. Oliver Zielinski
ICBM
Institut für Chemie und Biologie des Meeres
Head, Marine Sensors Group
Institut für Chemie und Biologie des Meeres
Carl von Ossietzky Universität Oldenburg
Schleusenstr. 1, 26328 Willhelmshaven, Tel. 04421-944-174, Fax: 04421-944-147
oliver.zielinski@uni-oldenburg.de

Prof. Dr. Ralf Rabus
Head Group General and Molecular Microbiology
ICBM
Institut für Chemie und Biologie des Meeres
Carl von Ossietzky Universität Oldenburg
Carl von Ossietzky Str. 9-11, 26129 Oldenburg, Tel. 0441-798-3884, Fax: 0441-798-3408
rabus@icbm.de

2.3 Scientific party / wissenschaftliche Fahrtteilnehmer

1	Meinhard Simon	Chief Scientist	ICBM
2	Kim Arndt	CTD	ICBM
3	Thomas Badewien,	CTD	ICBM
4	Holger Winkler	CTD	ICBM
5	Rohan Henkel	Bio-Optics	ICBM
6	Daniela Meier	Bio-Optics	ICBM
7	Daniela Voss	Bio-Optics	ICBM
8	Insa Bakenhus	Pelagic Microbiology	ICBM
9	Nils Bergen	Pelagic Microbiology	ICBM
10	Sara Billerbeck	Pelagic Microbiology	ICBM
11	Helge-Ansgar Giebel	Pelagic Microbiology	ICBM
12	Birgit Kürzel	Pelagic Microbiology	ICBM
13	Felix Milke	Pelagic Microbiology	ICBM
14	Gerrit Wienhausen	Pelagic Microbiology	ICBM
15	Laura Wolter	Pelagic Microbiology	ICBM
16	Mathias Wolterink	Pelagic Microbiology	ICBM
17	Jürgen Tomasch	Pelagic Microbiology	HZI
18	Irene Wagner-Doebler	Pelagic Microbiology	HZI
19	Marco Dogs	Polymer Microbiology	ICBM
20	Matthias Wietz	Polymer Microbiology	ICBM
21	Carol Arnosti	Polymer Microbiology	UNC
22	John Paul Balmonte	Polymer Microbiology	UNC
23	Heike Freese	Population Genomics	DSMZ
24	Cendrella Lepleux	Population Genomics	DSMZ
25	Anika Methner	Population Genomics	DSMZ
26	Avril von Hoyningen-Huene	Metagenomics	G2L
27	Bernd Wemheuer	Metagenomics	G2L
28	Lars Wöhlbrand	Metaproteomics	ICBM
29	Julius Degenhardt	Sediment Microbiology	ICBM
30	Bert Engelen	Sediment Microbiology	ICBM
31	Marion Gertrud Pohlner	Sediment Microbiology	ICBM
32	Chie Armano	Deep Sea Microbiology	UVI
33	Christian Baranyi	Deep Sea Microbiology	UVI
34	Barbara Bayer	Deep Sea Microbiology	UVI
35	Roberta Hansman	Deep Sea Microbiology	UVI
36	Thomas Reinthaler	Deep Sea Microbiology	UVI
37	Maria Pinto Gomes Ribeiro Teixeira	Deep Sea Microbiology	UVI
38	Mara Elena Heinrichs	Dissolved Organic Matter	ICBM
39	Jutta Niggemann	Dissolved Organic Matter	ICBM
40	Beatriz Noriega Ortega	Dissolved Organic Matter	ICBM

Figure 2.1: The scientific party of RV Sonne expedition BacGeoPac SO248

2.4 Crew / Mannschaft

1	Lutz Mallon	Captain
2	Nils-Arne Aden	Chief Mate
3	Jens Göbel	1st Mate
4	Hans-Ulrich Büchele	2nd Mate
5	Sabine Heuser	Surgeon
6	Achim Schüler	1st Engineer
7	Tim Stegmann	2nd Engineer
8	Steffen Genschow	2nd Engineer
9	Jörg Leppin	Chief Scientific Technical Service (WTD)
10	Hermann Pregler	Electronics (WTD)
11	Miriam Plöger	System Manager
12	Hendrik Schmidt	Electrical Engineer
13	Henning de Buhr	Electrical Engineer
14	Torsten Bolik	Fitter
15	Björn Bredlo	Motorman
16	Georg Hoffmann	Motorman
17	Sebastian Thimm	Motorman
18	Thorsten Bierstedt	Boatswain
19	Andreas Spieler	Cook
20	René Lemm	Chief Steward
21	Katharina Hellenbrandt	2nd Steward
22	Maik Steep	2nd Steward
23	Frank Stöckler	2nd Steward
24	Arnold Ernst	Deck
25	Dennis Vogel	Deck
26	Frank Heibeck	Deck
27	Günther Stängl	Deck
28	Jürgen Kraft	Deck
29	Reno Ross	Deck
30	Sascha Fischer	Deck

3. Narrative of the cruise / Ablauf der Forschungsfahrt

On Sunday, May 1st around 9:00 am local time Research Vessel Sonne with the embarked 40 scientists and 30 crew members left the port of Auckland for the BacGeoPac cruise to head to the first station at 30°S, 177°E, where we arrived in the morning of May 3rd. Three 20 foot-containers and air fright boxes with scientific equipment had arrived in time so that everything we needed was on board. As the scientists came on board on April 30th we had plenty of time to set up the labs and get ready for the first station work. This station was particularly exciting for us because we tested our brand new CTD-rosette with 24 20-Liter Niskin bottles (Fig. 3.1). The instrument was designed and constructed in the ICBM workshop and only tested once very briefly before shipping it to Auckland. Because of the large water demand during this cruise we had decided in October 2015 to build this new instrument in order to optimize water collection and to save time. It worked perfectly right away and during the entire cruise without any malfunctioning. At station 1, a shallow station at the eastern edge of the ultra-oligotrophic South Pacific Subtropical Gyre (SPS, for the Pacific biogeographic provinces see Fig. 4.1) where we collected water to a depth of 1000 m, we also deployed a McLane in situ pump at 60 m for three hours to collect water for bacterial population genomics studies, collected zooplankton to isolate bacteria by a vertical haul and microplastic by a horizontal tow with the Bongo net and carried out bio-optical measurements (Secchi-depth, hyperspectral und multispectral light field measurements (UV/VIS)) to characterize ocean optical properties. The next station 2 at 25°S, 179°E, still in the South Pacific Subtropical Gyre, was a deep station where, in addition to the work at station 1, we collected water all the way to the sea floor and surface sediment with a multi corer (MUC, Fig. 3.2). We used a brand new prototype-like instrument which worked perfectly during the entire cruise without any flaw or sediment loss due to incomplete closure of the lids at the bottom of the plexiglass tubes. In addition we collected water for our first mesocosm experiments. These types of samplings became the routine at the following stations which usually alternated between shallow and deep stations along the transect. Thanks to the large volume CTD we usually needed only one shallow and one deep cast, but in quite a few instances one or two extra casts for special needs.

Fig. 3.1: Scientists withdrawing water samples from the 24x20 Liter CTD rosette sampler

Fig. 3.2: Retrival of the Multi Corer

During the entire cruise we had regular meetings of the PIs of the different working groups and with the entire scientific party on board to discuss details of the planned station work and to present the planned work of each group. Later on first results of some of these groups were

included in the presentations. The planned work and some first results were also presented to interested members of the crew.

The stations along the transect were selected such that we aimed at visiting at least two stations, one shallow and one deep, in each biogeographic province. This aim was achieved in all provinces except in the South and North Pacific Equatorial Counter Current (SPE, NPE) which are very narrow so that we had only one station in each of these provinces. Hence the distance between the stations was about 4 to 6° latitude. Unfortunately, we could not visit a planned station in the SPS at 20°S which is situated in the EEZ of Fiji Islands. We had applied to work in Fiji's EEZ well in time but never received any response from the authorities and thus had to skip this station.

According to temperature and salinity in the near-surface layer we could clearly identify the water masses and biogeographic provinces. Water temperatures steadily increased from the SPS to the Pacific Equatorial Current from 23° to 30°C and further north decreased again to 22° at the northern edge of the North Pacific Subtropical Gyre (NPTG). The North Pacific Polar Frontal Region (NPF) was characterized by a strong decrease in temperature such that in the Pacific Subarctic Region (PSAG) and the Bering Sea (BER) temperature ranged between 4° and 6°C (Fig. 7.4). Salinity exhibited strong differences in the various biogeographic provinces, in particular in the equatorial region and the NPF (Fig. 7.3). From the deep CTD casts we could identify the characteristic water masses in the deep Pacific (Fig. 7.6). The water masses with the highest density at all stations was the central deep water (CDW). Overall, the tropical and subtropical water masses were clearly distinguished from those of the north Pacific.

In the permanently stratified warm provinces the DCM was situated between 60 and 120 m with the deepest extension in both subtropical gyres (Fig. 7.3). In the equatorial upwelling it was uplifted to 70 m. Well pronounced phytoplankton blooms were only established north of 40°N and in particular north of 50°N.

North of 5°N between depths of 200 and 1700 m extensive oxygen minimum zones were es-tablished with remaining oxygen concentrations of only about 15% of surface values (Fig. 7.5).

The microbial parameters assessed reflected well the different water masses and partially the biogeographic provinces. Final interpretation of the data, however, is only possible when we will have analyzed all the samples for the prokaryotic community and the composition of the dissolved organic matter (DOM) pool.

Prokaryotic abundance in the upper 100 m, assessed by flow cytometry on board, ranged between 2 and 22×10^5 cells ml^{-1} with continuously increasing values from south to north and highest numbers in the PSAG and BER. Bacterial biomass production, assessed by incorpora-tion of ^{14}C-labelled leucine, in the upper 100 m was highest in the SPE and NPE and much lower in the other provinces. Community growth rates in these provinces ranged between 1 and >2 per day but were much lower, usually not exceeding 0.4 per day, in the other regions. Turnover rates of dissolved free amino acids basically covaried with rates of biomass produc-tion but those of glucose and acetate exhibited different patterns with continuously increasing rates north of the equator and highest values in the PSAG and BER. Preliminary results of hydrolytic enzyme activities of various polysaccharides and peptidases exhibited distinct pat-terns for the various provinces. In particular the peptidolytic activities reached highest values in the SPE, PEQ and NPE, in line with the data of bacterial biomass production.

The mesocosm experiments at the station in the SPS, the NPE and the NPF, exhibited strik-ingly different growth responses of the ambient bacterial communities to the various substrate and vitamin B12 additions. At SPS the responses were generally slow. At NPE they were al-most immediate with high responses in all treatments whereas at the NPF they were interme-diate.

As quite a few prokaryotes and in particular Archaea in the deep sea are chemoautotrophic CO_2 dark fixation was assessed. Highest rates were measured in the equatorial region but in some regions further north values reached 50% of the equatorial maxima. Values at 1000 m were usually, but not always, higher than at 2000 m.

The surface sediment along the transect exhibited quite variable structures and textures. This was already obvious from the color of the sediment (Fig. 7.17). Bacterial abundance at the sediment surface ranged between 10^8 and 10^9 cells cm^{-3} with continuously increasing values north of the equator. At 20 cm below the seafloor cell numbers were about one order of magni-tude lower. Alkaline phosphate activities were highest in the region 6 to 20°N whereas ami-nopeptidase activities peaked between 34° and 50°N, the northern edge of the NPTG and the PSAG, regions of a pronounced oxygen minimum zone and a high sinking flux.

According to the preliminary data we were able to collect already during the cruise we are very confident that the BacGeoPac cruise was very successful and that we can reach the goals we set for this comprehensive study. However, to achieve them all the samples stored frozen in the home labs need first to be analyzed.

On May 31st we finished the work at the northernmost station. This left us enough time to finish the last incubations, pack all material and equipment before we reached the final destination, Dutch Harbor, on Unalaska one of the Aleutian Islands, Alaska. Our cruise was generally blessed with good weather even though we had to pass through two storms, one in the south-eastern Trade Wind region, and one in the north Pacific polar frontal region. Despite a swell of 5 to 7 m during these storms the ship operated smoothly and we could carry out our work as usual. In fact, we did not have any interruption of our work due to weather conditions or any malfunctioning of instrumentation or ship equipment.

Dutch Harbor as final destination of this cruise was a challenge and resulted in some incon-veniencies which were out of our control. It is the major fisheries harbor of the US and very much focused on services to the fisheries industries. Dutch Harbor is only reachable by small airplanes, but not during bad weather conditions, or in summer twice a month by a ship. In order to ship our frozen samples back to Germany the responsible carrier needed to charter a special airplane to Dutch Harbor. Further, the harbor can only handle 40 ft but not 20 ft con-tainers. Therefore, our three containers needed to remain on board until RV Sonne reaches a port in Japan in mid-August or even only in September.

A post cruise meeting for shipboard and shore-based scientists to present and discuss the results will be scheduled for July 2017. This rather late meeting after the cruise is because all except two working groups are also involved in research of cruise SO254 which takes place from January 26th to March 1st, 2017.

4. Aims of the Cruise / Zielsetzung der Forschungsfahrt

4.1 General aims

The Pacific Ocean between the subpolar regions of the northern and southern hemisphere stretches over distinct biogeographic provinces which differ with respect to water masses, hydrography, nutrients and plankton communities (Fig. 4.1): Subantarctic, south subtropical convergence, south Pacific subtropical gyre (SPS), Pacific warm pool (WAR), Pacific equatorial current (PEQ), south and north Pacific equatorial counter current (PSE, PNE), north Pacific subtropical gyre (NPTG), north Pacific polar frontal region (NPF), Pacific subarctic region (PSAG), Bering Sea (BER). These provinces differ greatly with respect to chlorophyll *a* and primary production, from ultraoligotrophic conditions in the SPS to eutrophic nutrient regimes in the NPF, PSAG and BER (Fig. 4.2).

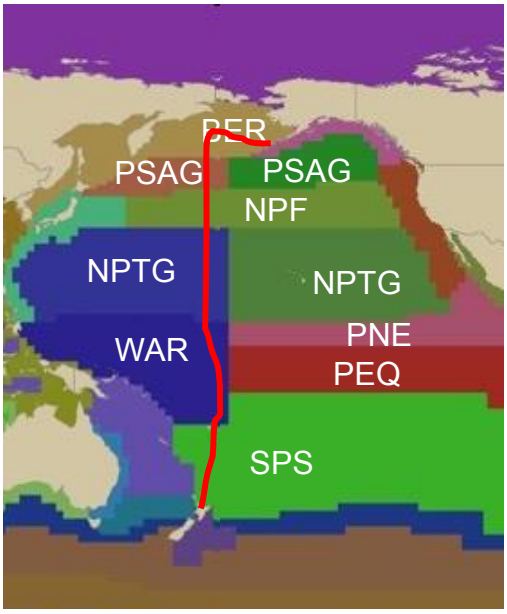


Fig. 4.1: Biogeographic provinces in the Pacific visited and track of cruise SO248 (red line). For abbreviations see text.

The overarching aim of the BacGeoPac cruise was to investigate how these general plankton- and hydrography-related biogeographic patterns are reflected in the growth and substrate dynamics, biogeography, composition and functional properties of the prokaryotic communities and in the chemogeography patterns of the DOM pool between SPS and BER. The Pacific is largely unexplored with respect to these microbial biogeography and chemodiversity patterns. The major focus was on the epipelagic and mesopelagic zones. However, we also included in our investigations the bathypelagic, abyssopelagic and sea floor-associated prokaryotic communities and DOM patterns and how they relate to the water masses of the dark ocean.

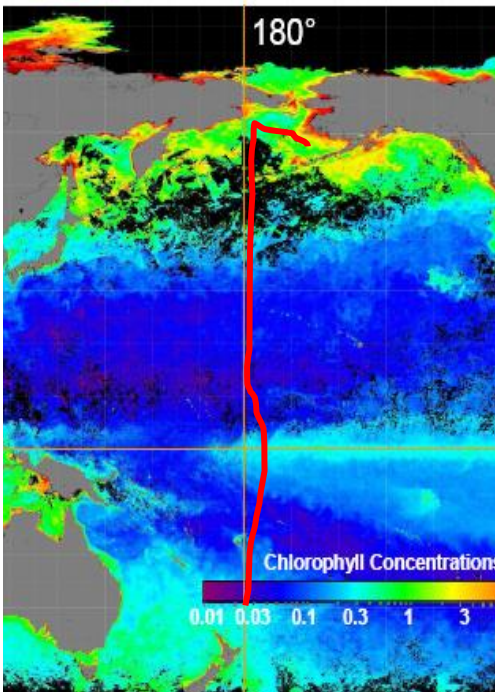


Fig. 4.1: Chlorophyll *a* concentrations in the Pacific and track of cruise SO248 (red line).

To achieve these aims we sampled a transect from the western edge of the SPS at 30°S to the BER at 59°N around the 180th longitudinal degree (Fig. 4.1 and 4.2).

In order to extend this transect further south and to cover the entire Pacific from subantarctic to subarctic waters we will return to RV Sonne in late January 2017 on cruise SO254 and continue this transect from 30°S to 60°S.

To better understand the functional properties of the prokaryotic communities in the different biogeographic provinces a special focus was on process studies. Therefore we applied radio- and fluorescently labelled model substrates and stable isotope tracer experiments and mesocosms with different substrate amendments and 24 hour time series studies.

Besides growth activities, substrate preferences and the composition of the bacterial and archaeal communities, the phytoplankton communities, nutrient concentrations and the DOM composition were studied comprehensively for the first time on such a long transect in the Pacific.

Most of the investigations were carried out in the frame work of the DFG-funded Collaborative Research Center *Roseobacter* (TRR51).

4.2 Major topics of investigations on board

4.2.1 Hydrographic and biogeochemical characterization of the biogeographic provinces and water masses

In order to characterize the biogeographic provinces and water masses we assessed the hydrographic properties of the water column from the surface to the sea floor by the sensors of the CTD rosette sampler (salinity, temperature, transparency, oxygen, fluorescence). For biogeochemical parameters such as chlorophyll, particulate organic carbon and nitrogen (POC, PON) and inorganic nutrients (nitrate, nitrite, ammonium, phosphate, silicate) samples were collected from distinct depths out of Niskin bottles mounted on the rosette sampler.

4.2.2 Composition, diversity and function of the epi- and mesopelagic microbial communities

Our aim was to comprehensively assess the composition, diversity and function of the prokaryotic communities in all biogeographic provinces in the epipelagic and mesopelagic zones. Therefore, we collected samples from the surface to 1000 m depth and prepared them for later analyses by state of the art molecular microbiological approaches such as fluorescent in situ hybridization (CARD-FISH), next generation sequencing of variable regions of the 16S rRNA gene, single cell sorting and genome sequencing, metagenomics, -transcriptomics and –proteomics.

To assess functional properties of these communities bulk rates of prokaryotic biomass production, turnover rates of amino acids, glucose and acetate were assessed by radiotracer techniques. Further, microautoradiography coupled with FISH (MAR-FISH) and using leucine as a proxy for protein synthesis and amino acids, glucose and acetate as substrates was applied. Microbial polymer hydrolysis was examined by applying fluorescently labelled polymeric substrates.

4.2.3 Mesocosm experiments to assess functional responses to substrate amendmens

In order to examine how the ambient bacterial communities respond to substrate amendments mesocosm experiments in triplicate 20 L carboys and controls were conducted in the SPS, NPE and NPF. An exudate of the diatom *Thalassiosira rotula*, alginate and vitamin B12 and a precursor were added to separate sets of mesocosms and incubated for six days at ambient temperature. Subsamples for bacterial abundance, biomass production, substrate turnover, bacterial community composition and DOM analysis by ultrahigh resolution mass spectrometry (see below) were withdrawn periodically.

4.2.4 Diversity and function of the microbial communities in the dark ocean

The bacterial and archaeal communities in the dark ocean (>1000 m depth) were investigated with respect to community composition and key functional processes, e.g. heterotrophic biomass production and CO_2 dark fixation. The specific aim was to examine whether the different water masses in the deep ocean, the subantarctic and subarctic intermediate waters and the deep water harbor distinct microbial communities with different rates of biomass production and CO_2-dark fixation. Similar methods as in the upper water column were applied.

4.2.5 Diversity and function of surface-sediment-associated microbial communities

In order to examine how the greatly varying trophic state and sinking flux of the different biogeographic processes is reflected in the sea floor-associated microbial communities their composition and polymer degradation potential was investigated in the upper 20 cm of the sediment. Similar methods as in the upper water column were applied.

4.2.6 Dissolved Organic Matter (DOM)

The composition of the DOM pool was assessed by ultrahigh resolution mass spectrometry, FT-ICR-MS, (Fourier transform ion cyclotron resonance mass spectrometry, Dittmar and Stubbins 2014) in the entire water column to characterize the biogeographic provinces and water masses also by these geochemical features. They are mainly a result of the processing of organic matter by the resident microbes. Concentrations of dissolved amino acids and carbohydrates and of dissolved organic carbon were measured as well.

5. Agenda of the cruise / Programm der Forschungsfahrt

5.1 Cruise track

A south – north transect across the Pacific was investigated from 30°S to 59°N at or close to the 180th latitudinal degree to comprehensively cover the major biogeographic provinces of this ocean (Fig. 5.1). In contrast to the impression of Fig. 4.1 and as verified by our hydrographic measurements this transect did not go through the Pacific Warm Pool but a little east and covered the various equatorial provinces with their complex currents, counter currents (PSE, PEQ, PNE) and upwelling regions. Sampling included extensive CTD-casts throughout the water column, bio-optical characterization of the euphotic zone, horizontal and vertical plankton net tows, collection of microplastic particles, in situ pump deployments in near surface waters and sediment sampling with a MUC at all deep stations. In the SPS, the PNE and NPF mesocosm experiments were carried out to examine the response of the bacterial communities to various substrate amendments. In the PEQ and NPF 24 hour time series were conducted to assess the response of the bacterial communities to diurnal changes in irradiance, primary production, DOM supply and mortality by grazing and virus infection.

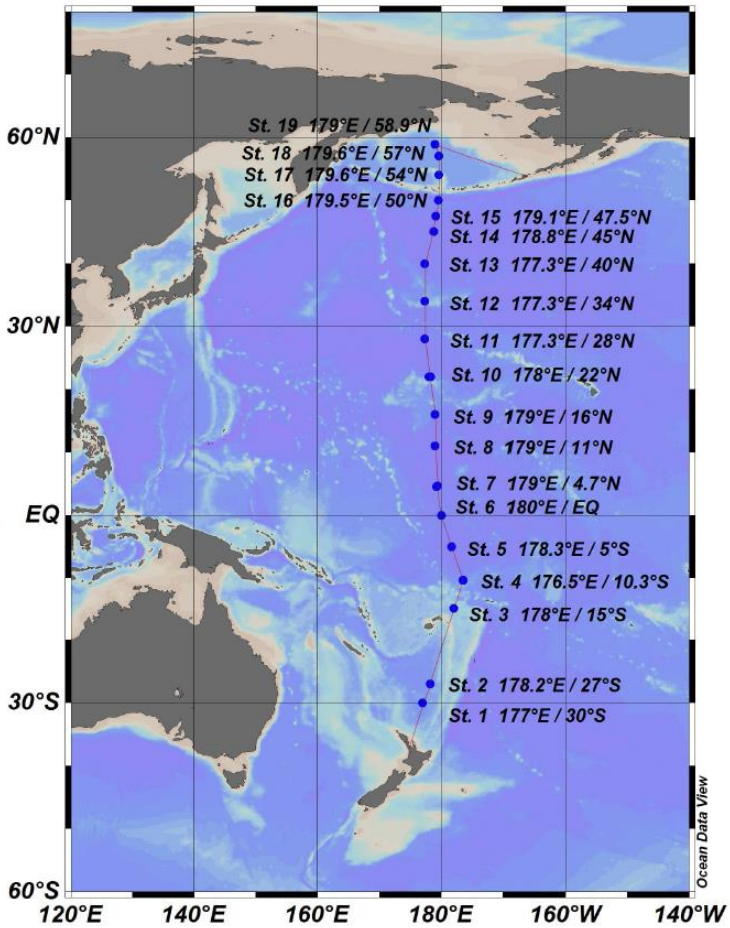


Fig. 5.1: Track and stations (no., latitude, longitude) of cruise SO248 across the Pacific.

5.2 Station work

The investigation included 19 stations, 11 “deep” stations from the surface to the sea floor, including the surface sediment, and 8 “shallow” stations from the surface to 1000 m depth (Fig. 5.1). The locations of the stations were planned and executed such that we had usually at least two stations in each biogeographic province. This resulted in distances of ~3-6° latitude between two stations. Only for the narrow PSE, PEQ and PNE this scheme did not work such that we had only one deep station in each of these provinces.

The operations of the deep stations usually started with either a MUC or a shallow CTD down to 1000 m, depending on the time of the day (Fig. 5.2). The aim was to have the CTD on deck in the morning around 8:00 hours local time whenever possible so that we had a morning situation for all analyses. We had a fixed number of defined depths between 20 and 1000 m depth for collecting samples (20, 40, 60, 100, 200, 300, 500, 1000 m) and only the depth of the deep chlorophyll maximum (DCM) was adjusted according the fluorescence reading of the CTD downcast. Sample collection with the Niskin bottles was always done during the CTD

Fig. 5.2: Retrival of the 24x20 Liter CTD, sediment cores by the MUC and the McLane in situ pump.

upcast. When the MUC was operated prior to the CTD, between 2:00 and ~6:00 hours local time we relocated the ship for the CTD cast to a new site at a distance of 2 nm. The deep CTD, covering the water column below 1000 m and to 10 m above sea floor with sampling collection roughly every 1000 m, followed thereafter and, if needed, another CTD for special water requirements. Samples for various parameters were withdrawn from the Niskin bottles (see below). The McLane in situ pump was usually deployed at 20 or 60 m for 3 hours shortly after the start of the shallow CTD from the stern on the starboard side (Fig. 5.2). This deployment scheme saved time and still allowed operating the CTD smoothly.

Table 5.1: Measured parameters in samples withdrawn from the Niskin bottles:

Parameter	0-200 m	200-1000 m	1000 m-seafloor
Particulate organic carbon / nitrogen	+	+	
Chlorophyll	+		
Inorganic nutrients (nitrate, nitrite, ammonium, phosphate, silikate)	+	+	+
Dissolved amino acids / carbohydrates	+	+	
DOC	+	+	+
DOM (FT-ICR-MS)	+	+	+
CARD-FISH	+	+	+
Bacterial biomass production	+	+	+
Turnover rates of amino acids, glucose, acetate	+		
MAR-FISH	+		
Microbial polymer hydrolysis	+	+	
Metagenomics, -transcriptomics, -proteomics	+		+
Prokaryotic community composition	+	+	+

Optical characterization of the upper 200 m followed the CTD operations. This included Secchi depth reading, Forel Ule estimates of ocean color and UV and optical profilers. The profilers were set out from the stern portside to 200 m in free falling mode as the ship gently moved forward.

Thereafter a vertical or horizontal tow of the Bongo net with a mesh size of 200 µm followed. The vertical tow for collecting zooplankton covered the upper 200 m of the water column. With the horizontal tow at the surface microplastic was collected which lasted 30 min at a ship speed of 2-3 kn.

In case the MUC was not operated prior to the CTD casts the station work was terminated with sediment collection by the MUC. From the sediment slices from the surface and 20 cm below seafloor were prepared for analysis of pore water, phosphatase and leucine aminopeptidase activities, prokaryotic cell numbers and community analysis.

Shallow stations followed basically the same sequence of operations except the deep CTD and the MUC casts.

During the two 24 hour time series stations CTD casts down to 500 m were run every 3 hours in addition to the operations of a regular deep station.

5.3 Underway measurements

In addition to ship-based underway data (weather conditions, incident light, ADCP) additional parameters were assessed by a FerryBox for a better characterization of the extension of the biogeographic provinces. This device is a flow through system connected to the ship's continuous pump system to monitor continuously temperature, salinity, chlorophyll fluorescence, turbidity and dissolved oxygen.

Discrete Aerosol Optical Thickness (AOT) measurements were made whenever clear and cloudless sky allowed. Readings were done with a handheld MICROTOPS II instrument kindly provided by the NASA/Goddard Space Flight Center in conjunction with the AERONET Maritime Aerosol Network program.

6. Settings of the working area / Beschreibung des Arbeitsgebiets

The Pacific Ocean, the largest water mass globally, exhibits distinct hydrographic patterns and biogeographic provinces between the tropics and subpolar regions (Figs. 4.1, 4.2, Fig. 6.1, 6.2, Longhurst 2006). The largest areas are covered by the ultraoligotrophic South Pacific and the North Pacific Subtropical Gyres, permanently stratified and nutrient-depleted areas. The tropics are characterized by the equatorial currents and southern and northern counter currents with pronounced upwelling features, leading to substantially higher rates of primary production and phytoplankton biomass than the subtropical gyres locked out of nutrient input from nutrient-enriched deep water. The polar frontal and the subarctic region are affected by the westerly and polar winds and pronounced seasonal hydrographic and plankton dynamics. High concentrations of inorganic nutrients, including silicate, lead to pronounced spring and summer phytoplankton blooms and a high sinking flux and sediments enriched in organic matter.

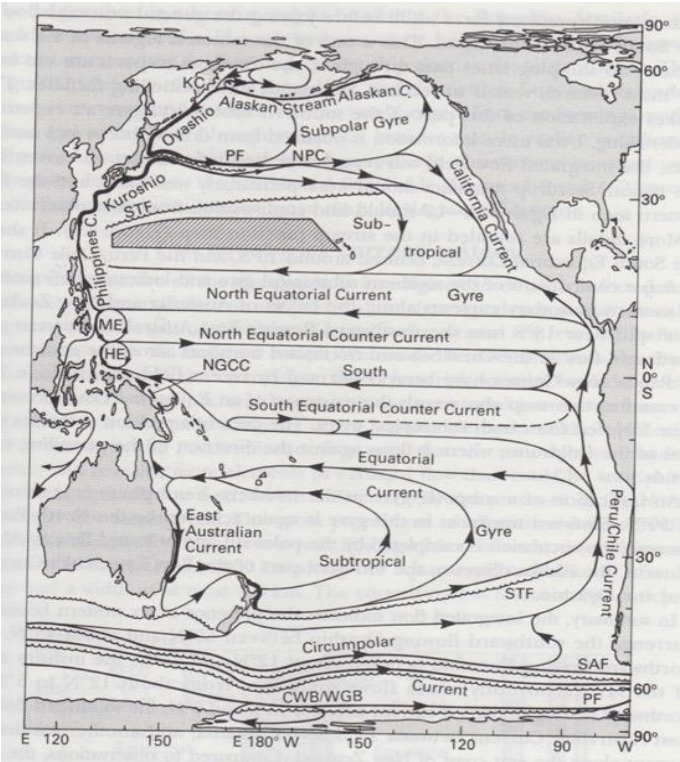


Fig. 6.1: Surface currents in the Pacific (Tomczak and Godfrey 1994).

Quite a few studies have been carried out on the composition and growth dynamics of bacterioplankton communities in various regions of the Pacific Ocean including the equatorial upwelling, the subtropical gyres and the colder regions, mainly on the northern hemisphere (Shi et al. 2011, Sowell et al. 2011, Tada et al. 2011, Ottesen et al. 2013). However, only scarce information and none applying state of the art community analysis exists on basin-wide patterns of the composition of bacterioplankton communities and microbial polymer hydrolysis in the Pacific (Baldwin et al. 2005, Arnosti et al. 2011). In fact no study is available on the composition and biodiversity of bacterioplankton communities and their active players in relation to the major biogeographic provinces in the Pacific. Further, no information is available on the DOM composition in the biogeographic provinces of this ocean.

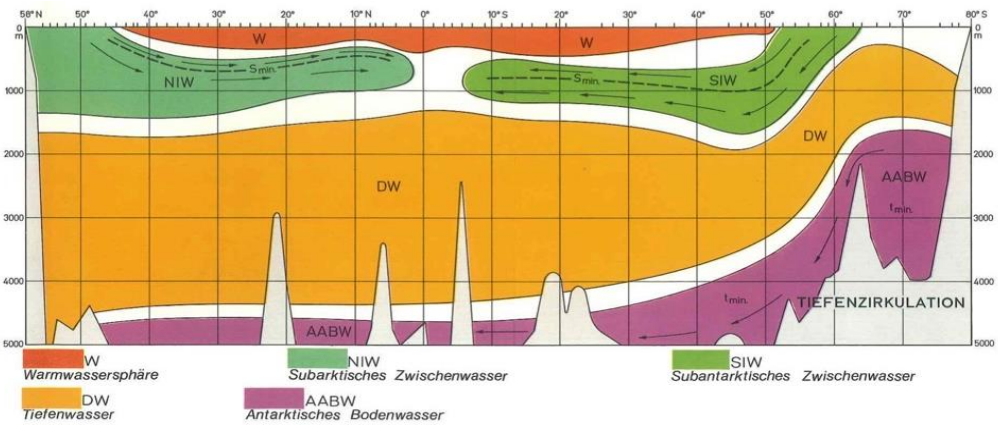


Fig. 6.2: Vertical structure of the water masses in the Pacific at 160°W between the surface and seafloor (Dietrich et al. 1992).

The deep Pacific ocean with the oldest oceanic water masses (Hansell 2013), pronounced northern and southern intermediate waters and a large central deep water mass (Fig. 6.2, Die-trich et al. 1992) is also rather unexplored with respect to assessing structure and function of the prokaryotic microbial communities. Only a few studies from the North Pacific Subtropical Gyre are available (DeLong et al. 2006, Swan et al. 2011, Ottesen et al. 2014). The only large scale studies including the dark ocean carried out so far investigated bulk growth properties of the microbial communities between the Bering Sea and tropical regions but did not address microbial community composition (Nagata et al. 2000, Yokokawa et al. 2013).

7. Work details and first results / Beschreibung der Arbeiten im Detail einschließlich erster Ergebnisse

Investigations described in chapters 7.3, 7.4, 7.6, 7.7, 7.8, 7.9 and 7.10 were carried out as projects and key work packages of the Transregional Collaborative Research Center Ecology, Physiology and Molecular Biology of the *Roseobacter* clade: Towards a Systems Biology Understanding of a Globally Important Clade of Marine Bacteria (TRR 51, www.roseobacter.de).

7.1 Oceanographic Measurements - New Deepwater-CTD Rosette
(TH Badewien, H Winkler, KL Arndt, O Zielinski)

The oceanographic measurements were carried out with the help of a CTD- (Conductivity, Temperature, Depth) probe attached to a rosette water sampler. The major goal was to identify the thermohaline structure of the water column. In addition, different water masses of the Pacific had to be identified.

To adequately analyze the genomic, proteomic and biochemical characteristics of bacteria in oligotrophic oceanic regions, high volumes of water from different depths had to be obtained. In addition, several mesocosm experiments were conducted onboard using ambient seawater. Thus, to serve the high demand for seawater, we designed and constructed a new frame sized in such a way that it could accommodate 24 water-sampling bottles with a volume of 20 L each as well as the standard Seabird probes.

Methods and instrument details

We tested the newly designed CTD-rosette for the first time under oceanographic conditions during this cruise. The system worked well even under harsh weather conditions and the high pressure present at the deepest sampling stations (up to about 5900 m depth).

We used a Sea-Bird Electronics Inc. CTD SBE 911plus probe, SN 09-1266, attached to a SBE 32 Carousel Water Sampler SN 32-1119 containing 24 20-liter Ocean Test Equipment Inc. bottles. The CTD system is equipped with double temperature and conductivity sensors, an oxygen sensor, a pressure sensors, an altimeter, and a combined chlorophyll fluorometer and turbidity sensor.

Before each measurement, the CTD was adapted to the ambient water temperature at 10 m water depth for 3 minutes. We obtained temperature, conductivity, oxygen, fluorescence, turbidity profile from the surface down to 1000 m for “shallow” casts and down to 10 m above the sea floor for “deep” casts. Temperature was calculated according to the ITS-90 temperature standard (potential T in °C). Absolute salinity (g/kg) was calculated using the TEOS-10 standard (IOC, SCOR and IAPSO, 2010; Millero et al. 2008, McDougall et al. 2012). Within the upper 500 m, the CTD was lowered at 0.5 m/s due to constraints by the winch system. At depths higher than 500 m, the speed could be increased up to 1 m/s.

All data were recorded and stored using the standard software Seasave V 7.23.2. The data were processed by means of ManageCTD, loops deleted, and data were added such as the CTD header, and ship position, based on the aboard data system DSHIP. We checked the data for unusual spikes using the despike-routine of the ManageCTD. Finally, the data were converted into different formats for subsequent analyses and publication. Other data from the DSHIP data set (salinometer, Ferrybox, weather recordings, ADCP, GPS) were extracted for further processing and as a supplement to the CTD data.

Table 7.1: Specifications and dates of calibration of the CTD sensors.

Temperature 1 Sea-Bird Electr. Inc. SN: 5828, Calibration date 23-Dec-15	Temperature 2 Sea-Bird Electr. Inc. SN: 5829, Calibration date 11-Dec-15
Conductivity 1 Sea-Bird Electr. Inc. SN: 4529, Calibration date 15-Dec-15	Conductivity 2 Sea-Bird Electr. Inc. SN: 4530, Calibration date 15-Dec-15
Pressure Sensor Sea-Bird Electr. Inc. SN: 1266, Calibration date 07-Jan-16	
Altimeter Sensor Bentos SN: 67334	
Flurometer FluoroWetlabECO_AFL_FL SN: FLNTURTD-4111, Calibration date 11-Sep-15	
Turbidity Sensor FluoroWetlabECO_AFL_FL SN: FLNTURTD-4111, Calibration date 11-Sep-15	
Oxygen Aanderaa AADI4831F SN: 527, Calibration date 2015-10-19	

All sensors attached to the frame were pre-calibrated by the manufacturers (Table 7.1). We compared the data of both temperature and conductivity sensors using data from 56 and 57 casts, respectively. The temperature sensors had a very high accuracy, with a mean difference of 0.0007 °C (Fig. 7.1). The conductivity sensors had an accuracy of 0.0071 ms/cm (Fig. 7.1). There was a small constant offset between both conductivity sensors. We collected about 30 seawater samples for further analyzes using a lab-based salinometer.

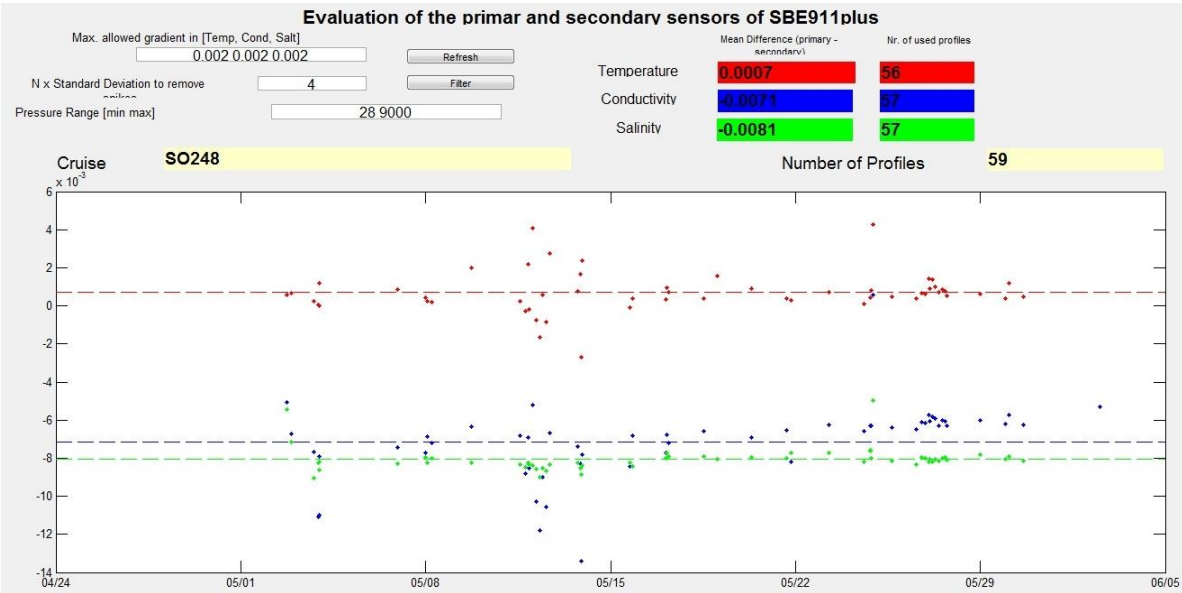


Figure 7.1: Accuracy check of the temperature and conductivity double sensors based on nearly all CTD-casts during cruise SO248.

Oxygen Calibration

For calibration of the Aanderaa oxygen sensor, we used the standard Winkler titration technique to determine the concentration of dissolved oxygen in seawater (Grasshoff et al. 1999). At almost each station we took two to four replicate water samples from two to three different depths. In total, we used 98 water samples for the calibration of the oxygen sensor. The results obtained from the oxygen sensor and the titration measurements compare well (R^2 = 0.96, see Fig. 7.2). The correction function has an offset of 7.75 µmol L^{-1}; the slope is 1.13.

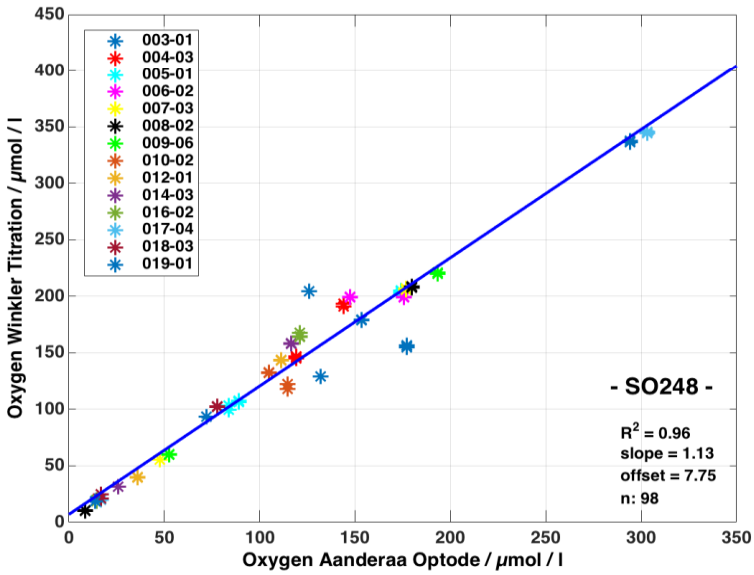


Fig. 7.2: Validation of the Aanderaa-type oxygen optode by using Winkler titration of samples obtained at 14 stations during cruise SO248.

Preliminary results

Altogether, we collected samples at 19 stations with 59 CTD-casts. About 30,000 L of seawater were used for analyses and experiments.

Contour plots of salinity and temperature down to 1000 m water depth over the entire transect from the southernmost to the northernmost station in the Bering Sea along 180° E/W are shown in Figs. 7.3 and 7.4. Black lines indicate isopycnals. The white dashed line indicates the depth of the chlorophyll maximum, as determined by the fluorescence sensor.

We can clearly identify the water masses in the tropical and subtropical regions with highest temperatures and salinity south of the equator. Another prominent feature is the strong salinity gradient with the frontal systems in the northern Pacific around 40-45 °N and the subarctic and Bering Sea regions with salinities below 33 and surface temperatures as low as 4 °C.

Fig. 7.5 shows the oxygen distribution down to a depth of 3000 m along the transect. The so-called oxygen minimum zone extends from about 200 m down to almost 2000 m in the northern Pacific and complies with previous studies (Dietrich et al. 1992). The maximum extension of the oxygen minimum zone was between 50° and 60° N.

Temperature-Salinity diagrams obtained from the measurements at the “deep” stations are shown in Fig. 7.6. The water masses with the highest density at all stations were identified as the central deep water (CDW) of the Pacific Ocean. Overall, we can clearly distinguish the tropical and subtropical water masses (stations 2-12) from those of the North Pacific (stations 14-19).

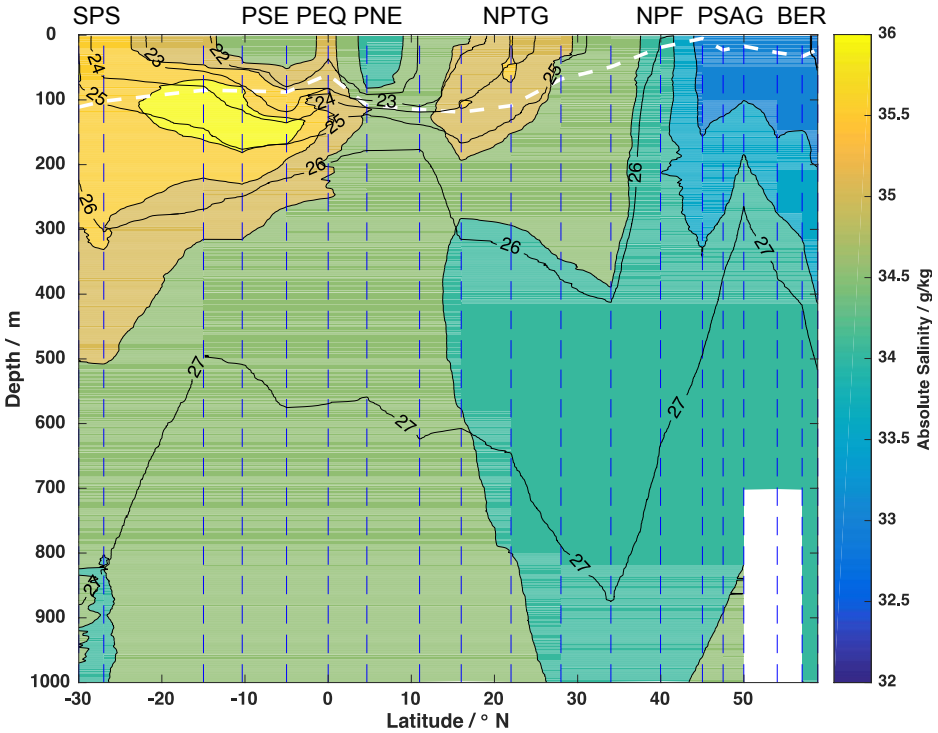


Figure 7.3: Contour plot of the absolute salinity distribution along the meridional transect of cruise SO248 and biogeographic provinces (top). Black lines indicate the isopycnals; the white dashed line the depth of the chlorophyll maximum and the dashed blue lines the positions of the stations.

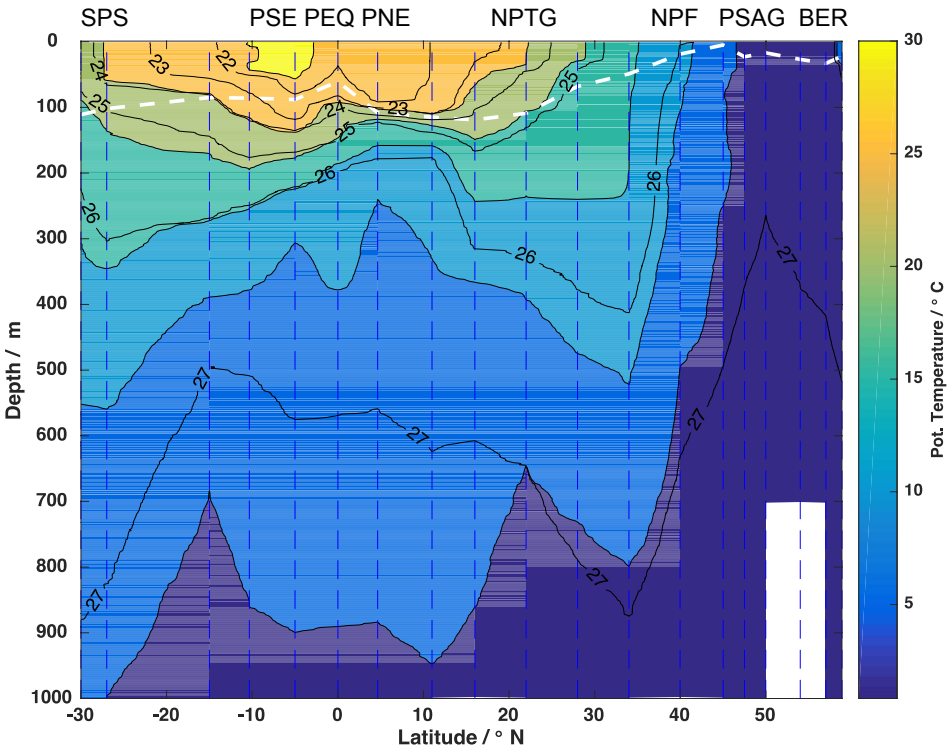


Figure 7.4: Contour plot of the potential temperature distribution along the meridional transect of cruise SO248 and biogeographic provinces (top). Black lines indicate the isopycnals; the white dashed line the depth of the chlorophyll maximum and the dashed blue lines the positions of the stations.

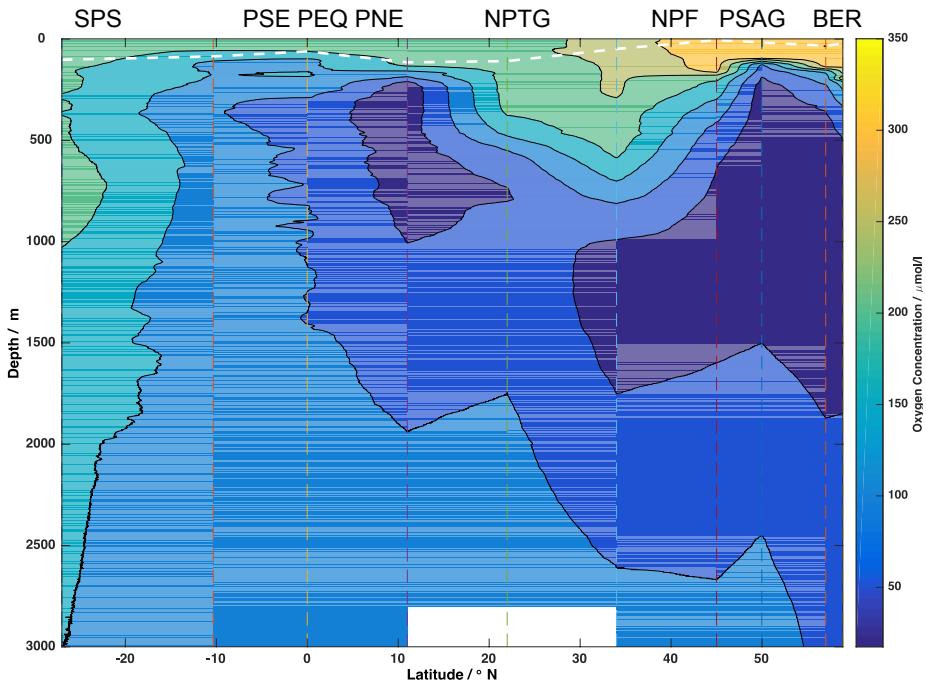


Figure 7.5: Contour plot of the oxygen concentration along the meridional transect of cruise SO248 and biogeographic provinces (top). Black lines indicate the isopycnals; the white dashed line the position of the chlorophyll maximum and the dashed blue lines the positions of the stations.

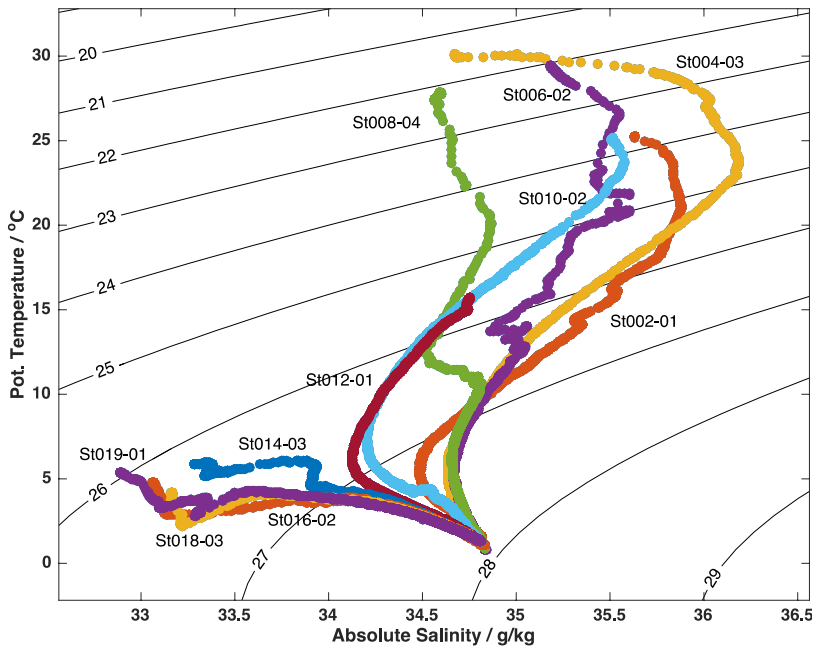


Figure 7.6: T-S-Diagram (potential temperature versus absolute salinity) of all deep stations of cruise SO248.

Data Management:

The data are available at PANGAEA: https://doi.pangaea.de/10.1594/PANGAEA.864673
Badewien TH, Winkler H, Arndt KL, Simon M (2016) Physical oceanography during SONNE cruise SO248 (BacGeoPac). Institute for Chemistry and Biology of the Marine Environment, Carl-von-Ossietzky University of Oldenburg, Germany, *Dataset #864673,* (doi:*10.1594/PANGAEA.864673).*

7.2 Bio-optics

(D Voss, D Meier, R Henkel, O Zielinski)

The main objective of the bio-optics part of the cruise was to determine and correlate the underwater light field, combined with transparency measurements and ship-based ocean color sensing to biogeochemical properties and the composition of plankton and bacterioplankton communities and the biogeographic provnices. As light availability controls phytoplankton growth and community composition and only few investigations were performed within this oceanic region covering distinct hydrographic patterns and biogeographic provinces, observations play an important role to elucidate causative links. To obtain a better insight into the biodiversity patterns of (bacterio-) plankton communities and their biogeochemical significance and role in DOM turnover the assessment of DOM was complemented by measuring chromophoric (CDOM) and fluorescence properties (FDOM). These measurements allow a highly sensitive DOM analysis (Coble 2007, Moore et al. 2009, Baszanowska et al 2011) and the correlation of DOM signatures to water masses and their specific microbial biogeochemical processes. A further objective of the cruise was to investigate the improvement of optical processing methods. Here we focused on the validation and calculation of nitrate in oligotrophic surface waters with an UV spectrophotometer continuously running over the whole cruise transect.

Methods

Hyperspectral und multispectral light field measurements (UV/VIS)

A HyperPro II profiling system (Satlantic, Halifax, Canada) was used to acquire bio-optical data for different parameters. The profiler consists of one hyperspectral irradiance and one hyperspectral radiance sensor as well as fluorescence and backscatter sensors and an integrated CTD. A second hyperspectral irradiance sensor was mounted on the research vessel for reference measurements. On the profiler, the irradiance sensor measures downwelling and the radiance sensor upwelling light. The fluorescence sensors measure chlorophyll, CDOM, phycoerythrin and phycocyanin fluorescence signals. The backscatter sensor retrieves data at 470 nm and 700 nm. Profiler measurements were conducted at almost all stations depending on sea, weather and light conditions. At these stations, three casts at the back of the ship were typically performed in free-falling mode (1x full depth, 2 x 50 m). At each cast, the profiler was lowered until the downwelling light values were of the same order of magnitude as the background noise level of the sensor. Besides the VIS version a second UV profiling system (Satlantic, Halifax, Canada) was used at the stations to determine the penetration of UV light within the water column. On the profiler, two irradiance sensors (selected wavelengths) measure the downwelling light. A second hyperspectral irradiance sensor was mounted on the research vessel for reference measurements of the full light availability. Three casts at the back of the ship were typically performed in free-falling mode (1x full depth, 2 x 50 m). Data processing was done onboard; further modelling will be performed afterwards.

Fig. 7.7: HyperPro II profiler to determine the underwater light field.

As a reference for the underwater light field measurements spectral absorption coefficients of particles and pigments were determined in discrete water samples afterwards in the lab. Therefore, particles were concentrated on filters for subsequent absorption analysis. One to 2 L of seawater from selected light field depths were filtered under low vacuum trough pre-combusted Whatman GF/F filters (47mm). Filters were immediately frozen at -80°C. Further analysis will be done in the home lab afterwards.

Ocean Color Sensing

Water transparency measurements were performed with a 0.9 m diameter Secchi disk at almost each station depending on sea and weather conditions. The Forel-Ule (FU) color scale is a device that is composed of 21 colors, from 'indigo blue' to 'cola brown', and represents the range of colors that can be found in the open sea, coastal, and continental waters. Based upon a historical background, this provides an estimate of the present water constituents influencing the water color. The color of the water was determined over a Secchi disk at half the disk's depth at each day station. When classical measurements were conducted at some stations additionally a smartphone app for FUI determination was used. Measurements were part of the EU project Citclops (www.citclops.eu, eyeonwater.org.

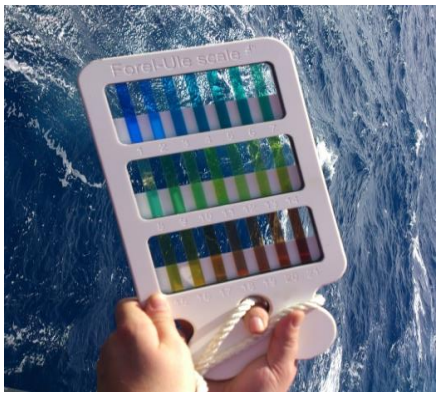


Fig. 7.8: Forel-Ule scale for observations during cruise SO248.

Above-water hyperspectral radiometric observations were conducted during the whole cruise. A radiometer setup with a RAMSES-ACC hyperspectral cosine irradiance meter to measure *ES* (λ) (downwelling solar irradiance), and two RAMSES-ARC hyperspectral radiance meters to measure *Lsfc* (θ*sfc*,Φ, λ) (upwelling water-leaving radiance) and *Lsky* (θ*sky*, Φ, λ) (sky-leaving radiance) were installed on the ships foremast (Fig. 7.9, TriOS GmbH, Germany). Hyperspectral measurements were collected at 5 min intervals over a spectral range of λ = 320 – 950 nm. Data processing will be done according to Garaba & Zielinski (2014). Furthermore newly developed processing algorithms will be tested with the collected data set. Measurements were combined with a security camera, taking pictures every 10 minutes for a later validation of spectra.

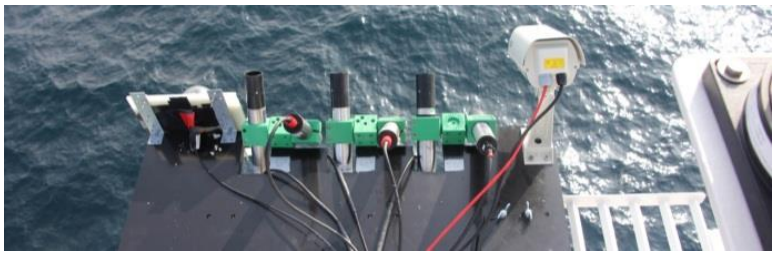


Fig. 7.9 Radiometric setup at the foremast of RV Sonne.

FDOM / CDOM measurements

Water samples were collected at each station from defined depths to measure CDOM and FDOM on shipboard fluoro- and spectrophotometrically, respectively, in 0.2 µm prefiltered samples.

Preliminary Results

Hyperspectral und multispectral light field measurements (UV/VIS)

Underwater light field measurements were performed at almost every station and showed pronounced differences in the different biogeographic provinces (Fig. 7.10). The vertical profile of the photosynthetic active radiation (PAR) decreased from the PNE (station 7) to the NPF (station 12) and BER (Station 17). stations were selected to show the changes in the. Analysis and modeling are in progress for all stations along the cruise transect.

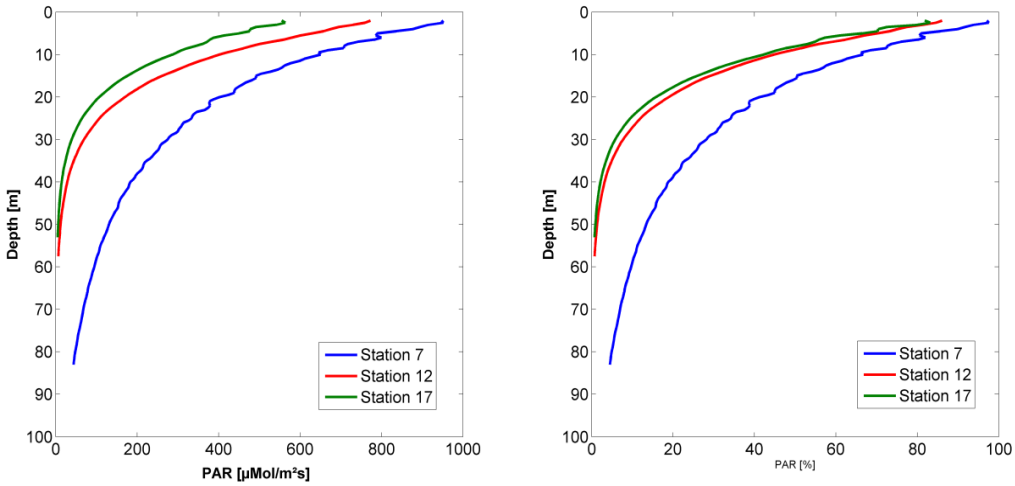


Figure 7.10: Vertical profile of absolute PAR (left) and percent (right) at 3 stations of cruise SO248 in the Pacific. For location of the stations see Fig. 5.1.

FDOM measurements

For each station and distinct depths water samples were taken for FDOM measurements. Data of station 3 in SPS show the typical differences of oligotrophic waters in the profile between the surface and 1000 m depth with increased fluorescence in the mesopelagic zone (Fig. 7.11).

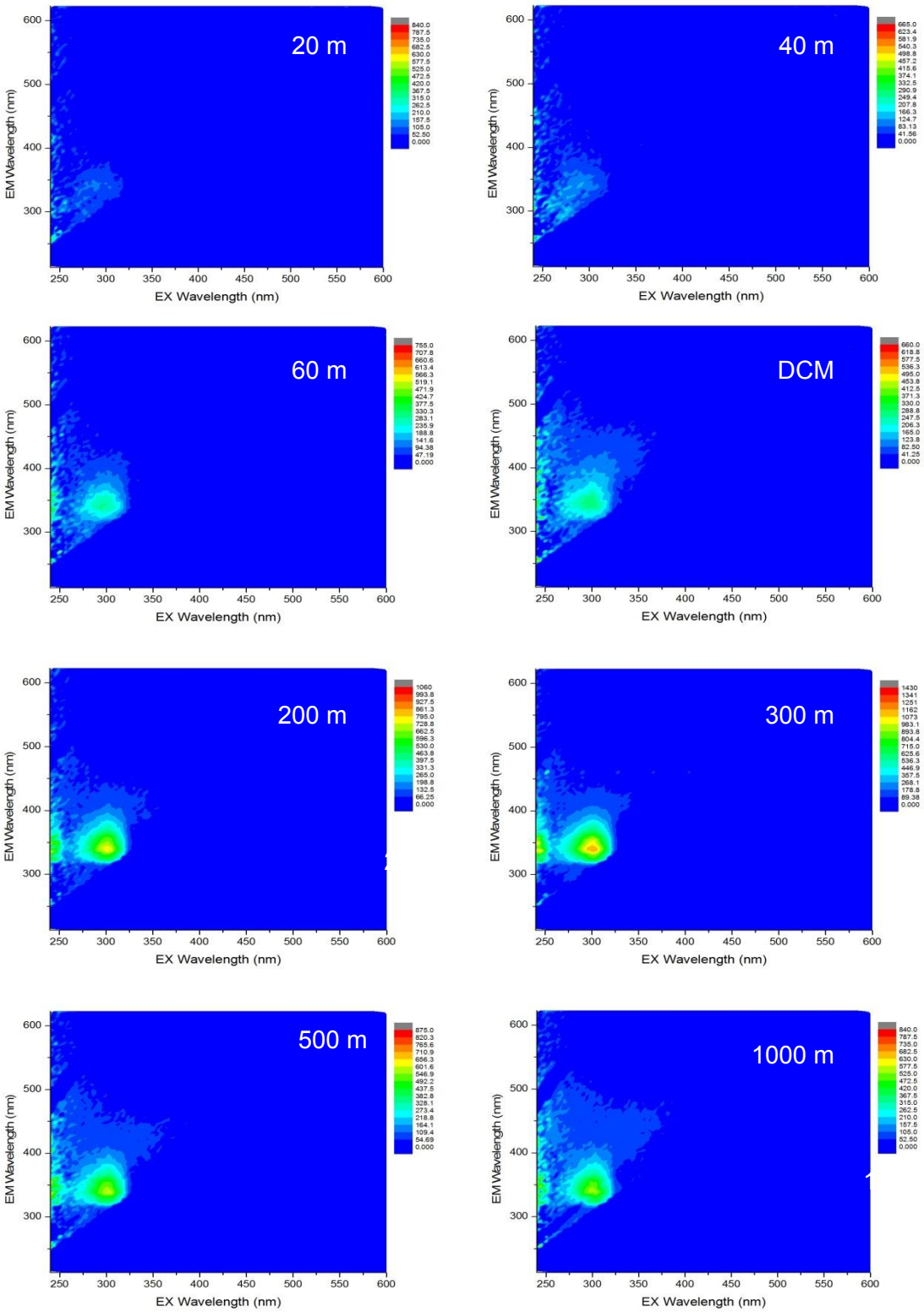


Figure 7.11: FDOM characteristics of station 3 in SPS between 20 and 1000 m depth. DCM: deep chlorophyll maximum.

Ocean Color Sensing

Water transparency and Forel-Ule (FU) color scale measurements were performed at almost every station. As shown on Figure 7.12 Secchi depth in the oligotrophic biogeographic provinces in the equatorial regions exceeded 40 m and decreased in the more eutrophic ones further north to <20 m. The Forel-Ule index exhibited inverse patterns.

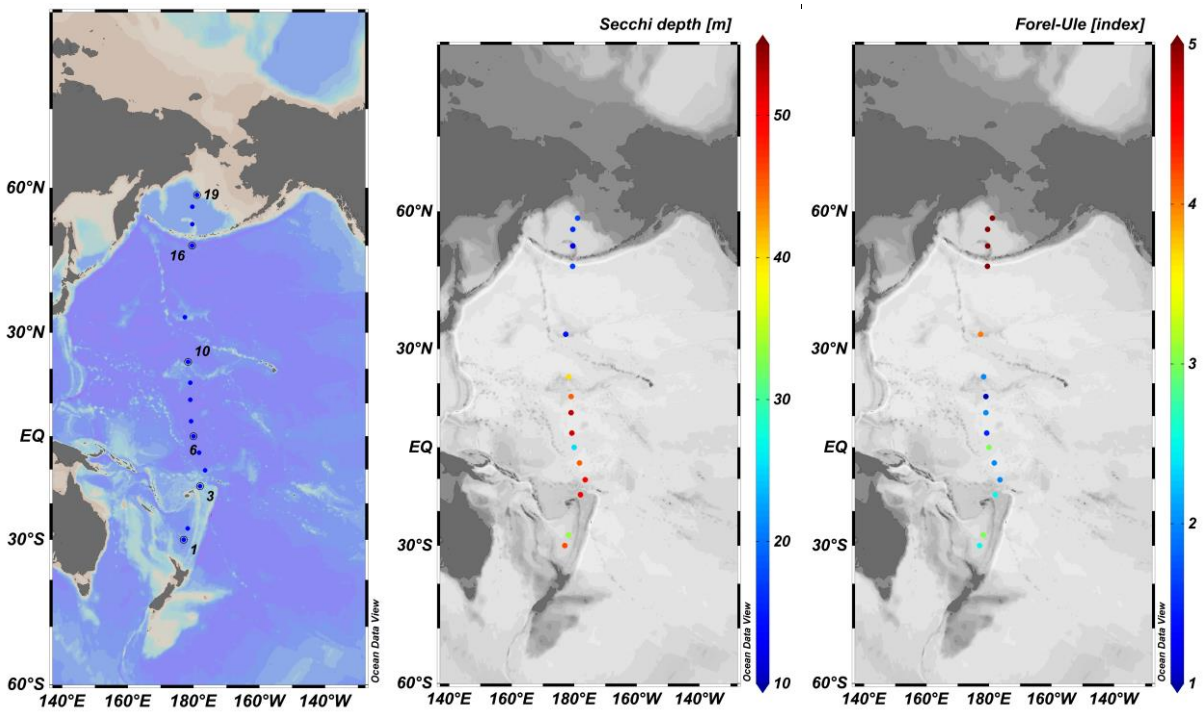


Figure 7.12: Station numbers (left), Secchi depth (central) and Forel-Ule index (right) of stations of cruise SO248. Due to bad weather or light conditions no observations were possible at station 11, and 13 to 15.

Data Management

All data will be transferred to the PANGAEA database as soon as they are available and quality checked. Depending on data type and progress of sample analysis, this will be done within 2-3 years. All datasets will be submitted to PANGAEA, allocated by the cruise identifier SO248.

7.3 Bacterioplankton cell numbers, biomass production and turnover rates of labile substrates.

(M Simon, I Bakenhus, S Billerbeck, N Bergen, F Mielke, L Wolter, M Wolterink, B Kuerzel, HA Giebel)

We aimed at a comprehensive assessment of the bacterioplankton community in the Pacific and its biogeographic provinces with a special emphasis on the Roseobacter clade and its major bacterioplankton subclusters. The work includes investigations of the biogeography, growth and population dynamics and the bacterioplankton community composition.

A list of investigated parameters is given in Table 5.1.

Methods

Our main work on shipboard was the collection and processing of water samples from depths between 20 and 1000 m. Samples were withdrawn from the Niskin bottles mounted on the CTD rosette from the mixed layer and the mesopelagic zones (for details on the CTD see chapter 7.1). Our sampling scheme included fixed depths between 20 and 200 m, the chlorophyll maximum and at "deep" stations also 500 and 1000 m. Samples for bacterial abundance, production and turnover of dissolved free amino acids and glucose were analyzed on shipboard. Bacterial abundance was assessed by flow cytometry and bacterial production and substrate turnover by radiotracer techniques and applying ^{14}C-leucine, ^{3}H-leucine, -glucose, –amino acids and -acetate. For details on the methods see Simon and Azam (1989) and Simon and Rosenstock (2007). In addition, samples for CARD-FISH and MAR-FISH analyses of the bacterial communities applying the same radiolabelled substrates were taken and processed for the upper 200 m. Further, samples for the analysis of dissolved free and combined amino acids and neutral sugars were collected, prefiltered through 0.2 µm polysulfon membranes (Gelman Acrodisc) and stored frozen until later analysis in the home lab by HPLC.

Preliminary Results

Bacterial cell numbers in the near surface layer ranged between 2 and 22x10^{5} cells ml^{-1} with a trend of increasing numbers from south to north, in particular at 20 and 60 m depth (Fig. 7.13). Bacterial biomass production and bulk growth rates were extremely low in the SPS and exhibited highest rates in the PSE and PNE at 20 m depth exceeding 2 per day (Fig. 7.13). In other tropical and subtropical regions bulk growth rates ranged between 0.3 and 1 per day with a trend of decreasing values further north in the colder water masses and biogeographic provinces. The extremely low rates of bacterial biomass production in the SPS and the high values in the PSE and PNE and generally decreasing values further north in the NPTG, NPF, PSAG and BER are well reflected in the integrated rates of bacterial biomass production of the upper 300 m of the water column (Fig. 7.14).

Turnover rates of dissolved free amino acids in the upper 100 m ranged from below 0.005 per day in the SPS to 0.8 per day in the equatorial region. Values in the colder regions further north were between 0.05 and 0.3 per day without a clear latitudinal gradient. In contrast, turnover rates or glucose and acetate exhibited a clear latitudinal gradient with increasing rates towards the PSAG and BER from below 0.05 to 0.2 per day.

Data management

All finally processed data will be stored on a server at ICBM, of TRR 51 and will be available on request if not otherwise mentioned. Most of the data will be published in international peer-reviewed journals.

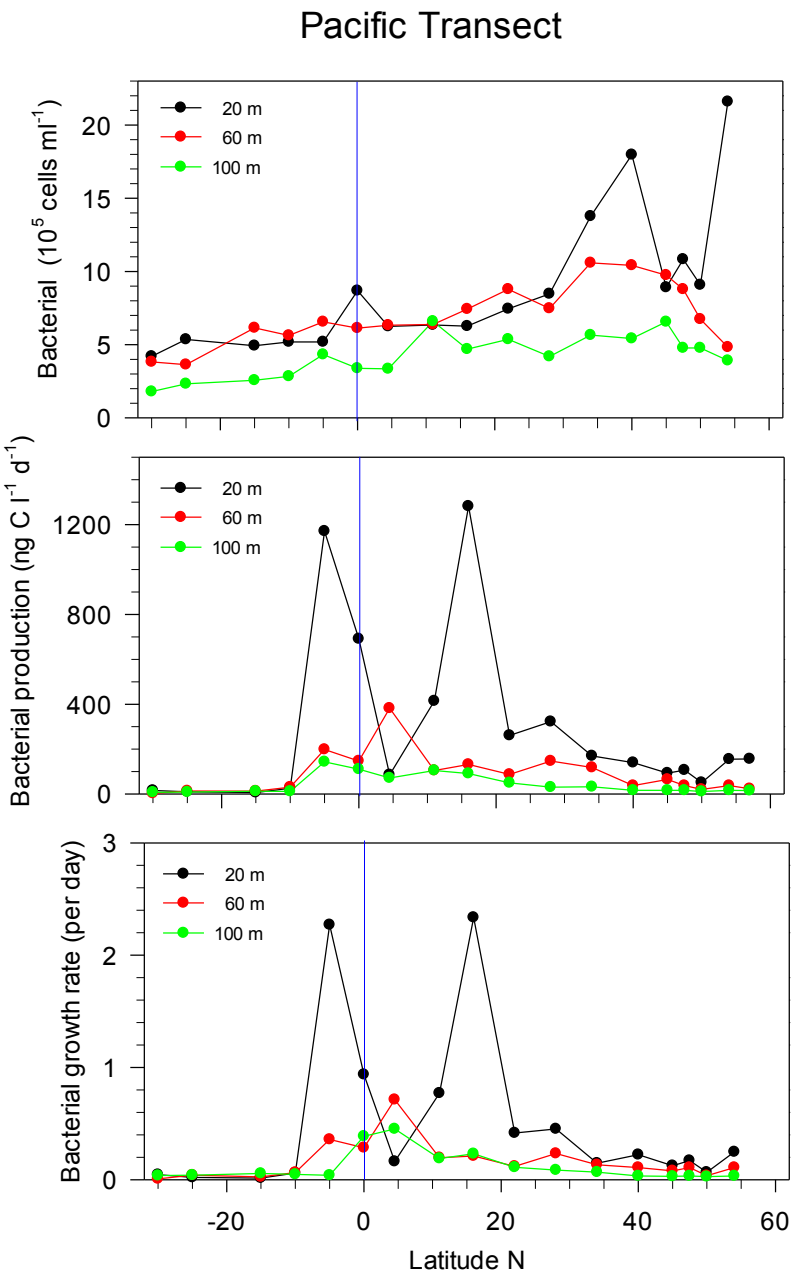


Fig. 7.13: Bacterial cell numbers (upper panel), biomass production (central panel) and bulk growth rates (lower panel) at 20, 60 and 100 m depth in the Pacific during cruise SO248.

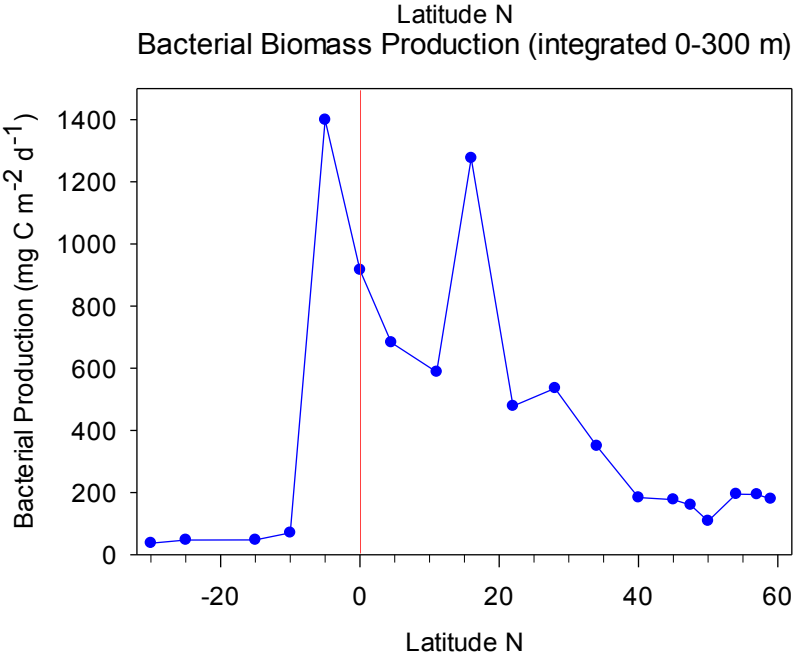


Fig. 7.14: Bacterial biomass production integrated from 0 to 300 m depth in the Pacific during cruise SO248.

7.4 Mesocosm experiments

(M Wietz, G Wienhausen, M Simon, M Dogs, M Wolterink, HA Giebel)

Mesocosm experiments were carried out to examine the response of the ambient bacterial communities in the SPS, the PNE and NPF to amendments of an exudate of the diatom *Thalassiosira rotula*, alginate and of vitamin B12 and a precursor.

Methods

Twenty-liter Nalgene carboys were filled with water from 20 m depth at station 2 (SPS) and station 14 (NPF) and from 40 m at station 7 (PNE). In one experiment two sets of triplicates were amended with the diatom exudates and incubated for 6 days, one set of triplicates and controls without amendment in the dark and the other set in a 12:12 light-dark cycle. In the second experiment, another set of triplicates was amended with alginate as a model polysaccharide and incubated in the dark for six days. In a third experiment vitamin B12 or a precursor and inorganic nutrients (nitrate, phosphate, silicate) was added to triplicates and incubated together with controls without any addition for six days in the dark. All incubations were at in situ temperature and subsampled periodically for bacterial abundance, bacterial biomass production and the vitamin experiment also for turnover rates of amino acids, phytoplankton and the alginate experiment also for turnover rates of glucose. After six days a large part of the remaining volume was filtered onto 0.2 µm filters for metagenomic and transcriptomic analyses of the bacterial communities.

Preliminary Results

Bacterial abundance in all experiments increased only little over time. However, bacterial biomass production increased over time in all experiments indicating that the bacterial communities did respond to the different amendments. However, the responses differed in the various biogeographic provinces. The response in the SPS was low and a short lag time, that in the PNE very rapid exhibiting highest rates and that in the NPF slow but steady over the entire incubation time.

The later analyses of the bacterial community composition will show which bacterial lineages responded and elucidate differences in the response patterns to the various amendments and incubations conditions, i.e. dark versus light:dark.

7.5 Extracellular Peptidase and polysaccharide activities

(C Arnosti, JP Balmonte)

The objective was to measure heterotrophic activities of microbial communities in the different biogeographic provinces and at different depths in order to determine the extent to which bio-geographic and depth-related differences in microbial community composition and genetic con-tent are reflected in activities of the extracellular enzymes that initiate the remineralization of organic matter.

Methods

We measured peptidase and polysaccharide hydrolytic activities at 8 stations (1, 2, 4, 6, 7, 10, 14, 16) and 5 different depths along the latitudinal transect. Peptidase activities at the surface and the DCM were also measured at the stations 3, 5, 8, 9, 11, 12, 13, 15 and 17. Further, hydrolytic activities of particle-associated (>3 um) bacteria were compared to whole-water ac-tivities at the 8 stations and 3 depths (surface, DCM, bottom water). Peptidase and polysac-charide hydrolytic activities were also measured in the mesocosms that were amended with a diatom exudate and alginate so that these activities can be related to the growth dynamics and composition of the bacterial communities responding to the added substrates.

Glucosidase and peptidase activities were measured using MUF and MCA-tagged small sub-strates (glucose; leucine; short peptides to measure trypsin and chymotrypsin activities) after the method of Hoppe (1983) and Obayashi & Suzuki (2008), although our measurements were made using a plate reader. Activities of polysaccharide hydrolyzing enzymes were measured with fluorescently-labeled polysaccharides, using the method of Arnosti (1995; 2003). Gravity-filtration measurements of enzyme activities were made by gravity-filtering water through a 3.0 um pore-sized filter, then cutting the filter into 12 equal portions for measurements of enzyme activity in duplicate, after D'Ambrosio et al (2014).

Preliminary results

We have compiled preliminary results for peptidase and β-glucosidase activities from the sur-face and DCM between stations 1 and 11 (30 S to 28 N). Rates and patterns of activities var-ied by location; across all substrates, activities were lower at St 1-3 and 11 than at St 4-10. For some substrates and sites (L-MCA at St 5, 7, 9 and 10; AAPF-chym at St 4, 5, and 7), activi-ties in the DCM exceeded those in surface water. Trypsin/chymotrypsin activities showed greater range and spatial variability than did leucine aminopeptidase activity. Trypsin activities in surface waters were notably high at St 3 and 4, whereas chymotrypsin activities were high at St 6 and 10. Ranges of these activities were a factor of 3 greater than for leucine aminopepti-dase (Fig. 7.15).

The raw data for the rest of the peptidase samples has been collected, but still need to be pro-cessed. All of the samples for polysaccharide hydrolase activities remain to be run (in excess of 10,000 samples); we have the capacity to analyze a maximum of 50 samples per day, and we have a backlog of samples from other cruises that are still in the pipeline. We estimate that we will complete running the samples on our HPLC/GPC system during the spring of 2017. Data analysis will commence at/after that time.

Data management

All of the raw data and processed data will be posted and stored on our lab's password-protected Sakai website, which is backed up and maintained by the University of North Caroli-na. After publication, data can be made publicly available also through public databases.

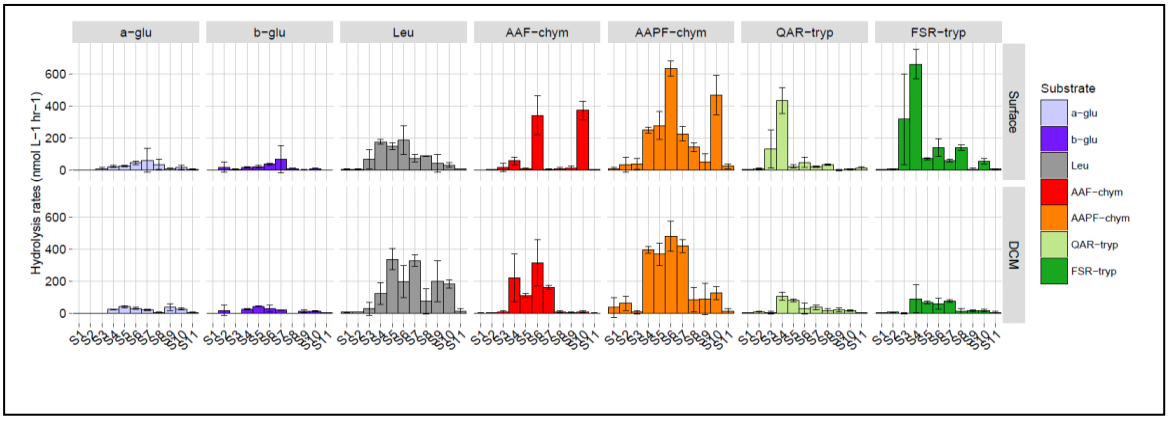


Fig. 7.15: Hydrolysis rates of α- and β-glucosidases, leucine-amino-peptidase, chymotrypsin and trypsin at 20 m depth (surface) and the deep chlorophyll maximum (DCM) at stations 1 to 11 of cruise SO248 in the Pacific.

7.6 Bacterioplankton biogeography and bacterial algal interactions

(I Wagner-Döbler, J Tomasch)

Algae-Bacterial Interactions

A topic still controversially debated in microbial ecology is the extend to which the microorganisms colonizing eukaryotes like corals and microalgae are stable symbionts selected for specific functions or the result of random attachment (Hester et al. 2016). We will use chlorophyll auto-fluorescence-activated cell sorting to isolate single phototrophic microalgal cells together with their attached microbial communities (the holobiont) from water samples of the photic zone. Multiple-displacement amplification (SDA) will be used to obtain DNA from the single holobionts. 16S rRNA gene amplification and next generation sequencing (tag-sequencing, amplicon sequencing) will be used to characterize the microbial communities from approx. 200 single microalgae holobionts. Statistical methods will be employed to determine the stable and variable part of the community (Hester et al. 2016). Based on these results, the metagenomes of algal cells with highly similar as well as divergent microbiomes will be analyzed in order to reveal how community divergence influences functional diversity or conservation.

Bacterioplankton biogeography

Deep sequencing of the 16S rRNA gene of bacteria and chloroplasts from microalgae will be used to determine the composition of microbial communities in the epipelagic zone of the latitudinal gradient crossing the biogeographic provinces. Water samples will be fractionated into three size classes by sequential filtration to determine the influence of particle size on biogeographic patterns and to compare bacterioplankton communities associated with microalgae to free-living ones. The same approach has previously been used for the Atlantic Ocean (Milici et al. 2016a, b, c). The data will serve as a background for interpreting the results of single holobiont sequencing.

Diel changes in gene expression

Bacteria in the photic zone of the oceans adapt their transcriptional activity to the diel regime (Ottesen et al. 2013, 2014). We will use a data set of the two 24 h time-series with sampling

intervals of three hours to analyze the transcriptional activity patterns of the bacterioplankton using Illumina RNA sequencing.

Methods

Unfiltered CTD water samples for single cell sorting, subsequent 16S rRNA gene sequencing and metagenomics were obtained at 20 m and 60 m at each station along the cruise. Samples were cryo-conserved using three different protocols (glycine-betaine, glycine-betaine and TE, glycerol).

At each station the water column was sampled at 20, 40, 60, 100, 200, 500, and 1000 m depth. The DCM was additionally sampled if it differed from the standard depths by more than 5 m. Samples (10 L) were sequentially filtered from 8 µm to 3 µm to 0.22 µm to separate the plankton into three size fractions (large particle associated, small particle associated and free living bacteria). For RNA extraction, 20 L water samples were taken at 60 m depth and the DCM.

At two stations (0.00 N and 50.00 N) 20 L water samples were taken over a 24 h period every three hours at two depths (20 m and DCM) and filtered as above.

All samples were stored at -80°C until further analysis in the home lab.

Data management

Raw data will be sequenced by the Genome Analysis group of the HZI. Raw and processed data will be stored on HZI servers. Analyses will be stored on the servers of the group Microbial Communication and published in international peer reviewed journals. Raw and processed data will be made publicly available on the European Nucleotide Archive (http://www.ebi.ac.uk/ena) upon publication.

7.7 Population structure and divergence in the Roseobacter group

(HM Freese, A Methner, C Lepleux)

Bacteria of the *Roseobacter* group are abundant and widely distributed in marine systems as well as physiologically and phylogenetically highly diverged which suggests that adaptation and selection have been the major drivers of their evolution. Exclusively surface-associated *Phaeobacter* species from the *Roseobacter* group showed clade-specific preferences in association with a host or environmental resource patches. Their population structure and evolutionary mechanisms differed to so far investigated pelagic *Prochlorococcus* and *Pelagibacter* but also to vibrios which switch between free-living and associated lifestyles. This leads to the question if this population structure and these evolutionary mechanisms are representative for the *Roseobacter* group even at different hierarchical levels or for a specific lifestyle. Therefore, the relevance of these evolutionary mechanisms and the ecological niches of the intraspecific genome based cluster will be elucidated for closely related genera, like *Pseudophaeobacter*, which occur associated and in sediments as well as the distantly related genome streamlined pelagic *Roseobacter* clade affiliated (RCA) cluster.

Methods

At all stations ≥30°N 9 water samples from 20 m depth were amended with glycine betaine and frozen at -80°C for later cultivation independent population genomic analysis of the RCA cluster *via* single cell genomics. In parallel, bacteria from large volumes (Fig. 7.16) were size

fractionated and concentrated onto membrane filter (0.2 µm, 3 µm, 10 µm) with a McLane WTS-LV Sampler in situ at 20 m depth and frozen at -80°C for later DNA and RNA extraction.

To elucidate physiological potential and niches of subpopulations of various species of the *Roseobacter* group water samples from 20 m, the DCM or 100 m and 500 m were incubated with 14 different substrates in combination with 5-Ethynyl-2'-deoxyuridine (Click-iT®) in microcosm experiments at 11 stations. After 6 h incubation, cells were harvested, fixed, washed and permeabilized on board and frozen for further processing at home. At three stations surface samples were additionally incubated with 3 different CNS substrates in mesocosms, filtered, fixed and frozen for later RNA extraction.

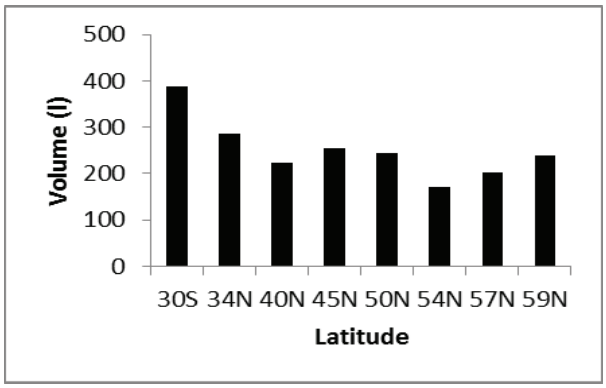


Fig. 7.16: Volumes of surface water filtered with the McLane in situ pump within 3 h at stations ≥30°N

To enrich strains closely related to *Phaeobacter*, samples of the surface sediment, zooplankton concentrated by a 100 µm or 300 µm Bongo net were incubated in replicates of serial dilutions using a general and a specific medium over the transect. After at least 10 days of continuously incubation at 15°C, 96 well plates with grown wells were subject to a specific PCR and screened by gel electrophoresis. Positive single wells were streaked on agar plates, transferred into fresh medium and cryo-preserved which will be continued at home.

Preliminary Results

Overall, 328 enrichments in 96 deep well plates and 40 agar plates of exemplary stations were inoculated. Bacteria were readily enriched from plankton samples over the whole transect but only exceptional growth was observed in sediment enrichments so far. However, further growth of the sediment enrichments is expected in the next weeks. *Phaeobacter* related bacteria did not dominate the plankton enrichments but 11% of the so far 131 screened 96 well plates contained at least one strain. From one larger crab, already 5 different bacteria from the *Roseobacter* group with a 16S rDNA similarity of 97 – 93% to *Phaeobacter* were isolated which may point to an organism dependent association of *Roseobacter* bacteria. However, this has to be verified when screening, isolation and molecular analysis of all enrichments are completed. Depending on the isolation success, selected bacterial strains will be genome sequenced and their population genomics analyzed.

The result of the cultivation independent population genomic analysis and of the substrate dependent physiological potential of bacterial subpopulations in 460 assays will become available after processing of the samples (single cell genomics, metagenomics and transcriptomics as well as counting, sorting and sequencing of active (i.e. fluorescing cells) in the laboratories at home after several months.

Data management

The results will be published in international peer-reviewed journals and molecular data will be submitted to the respective data base (e.g. NCBI).

7.8 Microbial abundance, diversity and activity in Pacific deep sea sediments

(M Pohlner, J Degenhardt, B Engelen)

For the analysis of seafloor sediments along the SO248 transect, we followed three main objectives: First, we wanted to determine if the site-specific conditions of the biogeographic provinces in the water column are reflected by the microbial abundance and diversity at the seafloor. Second objective was to compare enzymatic activities of benthic communities along the transect. To identify the role of benthic viruses in shaping microbial community structures and supporting microbial turnover by the viral shunt was the third objective.

The following questions will be addressed:

- Are there regional microbial distribution patterns and is there an overlap in diversity between sediments and the overlying waters?
- Which factors specifically trigger the distribution, abundance and diversity of the *Roseobacter* group in marine sediments?
- Are the environmental settings at the seafloor reflected by exo-enzyme activities of phosphatase and amino peptidase?
- Which members of the benthic communities are affected by viral lysis and which part takes advantage of the viral shunt?

Methods

To answer the above-mentioned questions, samples from seafloor sediments were taken by a MUC at 10 stations along the transect (Table 7.1). The water depth of the sites ranged between 3258 and 5909 meters below sea level (mbsl). At all sampling sites, sufficient amounts of sediments were recovered. However, the surface layer of site 18 was lost as the MUC penetrated too deep into the seafloor. Due to the tight time schedule of the cruise, no further attempts were made to sample this station.

Tab. 7.1: Position and depth of sediment sampling sites of cruise SO248.

Station	Date	Latitude	Longitude	Depth (mbsl)
2	04.05.16	26° 59,6' S	178° 13,8' E	4185
4	08.05.16	10° 20,0' S	176° 28,5' W	4130
6	11.05.16	0° 1,9' S	179° 59,4' W	5285
8	15.05.16	10° 58,0' N	179° 0,1' E	5402
10	18.05.16	21° 58,0' N	178° 19,0' E	3258
12	21.05.16	33° 58,4' N	177° 20,5' E	3486
14	24.05.16	45° 0,0' N	178° 45,0' E	5909
16	26.05.16	49° 60,0' N	179° 33,0' E	5621
18	29.05.16	56° 60,0' N	179° 35,0' E	3811
19	30.05.16	58° 54,5' N	178° 55,8' W	3300

At all stations, subsamples were regularly taken from the seafloor and 20 cm below seafloor (cmbsf). Aliquots were processed for total cell counting and phosphatase and amino peptidase activity measurements by applying fluorescently labelled model substrates, both performed directly onboard. For later analyses, subsamples were taken for virus counting, CARD-FISH quantification, DNA/RNA-extraction, inorganic sediment composition, sediment density and porosity. Porewater was collected separately form the respective sediment layers to analyse the concentrations of phosphate, DOC, amino acids, mono- and polysaccharides as well as high-resolution DOM composition. To investigate the viral shunt in seafloor sediments, phage-induction experiments were performed with samples from sites 6 and 10. A third experiment was set-up with samples from site 19, but was started two weeks after return to the homelab. The experiments will be evaluated in the frame of a Master thesis.

Preliminary results

The sediment cores showed a large variety in texture and colour indicating different elemental sediment compositions (Fig. 7.17). A detailed geochemical description will be performed at ICBM in the frame of a Bachelor thesis.

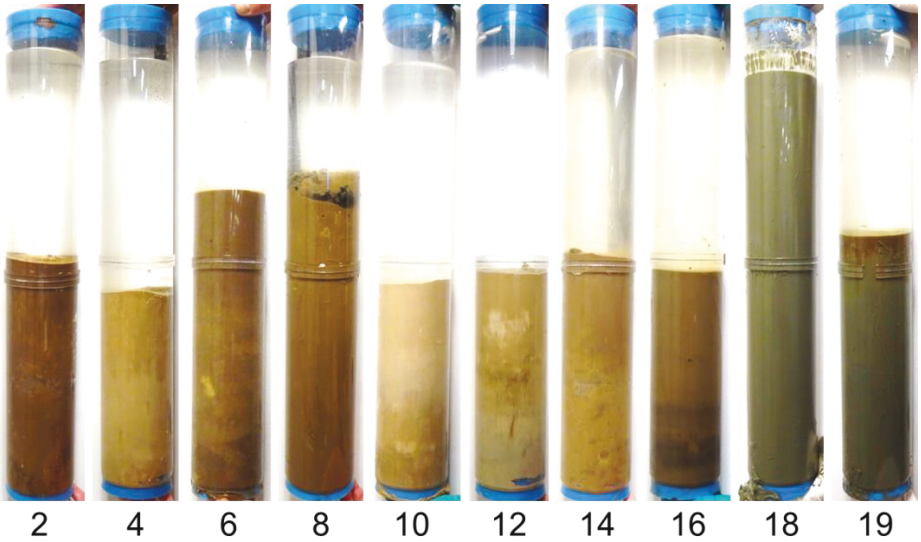


Fig. 7.17: Representative sediment cores from the SO248 transect. Numbers correspond to the stations. At station 18, the surface layer was lost due to overfilling the core-liner.

Total cell counts at the seafloor were in the range of 10^8-10^9 cells cm^{-3} (Fig. 7.18). Covarying with the productivity in the overlying water column, they increased from station 8 to 19 with highest numbers in the highly productive Bering Sea. Cell counts at 20 cmbsf decreased by one to two orders of magnitude at all stations.

The results of the direct counting will be confirmed and extended within the frame of a Master thesis by specific quantification of *Bacteria* and the *Roseobacter* group using CARD-FISH and quantitative PCR targeting the 16S rRNA gene. Accordingly, all samples will be subjected to next generation sequencing to determine the microbial diversity with special focus on the *Roseobacter* group. Data from this diversity analysis will be compared to metagenomic and metatranscriptomic studies (see chapter 7.9).

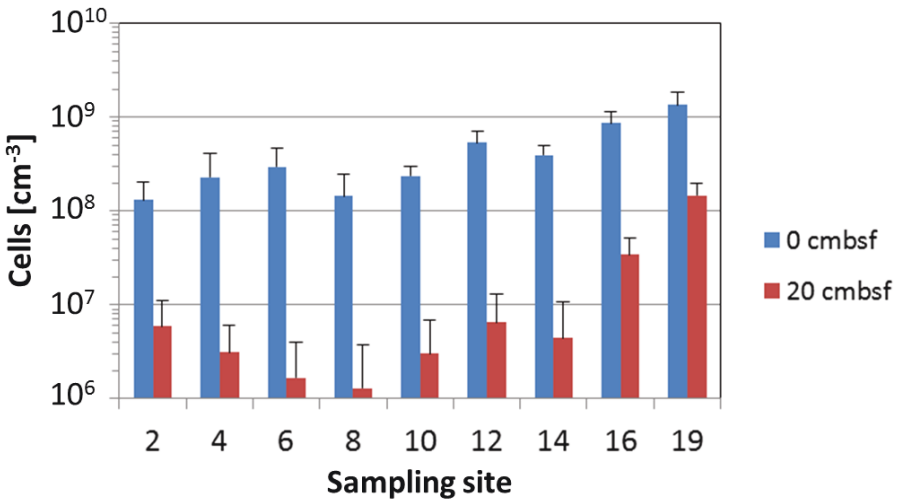


Fig. 7.18. Total cell counts along the SO248 transect. Cells were counted onboard by epifluorescence microscopy using SybrGreen as fluorescent dye.

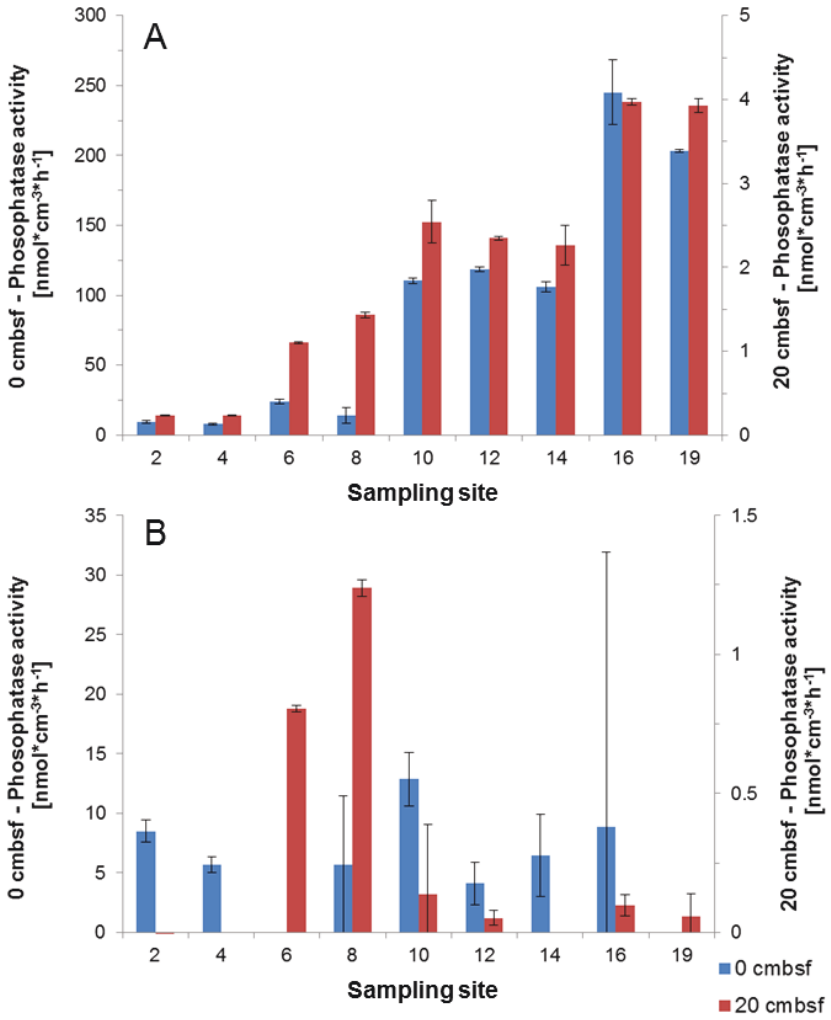


Fig. 7.19. Phosphatase activities along the SO248 transect at the stations indicated (sampling site). A: Total activities; B: Background-corrected activities. Left Y-axis: Surface samples; Right Y-axis: samples from 20 cm bsf. Note the different scales of the y-axes.

While the total phosphatase activities show a trend of increasing values from south to north (Fig. 7.19a), the assay was biased by a relatively high background-activity of the heat-inactivated control. This phenomenon was also found previously for deep-subsurface sediments of the South Pacific Gyre (unpublished data) and will further be investigated. The background-corrected activities (Fig. 7.19b) were roughly tenfold lower than total activities.

Aminopeptidase activities reflect the ability of benthic microbial communities to degrade proteins and to potentially use them as substrates. The aminopeptidase activities were not influenced by unspecific protein degradation as visualized in Fig. 7.20a and b. Generally, the benthic communities also showed increasing activities from south to north with higher activities at the seafloor in comparison to the deeper layer. The results will be correlated to the other hydrolytic activities of other biopolymers obtained by C Arnosti (see chapter 7.5).

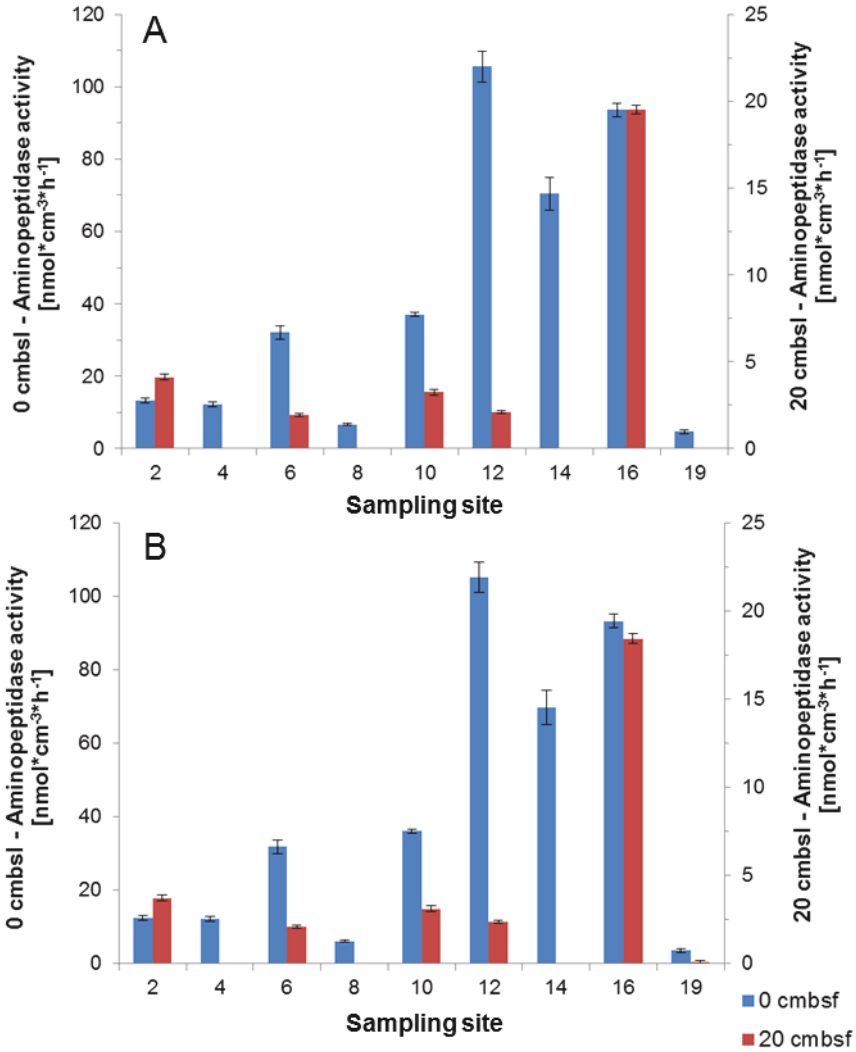


Fig. 7.20. Aminopeptidase activities along the SO248 transect. A: Total activities; B: Background-corrected activities. Left Y-axis: Surface samples; Right Y-axis: samples from 20 cmbsf. Note the different scales of the y-axes.

Data management

The results will be transferred to a database which will be available for the other cruise participants and finally published in international peer-reviewed journals.

7.9 Metagenomic, metatranscriptomic and metaproteomic analysis of bacterial communities in the water column and surface sediment

(B Wemheuer, A von Hoyningen-Huene, L Wöhlbrand)

The aim was to investigate the diversity and function of the *Roseobacter* clade and other marine microbes along the longitudinal transect from the SPS at 30°S to BER at 59°N. Community structure and diversity are assessed by community barcoding using universal primers for bacteria and archaea. Furthermore, the potential and functions of the microbial communities will be assessed using comparative metagenomic, metatranscriptomic and metaproteomic approaches.

Methods

Water samples were taken at ever station from 20 m depth, the DCM and 300 m depth from the Niskin bottles. A total of 40 L per depth were pre-filtered through a 20 µm nylon net in order to remove large particles and micro- and macroplankton. For DNA and RNA analysis, bacterioplankton was harvested by serial filtration of 20 L of prefiltered sea water using a 2.7 µm glass fibre filter (Whatman GF/D, GE Healthcare, Freiburg, Germany) followed by a filter sandwich consisting of a 0.7 µm glass fibre filter (Whatman GF/F, GE Healthcare) and a 0.2 µm polycarbonate filter (Whatman Nuclepore, GE Healthcare). Particle-associated bacterioplankton was caught in the 2.7 µm filter while the free-living community was caught in the filter sandwich. For proteome analysis, the remaining 20 L of seawater were prefiltered using the 2.7 µm glass fibre filter. The free-living bacterioplankton was subsequently harvested on four 0.2 µm (47mm diameter) polyether sulfone filters (Satorius, Göttingen, Germany). After filtration, all filter samples were stored at -80°C until further analysis.

At the two 24 h time series stations, samples were collected in a 3 hours' routine in a similar way as described for proteomic analysis. In case of these samples, six 0.2 µm polyether sulfone filters were used for filtration of approx. 40 L of sea water. Four filters will be used for proteome analysis and two filters for DNA extraction to allow for the construction of a station-specific metagenome-based protein database for protein identification.

Moreover, a total of 6.5 L of oxygen-depleted water of detected oxygen minimum zones (OMZ) was collected at stations 6, 7, 8 and 17. In addition, 24 bottles containing 80 ml anoxic seawater medium were inoculated on board with 4 ml collected from the OMZ. Samples of anoxic or oxygen depleted sediments were collected at stations 18 and 19 and covered with anoxic seawater medium. These samples are designated for starting enrichment cultures in the home laboratory.

In addition to water samples, sediment samples were collected at the sediment surface as well as at 20 cm depth for metagenomic and metaproteomic analysis. For each sampling station and sediment depth, around 5 g sediment were collected in quadruple and stored at -80°C.

Functional Community Fingerprints

To obtain a functional fingerprint of the microbial community inhabiting ocean surface waters, approximately 400 µl of the 2.7 µm filtered seawater were incubated for three days at 15°C in 48 deep well plates containing 50 µl of different nutrient solutions, sugars, trace elements or vitamins in triplicates, with artificial seawater as a control. After incubation, DMSO was added and the plates were frozen at -80°C until further use. Changes in community structure will be assessed by community barcoding.

Preliminary results

In the course of the cruise, a total of 57 and 114 filter samples were obtained for metagenomic and metatranscriptomic analysis of the particle-associated and free-living bacterioplankton communities. DNA and RNA will be extracted and purified. For metagenomic analysis, isolated DNA will be directly sequenced using a HiSeq 4000 (Illumina, Madison, USA). In addition, the DNA will be used as a template in PCRs targeting bacterial and archaeal 16S rRNA genes. Obtained PCR products will be sequenced using a MiSeq sequencer (Illumina, Madison). For metatranscriptomics, ribosomal RNA will be depleted in total envrionmental DNA. Obtained RNA will be converted to cDNA and sequenced using a HiSeq 4000 (Illumina, Madison, USA). In addition, the structure of the putatively active bacterioplankton community will be assessed by sequencing of 16S rRNA transcripts generated from total environmental RNA.

A total of 324 filters were collected for meta-proteomic analysis of the bacterioplankton: 228 at the regular stations and additional 96 filters at the 24 h sampling campaigns. In addition, 72 sediment samples were collected at nine distinct sampling stations. Filter and sediments samples will be subjected to cellular lysis, protein extraction, generation of peptides per sample and analysis by mass spectrometry. Final protein identification will be based on the metagenome/-transcriptome-based protein sequence database generated from the same samples.

Data management

Sequence data generated by community barcoding and sequencing of environmental DNA and RNA will be made publically available by submission to the Sequence Read Archive (SRA) of the National Center for Biotechnology Information (NCBI). Subsequent to protein identification and publication of respective data, the obtained proteomic data will be made publicly available via appropriate proteomic databases (e.g. proteome exchange) or own server structures if necessary.

7.10 Dissolved Organic Matter

(J Niggemann, B Noriega-Ortega, M Hinrichs, T Dittmar)

It is unknown whether and if so how the composition of the DOM pool reflects the different biogeographic provinces in general and in particular in the Pacific Ocean. Further, the DOM pool in the water masses of the dark Pacific, the oldest water oceanic masses (Hansell 2013) is till vey poorly characterized. Therefore the objective was to characterize the DOM pool in these waters. Together with other physical and biological parameters, i.e. characterizing the microbial community growth dynamics and composition, investigated on this cruise we will be able to shed light on controls of the DOM patterns.

Methods

For the bulk DOM characterization, water samples (4 L) from most depths of all stations covering the entire water column were withdrawn from the Niskin bottles, passed through GF/F glass fiber filters (precombusted 400°C, 4 h, Whatman, Maidstone, UK) and acidified to pH 2. Duplicate subsamples for dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) will be analyzed as non-purgeable organic carbon by high temperature catalytic combustion using a Shimadzu TOC-VCPH/CPN instrument equipped with a TNM-1 module in the home lab. In order to desalt and concentrate the marine DOM for the analysis of the molecular composition, the remaining sample was solid-phase extracted using commercially available modified styrene divinyl benzene polymer columns after Dittmar et al. 2008 (PPL, Agilent, Santa Clara, CA, USA). The obtained DOM extracts will be analyzed upon arrival in the home lab on a 15 tesla FT-ICR-MS (Bruker Daltonics, Billerica, MA, USA) equipped with an electrospray ionization source (Bruker Apollo II).

Selected samples from the main stations were filtered, frozen, and shipped to Aron Stubbins and Leanne Powers at Skidaway Institute of Oceanography (Savannah, Georgia, USA). Apparent quantum yield (AQY) spectra, defined as moles DBC lost per moles photons absorbed by CDOM will be obtained. These describe the efficiency of DBC loss and can be used in ocean color based models to estimate its loss on regional/global scales. Coupling the photochemical model with a physical model will allow for a better assessment of the supply (upwelling of deep DBC rich waters) and subsequent photochemical loss in the sunlit waters.

Preliminary results are not yet available.

7.11 Dark ocean microbial biogeography

(T Reinthaler, C Amano, B Bayer , RH Hansman, E Sintes, M Pinto, C Baranyi, GJ Herndl)

About 75% of the ocean is deeper than 200 m, however, most concepts on the interaction between the physical and chemical environment and the biota are derived from the relatively thin ocean surface layer. Moreover, the link between prokaryotic activity and biogeochemistry in the dark ocean is not firmly established despite recent studies that highlight the role of Bacteria and Archaea in the cycling of organic and inorganic matter in the dark ocean (Baltar et al. 2009, Herndl et al. 2005, Reinthaler et al. 2006). Among others, the observation that the most important source of substrate for prokaryotes, i.e., DOC, is not depleted (Barber 1986) led to the longstanding view that microbes in the deep are dormant or even dead (Jannasch and Wirsen 1973). This paradigm is challenged, however, by recent evidence suggesting that prokaryotes in the dark ocean are as active (or even more active) on a per-cell level as compared to the sunlit surface (Kirchman et al. 2007, Reinthaler et al. 2006, Varela et al. 2008).

Despite the major insights gained from studies on microbial activity in the surface ocean, knowledge on the microbial processing of organic matter and nutrients in the dark ocean is still in its infancy due to the lack of data. For this reason, the IPCC called attention to the fact that it is not possible to parameterize prokaryotic activity for an enhanced understanding of the global ocean carbon cycle (Intergovernmental Panel on Climate Change 2001) and an interdisciplinary workshop of experts on integrating biogeochemistry and ecosystems in a changing ocean emphasized to study the interactions of the physics, chemistry and biology on an interdisciplinary basis (IMBER IMBIZO http://www.imber.info/IMBIZO1.html).

Thus, the objectives here are to establish a biogeography of microbial diversity and activity in the meso- and bathypelagic waters of the Pacific which is a particularly under-sampled ocean.

Methods

Prokaryotic heterotrophic production

Samples for prokaryotic heterotrophic production were taken from Niskin bottles at all “deep” stations at depths ranging from 200 m to 10 m above sea floor (see Table A3 in appendix). Occasionally, a sample was also taken from the supernatant of the MUC. Triplicate life and 2 control samples were incubated in glass vials. Microbial heterotrophic production was measured by incubating 20–40 mL of seawater with 5 nM ^{3}H-leucine (final concentration, specific activity 120 Ci mmol^{-1}, ARC) in the dark at in situ temperature (±1°C) for 5 to 24 h. Incubation times and volumes were chosen according to the sampling depth and based on previous experience. Duplicate formaldehyde-killed blanks were treated in the same way as the samples. Incubations were terminated by adding formaldehyde (2% final concentration) to the samples. Samples and blanks were filtered through 0.2-µm polycarbonate filters (Whatman Nuclepore, 25 mm filter diameter) supported by cellulose acetate filters (Millipore HA, 0.45-µm pore size). Subsequently, the filters were rinsed with 5% ice-cold trichloroacetic acid and with Milli-Q. Fil-ters were dried, 8 ml of scintillation cocktail (FilterCount, Canberra-Packard) added, and after about 18 h measured on board by liquid scintillation counting (Perkin Elmer Tricarb).

MAR-FISH

Samples for fluorescence in situ hybridization combined with microautoradiography were incubated in plastic tubes (Greiner Bio-One). To volumes between 20 mL and 80 mL (depending on the depth) ^{3}H-leucine was added (5 nM final concentration), similar to the activity measurements. After 5 to 24 h the samples were fixed with 2% filtered formaldehyde and incubated for up to 18 h at 4ºC to fix the cells. Subsequently the samples were filtered onto 0.2-µm polycar-

bonate filters (25 mm diameter, Millipore GTTP) and rinsed with Milli-Q. The filters were placed into 2 mL microfuge tubes and dried. Finally, the tubes with the filters were frozen at -80ºC until analysis in the home laboratory.

Abundance of active bacteria in the dark ocean (Click-it

To evaluate the active prokaryotic community in the dark ocean seawater samples were withdrawn at all "deep" stations from the Niskin bottles at most depths at 100 m and below into acid-washed polycarbonate bottles. Duplicate 15 mL water samples were transferred into 15 mL sterile tube (Greiner Bio-One) and incubated with either homopropargylglycine (HPG) or 5-ethynyl-2'-deoxyuridine (EdU) (20 and 40 nM final concentration, respectively) at in situ tem-perature (±2ºC) for 10-24 h (see Table A3, appendix). Duplicate 1 mL subsamples were col-lected at the beginning and end of the incubation in 1.5 mL tubes, fixed with glutaraldehyde (0.5% final concentration) and stored at -80ºC. These samples will be used to evaluate the active prokaryotic abundance by flow cytometry. The remaining volume was stored at -80ºC after adding 0.2-µm filtered Glycerol TE buffer (10% final concentration) for single-cell ge-nomics. Further analysis will be conducted in the home lab.

DIC fixation

DIC fixation by deep ocean microbes was measured through the incorporation of ^{14}C-bicarbonate. Samples were collected between 200 m to either 1000 m or 2000 m depth de-pending on the station (Table A3, appendix). Seawater was collected from Niskin bottles and split into triplicate 40 ml samples and duplicate blanks in 50-ml plastic screw-top tubes (Greiner Bio-One). 50 µCi of ^{14}C-sodium bicarbonate in 50 µl pH 9 Milli-Q water was added to each tube. Blanks were killed by adding 2.5 ml formaldehyde (2% final concentration) prior to substrate addition. All samples and blanks were incubated at in situ temperature for 48 to 72 h. Samples were terminated by adding formaldehyde (2% final concentration) filtered along with the blanks through 25 mm 0.2-µm polycarbonate filters (Whatman Nuclepore) supported by 0.45-µm cellulose acetate filters (Millipore HA). Sample tubes and filters were rinsed twice with 10 ml 0.2-µm filtered seawater. Filters were then exposed to fuming HCl for 20-24 h, before being placed in 20-ml scintillation vials with 8 ml scintillation cocktail (FilterCount, Canberra-Packard). After approximately 18 h, samples were counted on board in a liquid scintillation counter (Perkin Elmer Tricarb).

Additional experiments on bicarbonate uptake by the autotrophic prokaryotic community were also conducted at several stations and depths. One of these types of experiments was to determine the contribution of ammonia oxidizing Archaea to bulk DIC fixation by inhibiting ammonia oxidation through nitric oxide scavenging with 2-phenyl-4,4,5,5,-tetramethylimidazoline-1-oxyl-3-oxide (PTIO, Sigma; Martens-Habbena et al. 2015). PTIO was added to selected seawater samples (Table A3, appendix) at 100 µM final concentration for at least 30 min prior to substrate addition, and incubations then proceeded as described above. In separate experiments, the effect of temperature on bicarbonate uptake was determined by incubating deep seawater samples with bicarbonate additions at 20˚C (Table A3) rather than at in situ temperature.

MAR-FISH samples for bicarbonate uptake were collected as detailed above at stations and depths indicated in Table A3. One hundred µCi of ^{14}C-sodium bicarbonate was added to 80 ml seawater for 48-72 h.

Amino acids

Samples were collected for dissolved amino acids concentrations throughout the water column at deep stations (Table S2, appendix). Duplicate samples of 2 ml seawater were filtered through 0.2-µm syringe filters (Acrodisc, Pall) into pre-combusted 4-ml amber glass vials and then frozen at -20˚C for analysis in the home lab.

Prokaryotic Abundance

Water samples were collected at every deep station from the surface to the bottom layers (Table S2, appendix). Duplicate 1.8 mL samples were fixed with glutaraldehyde (final concentration 0.5%), frozen in liquid nitrogen, and stored at -80°C. The abundance of prokaryotes will be measured in the home lab by flow cytometry after nucleic acid staining with SYBRGreen.

CARD-FISH

Samples for Catalyzed reporter depositions fluorescence in situ hybridization (CARD-FISH) were fixed with 2% filtered formaldehyde in plastic tubes (Greiner Bio-One) in volumes between 20 mL and 80 mL (depending on the depth) and incubated for 12-18h. Subsequently, samples were filtered onto 0.2-µm polycarbonate filters (25 mm diameter, Millipore GTTP) and rinsed with Milli-Q. Filters were placed into 2 mL microfuge tubes and dried. Finally, the tubes with the filters were frozen at -80ºC until analysis in the home lab.

DNA samples

Samples for DNA and RNA analysis were taken at all deep stations between 200 m depth and 10 m above sea floor (Table S2 appendix). Depending on the depth, between 1 and 5 L were filtered onto 0.2-µm polycarbonate filters (47 mm diameter, Millipore GTTP) in duplicate, using a peristaltic pump. After filtration, filters were folded and placed into microfuge tubes, flash frozen in liquid nitrogen and stored at -80ºC. In the home lab, DNA and RNA will be extracted for biodiversity analysis.

Genome analysis of single cells

Samples for single cell DNA analyses were taken at depths ranging from 100 m to 5000 m depth. One mL was cryo-preserved with 100 µl GlyTE Buffer for 5 min and subsequently frozen at -80°C. Samples will be shipped to the Single Cell Genomics Center at the Bigelow Laboratory for Ocean Sciences for sequencing.

High volume sampling for proteomics and exoproteomics

At 4 stations high volume samples were taken for later proteomics and exo-proteomics analysis. For 500 and 2000 m depth 250 or 480 L were collected in Niskin bottles and transferred to several 80 L barrels. The raw seawater was pre-filtered over a 3.0 µm (147 mm diameter, Millipore) and a 1.0 µm (293 mm diameter, GE Water Tech) polycarbonate filter using positive pressure diaphragm pumps (Verderair Cont-EX). The pre-filtered seawater was filtered onto a 0.2-µm Durapore membrane (293 mm diameter, Millipore). Initially, the permeate was concentrated to ~1 L using an ultrafiltration system with a pore size of 5000 Da and 0.5 m^2 filtration area (Millipore Pellicon Ultrafiltration System). This volume was further concentrated to ~30 mL using a small scale 5000 Da ultrafiltration cassette (Vivaflow Sartorius). The final concentrate was flash frozen in liquid nitrogen and stored at -80ºC. In the home lab the proteins from these samples will be extracted and analyzed using an nanoLC-MS/MS approach.

Preliminary results

Leucine incorporation in the dark ocean decreased by one to two orders of magnitude relative to the epipelagic zone (Fig. 7.21). This trend was obvious for all stations irrespective of the biogeographic province and water mass. In near-bottom samples, leucine incorporation deviated occasionally substantially from this exponentially decreasing trend with depth.

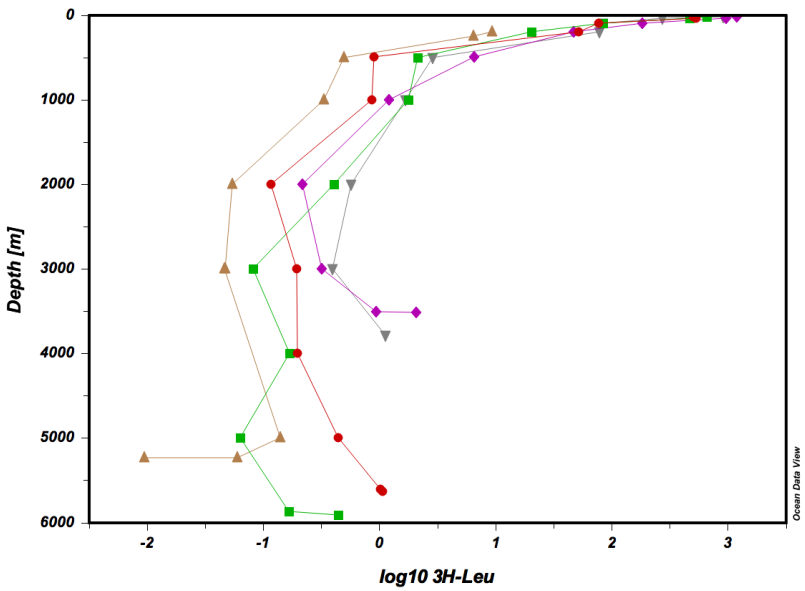


Fig. 7.21: ^{3}H-Leucine incorporation in the entire water column down to 10 m above seafloor at selected stations of cruise SO248.

DIC fixation varied greatly vertically and along the transect (Fig. 7.22). Highest values occurred in the SPS and NPTG at 200 m and lowest values in the deep water in the southern Pacific and north of 45°N (Fig. 7.22B, C, D). Enhanced values were also measured at 700 and 1000 m in the equatorial upwelling region (Fig. 7.22D).

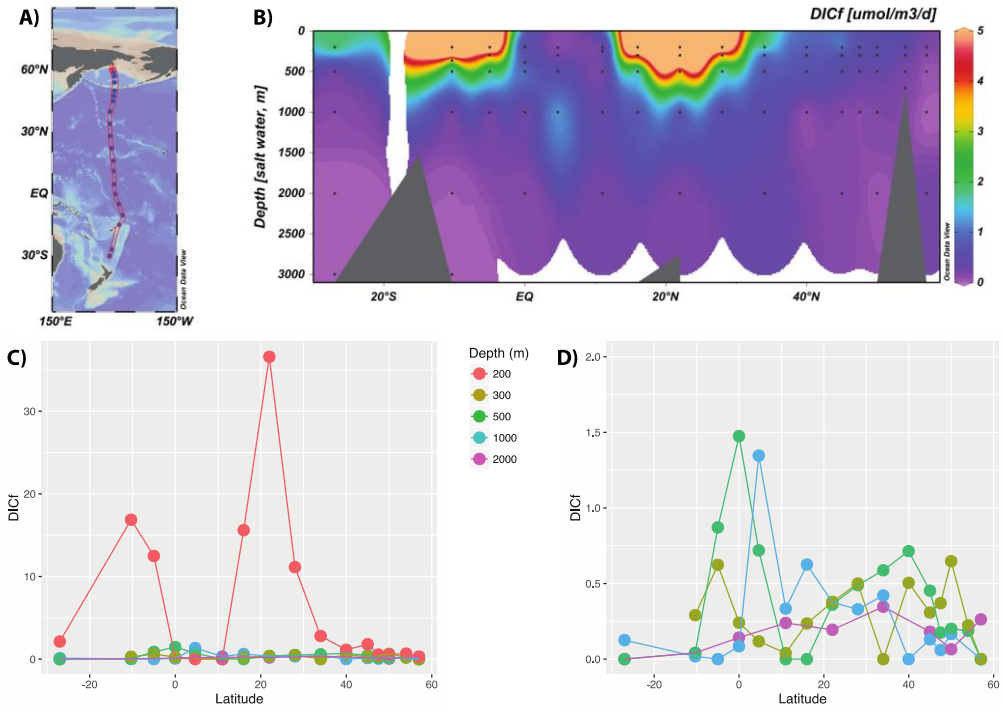


Fig. 7.22: DIC fixation rates in the Pacific during cruise SO248. A: Transect and stations visited; B; contour plot of DIC fixation rates; C and D: DIC fixation rates at depths of 200, 300, 700, 1000 and 2000 m depth along the transect.

Data management

The data will be archived on the server of University of Vienna as a safe backup. Until publication, the data are available to members of PacGeoBac and on request from the authors. After publication the data will be submitted to the data information system Pangaea and will be available to everyone.

7.12 Prokaryotic leucine incorporation measurement under in situ pressure conditions with an in situ microbial incubator

(C Amano, T Reinthaler, GJ Herndl)

Prokaryotic activity and community composition is highly depth-stratified in the oceanic water column reflecting the increasing recalcitrance of dissolved organic matter and decreasing temperature with depth (Delong et al. 2006). While the abundance and microbial activity of dark ocean microbes have been investigated over the past decade (Aristegui et al. 2009, Reinthaler et al. 2010, Yokokawa et al. 2013), their metabolic rates have been largely determined under atmospheric pressure conditions. Moreover, the role of increasing hydrostatic pressure in controlling deep ocean microbial activity is less studied. To characterize marine prokaryotic activities at in situ pressure condition, an in situ microbial incubator (ISMI) was deployed during this cruise. The ISMI can collect and incubate seawater at a chosen depth and is also able to fix a certain volume of the incubated samples at specific time intervals. Here we tested the operation of the in situ incubator and measured prokaryotic leucine incorporation both at in situ and at atmospheric pressure conditions.

Methods

Leucine incorporation under in situ vs. atmospheric pressure incubations

In situ incubations with the ISMI were done at 1000 and 2000 m depth at stations 10 and 16. The HCl washed polycarbonate bottles (500 mL) and all silicon tubings were filled with ultrapure water or filtered seawater to prevent rupture of the materials. Formaldehyde was added into the fixation cylinders (2% final concentration), and 380 µL of ^{3}H-leucine was injected into triplicate incubation bottles (final concentration 5 nM leucine, 120 Ci mmol^{-1}) with luer-lock syringes. Prior to deployment, the sampling schedule was programed with a custom made software (N-Com communicator ver. 3.01, Nichiyu Giken Co Ltd) and the ISMI was mounted on the CTD frame. After reaching the target depth, seawater was pumped into the incubation bottles and thereby, mixing the water with the added ^{3}H-leucine.. Sub-samples were collected in the fixing cylinders and terminated by formaldehyde in situ at the initial time (T=0) and at the end of the incubation (T=8h). After recovering the ISMI and collecting the fixed water samples, the samples were filtered onto 0.2-µm pore size polycarbonate filters (25 mm diameter, Millipore GTTP) on board. The filters were used for leucine incorporation rate measurements using the on board scintillation counter and will be further used for MAR-FISH analysis as described above. To compare the in situ rates to the leucine incorporation at atmospheric pressure, water samples were also taken from decompressed Niskin bottles and incubated in the incubation ISMI bottles at atmospheric pressure conditions.

Comparison of ISMI bottles and commercially available material

To test whether there is a difference between ISMI bottles and other commercially available bottles, ^{3}H-leucine incorporation rates were determined in 50 mL tubes (Greiner Bio-One), pol-

ycarbonate bottles, and the custom made polycarbonate bottles of the ISMI. Seawater was collected from 2000 m depth at St. 14 and incubated with 5 nM ^{3}H-leucine at 4ºC under atmospheric pressure. Triplicate live samples and duplicate formaldehyde-killed blank were incubated in the three types of bottles. The leucine incorporation rate was measured as described above.

Checking the instrumental bias with full setup of the system

To check for potential biases in rate measurements due to instrument tubing and rinse water, seawater was collected from 500 m depth at St. 17 and incubated to determine ^{3}H-leucine incorporation. The incubation tests were performed at 4ºC under atmospheric pressure using the full setup of the ISMI and in parallel the ISMI bottles without the system.

Preliminary Results

Although the leucine incorporation rate obtained in the ISMI bottle was ca. 20% lower than that obtained with the other materials, no difference was found between ISMI bottles and the full setup of the ISMI. At both stations, leucine incorporation obtained under in situ pressure conditions was lower than under atmospheric pressure conditions (Fig. 7.23).

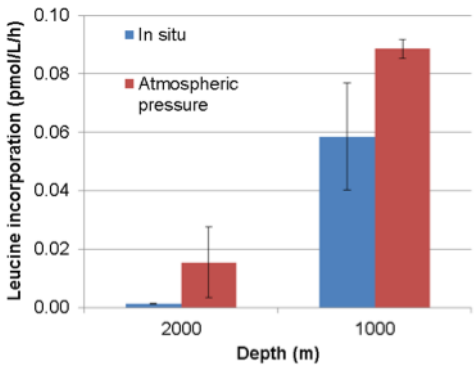


Fig. 7.23: Leucine incorporation rates at in situ and atmospheric pressure conditions. The error bars indicate the mean ± |mean-replicate| of duplicate bottles or mean ± SD.

Data management

The data from the single measurements will be combined in an excel spreadsheet. A version of this file will be archived on the server of the University of Vienna as a safe backup. After publication the data will be submitted to Pangaea and available to everyone.

7.13 The role of Archaea in the oxygenated water column

(B Bayer, GJ Herndl)

Planktonic prokaryotes are phylogenetically and metabolically diverse (DeLong et al 2006, Giovannoni and Stingl 2005) and play central roles in mediating a variety of different biogeochemical cycles (Azam and Malfatti 2007). It has now been firmly established that Archaea appear to be ubiquitous in the oxygenated oceanic water column (Karner et al 2001, Varela et al 2008). We aim at investigating the metabolic potential of deep-sea prokaryotes during cruise SO248, specifically focusing on Archaea.

Like Bacteria, Archaea have evolved a variety of different metabolisms that utilize organic or inorganic electron donors and acceptors, with many of them being able to assimilate inorganic carbon (CO_2, HCO_3^-) (Offre et al 2013).

Marine Group I Thaumarchaeota (formerly known as Marine Group I Crenarchaeota) have been found to be consistently abundant throughout the water column, comprising up to 40% of the total prokaryotic community in deep waters (Karner et al 2001, Teira et al 2006). Previous studies point towards the presence of additional metabolic capacities of Marine Group I Thaumarchaeota (Luo et al 2014, Swan et al 2014). One objective is to investigate if urea can serve as an alternative substrate for Thaumarchaeota in the deep Pacific, using Stable Isotope Probing (SIP) to detect substrate incorporation.

In addition to Thaumarchaeota, typically two euryarchaeal groups can be detected in considerable abundances in the marine water column: Marine Group II and III Euryarchaeota (Fuhrman and Davis 1997). Metagenomic analyses indicated that Group II Euryarchaota in surface waters may be capable of proteorhodopsin-dependent photoheterotrophy (Iverson et al 2012), however, metabolic capacities of deep sea Euryarchaeota remains enigmatic. Recent analyses of Single-Amplified-Genomes indicated that deep sea Marine Group II and III Euryarchaeota are heterotrophs able to utilize proteins and amino acids (Bayer et al., unpublished). The objective is to investigate the response of Euryarchaeota to amino acid additions in order to test this hypothesis.

Methods

Seawater from 3 different depths (500 m, 1000 m, bottom) was sampled at stations 4 and 12 and incubated in 2-10 L carboys amended with either L-Alanine, D-Alanine, Arginine (final concentration: 10 µM) or no substrate. Prokaryotic cell abundance was measured on board via Flow Cytometry (Accuri, BD) over the time course of the experiments. Incubations were terminated when exponential growth was reached, or after 14 days. Additionally, samples for DNA, proteomics, CARD-FISH and amino acid analyses were taken at the beginning and at the end of the incubations. DNA and proteins will be extracted in the home lab and community composition will be analyzed.

High volume mesocosms amended with ^{13}C-labelled urea

Seawater at stations 4 and 12 was taken from 500, 1000 and 4000 m depth and incubated in high volume mesocosms (200 L for 1000 m, 100 L for 500 m depth) amended with ^{12}C- or ^{13}C Urea (final concentration: 10 µM). After 6-14 days, the total volume was filtered onto 0.2 µm Durapore membranes (293 mm diameter, Millipore) and stored at -80°C. Stable isotope probing (SIP) will be carried out in the home lab.

Preliminary results

Increases of cell abundances towards the end of the experiment at station 4 show that the bacterial community responded to the amino acid additions (Fig. 7.24).

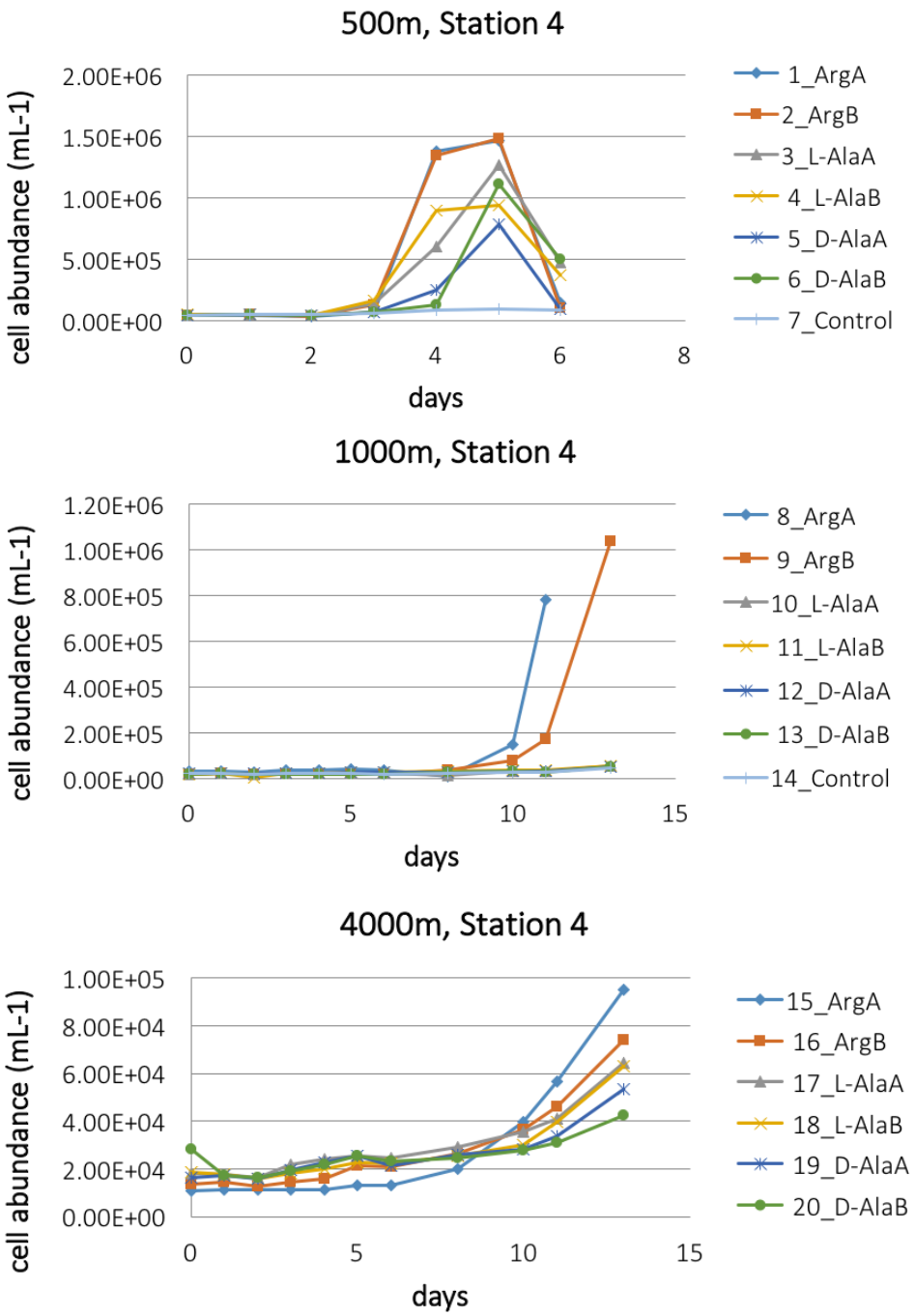


Fig. 7.24: Prokaryotic abundance during incubation of samples amended with the amino acids shown in the legend from the station and depth indicated.

Data management

Sequencing data will be archived on the server of the University of Vienna• as a safe backup. Until publication, the data is available to members of PacGeoBac and on request from the authors. After publication the sequencing data will be submitted to NCBI and will be available to everyone.

7.14 Plastic and microbial communities

(M Pinto, GJ Herndl)

The aim was to study the microbial community composition and metabolism of the biofilm of plastics in different biogeographic provinces during this cruise and to determine how they differ from the microbial communities in the surrounding seawater.

Methods

Plastics were collected with horizontal tows at the surface with a Bongo net composed of two nets of 1 m diameter and 3 m length, which was held 15 to 20 m away from the ship. The net was launched at 13 stations, and was towed at a speed of 1-2 knots for 30-45 min. The mesh size of the net was 300 µm.

To divide the collected material into 4 different size classes, the material from the cod end of the net was passed through a sieve tower, composed of four sieves with mesh sizes of 9.5 mm, 4.75 mm, 1.4 mm, 300 µm. Afterwards, plastics were counted and separated either by naked eye or, in the case of smaller pieces, under the dissection microscope and separated for different analysis: Scanning electron microscopy (SEM), fluorescence in situ hybridization (FISH), Raman spectroscopy and molecular analysis. Additionally, to monitor the biofilm establishment on plastics, plastic squares of 1 cm^2 were incubated in glass bottles with 1 L of seawater for 10 days. A bottle without any plastic incubated and another with plastic incubated in 0.2-µm filtered seawater were kept as controls. Every other day, both plastic and water were sampled for molecular analysis, SEM, cell abundance and FISH. At the end of the experiment, the heterotrophic activity on the plastics was measured with radiolabelled leucine and the remaining seawater was filtered onto 0.2 µm polycarbonate filters for metagenomics.

Preliminary results

Plastics were found at 4 stations between 11°N and 40°N, with the highest plastic abundance at 33°N with 178 collected plastics (around 63 pieces per km^2 of water surface) (Fig. 7.25). All samples were frozen and transported to Vienna, and are currently stored at -80°C until further processing.

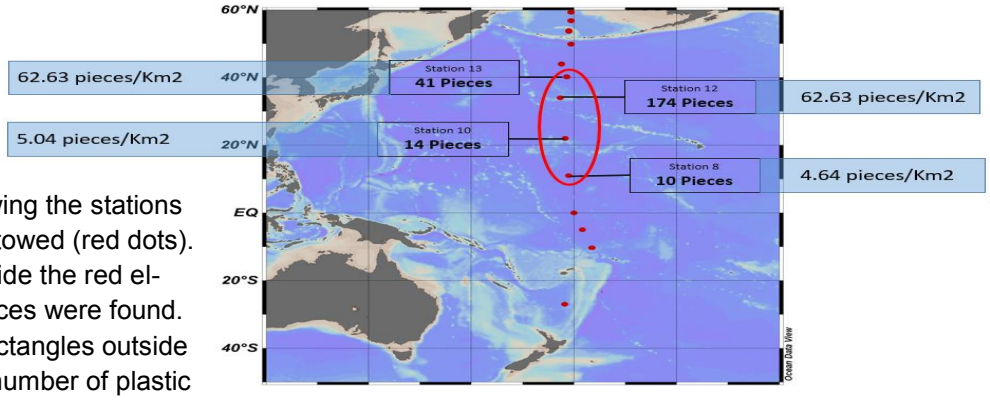


Fig.7.25. Map showing the stations where the net was towed (red dots). At the stations outside the red ellipse, no plastic pieces were found. Numbers in blue rectangles outside the map show the number of plastic pieces collected per km² of surface seawater.

Data management

All data obtained from this cruise will be available after publication in a peer-reviewed journal. Additionally, information on the amount of plastic collected at different latitudes will be shared with organizations interested in plastic pollution research.

7.15 Under way measurements by FerryBox

Continuous FerryBox flow-through measurements of surface waters

A FerryBox is a flow-through system deployed as an underway device for ship expeditions and for attendant measurements during stationary operations (Fig. 7.26). The system provides basic data at high spatial and temporal resolution for various parameters, e.g. salinity, temperature (at the intake and inside the system), Chl *a* -fluorescence, turbidity, and dissolved oxygen. For multi-parameter sensing and validation of the ships flow-through system (equipped with thermosalinograph and bbe FluoroProbe sensor), the FerryBox was fed by water from the ship system via a bypass. Measurements were performed at a sampling interval of 1 min. Once a day, a salinity reference sample was taken (glass bottle, 250 ml) to validate the salinity sensor of the FerryBox as well as the salinity probe of the thermosalinograph of the ships system. Analysis of the salinity samples is ongoing.

On this cruise, a second box (FerryBox AddOn) equipped with an UV- and a VIS-spectrophotometer, was used to collect absorption spectra to, e.g. improve current processing algorithms of optical nitrate detection for oligotrophic waters. Measurements were performed at a sampling interval of 10 min. Processing will be performed according to Zielinski et al (2011) and Frank et al (2014). Validation and improvement of processing algorithms to calculate optical nitrate and transmission are still under progress.

Further investigations in this section include the sampling for harmful algae toxins along the whole cruise transect. Therefore a special absorber pad was installed in the outflow of the flow-through boxes. Within a fixed time interval of 5 days water was running through these absorber pads with respect to the investigated area. Pads were stored at 4°C until further processing, wash out of toxins and analysis via LC-MS/MS.

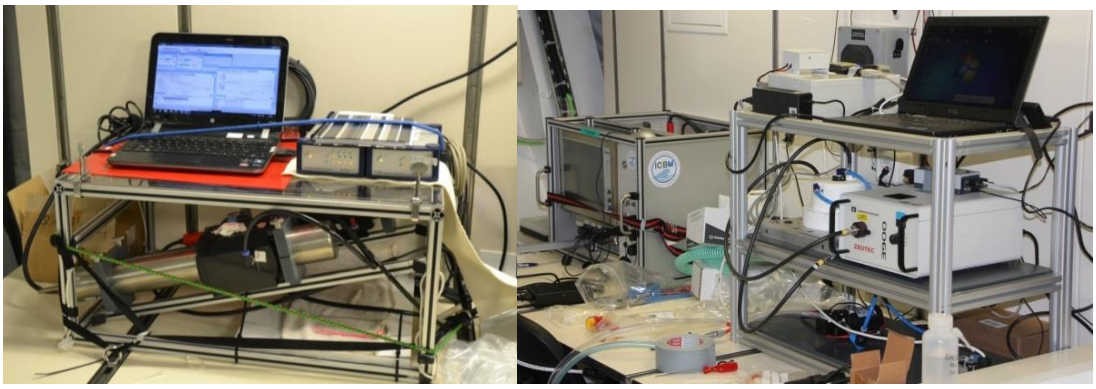


Figure 7.26 FerryBox system (right) for hydrographic parameters in surface waters and AddOn Box (left) for the collection of UV/VIS spectra for calculation of transmission and optical nitrate.

7.16 Meteorology data on aerosol and water vapor

(H Winkler, TH Badewien, KL Arndt, S Kinne, A Smirnov)

Meteorological data during the SO248 cruise were continuously obtained via built-in systems *(weather-station, thermosalinograph / TSG,* so-called "*underway-data"*). We used handheld instruments for measuring aerosol and water vapor.

Meteorological Underway Data

Weather data such as air temperature, wind speed, wind direction and global radiation were extracted from the underway data, which are logged and controlled by the DSHIP-Software. Hydrographic data from the sea surface were taken via a thermosalinograph connected to a through-flow-system in the front of the ship.

Microtops Aerosol and Water Vapor Survey

During cruise SO248 we measured direct solar attenuation by means of a handheld Microtops instrument during cloud-free conditions at daytimes. The system provides information on atmospheric aerosol amount, aerosol size and atmospheric water vapor. The data will be included in the *Aeronet Maritime Aerososol Network* (http://aeronet.gsfc.nasa.gov). Data were delivered to Alexander Smirnov (Science Systems and Applications, Inc., NASA/Goddard Space Flight Center), who processed them. First results can be seen at http://aeronet.gsfc.nasa.gov/new_web/cruises_new/Sonne_16_0.html.

In collaboration with NASA-GSFC, Microtops measurements are conducted worldwide on an opportunity basis aboard (research) vessels in order to complement continental aerosol monitoring at AERONET sites.

Figure 7.27 Microtops and GPS unit provided by the Marine Aerosol Network of AERONET at NASA-GSFC.

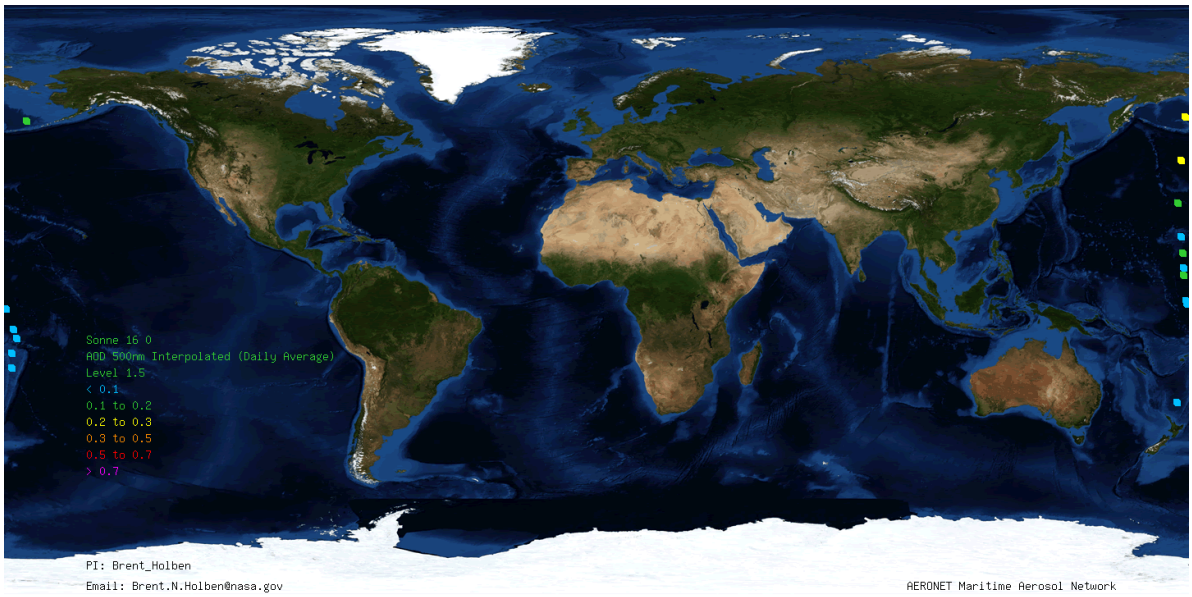


Figure 7.28 Overview of measuring points of aerosol and water vapor during cruise SO248 (*http://aeronet.gsfc.nasa.gov/new_web/cruises_new/Sonne_16_0.html, as processed until July, 06 2016).*

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10. Abbreviations / Abkürzungen

ADCP	Acoustic Doppler Current Profiler
AOT	Aerosol Optical Thickness
BER	Bering Sea
CARD-FISH	Catalyzed Reporter Deposition Fluorescent In Situ Hybridization
CDOM	Chromophoric DOM
Chl	Chlorophyll
CTD	Conductivity Temperature Depth sensor
DCM	Deep Chlorophyll Maximum
DCW	Central Deep Water
DOC	Dissolve Organic Carbon
DOM	Dissolved Organic Matter
DSMZ	Deutsche Sammlung für Mikroorganismen und Zellkulturen
EEZ	Exclusive Economic Zone
FDOM	Fluorescent DOM
FISH	Fluorescent In Situ Hybridization
FT-ICR-MS	Fourier Transform Ion Cyclotron Resonance Mass Spectrometry
FUI	Forel Ule color Index
G2L	Göttingen Genomics Laboratory
GC	Gas Chromatography
GPS	Global Positioning System
HPLC	High Performance Liquid Chromatography
HZI	Helmholtz Institut für Infektionsforschung
ICBM	Institut für Chemie und Biologie des Meeres
ISMI	In Situ Microbial Incubator
MAR-FISH	Microautoradiography coupled to FISH
MUC	Multi Corer
NCBI	National Center for Biotechnology Information of the US
NIW	Northern Intermediate Water
NPF	North Pacific Polar Frontal region
NPTG	North Pacific subTropical Gyre
OMZ	Oxygen Minimum Zone
PAR	Photosynthetic Active Radiation
PCR	Polymerase Chain Reaction
PEQ	Pacific EQuatorial current
PNE	North Pacific Equatorial counter current
POC	Particulate Organic Carbon
PON	Particulate Organic Nitrogen
PSAG	Pacific SubArctic reGion
PSE	South Pacific Equatorial counter current
RCA	*Roseobacter* Clade Affiliated
SIW	Southern Intermediate Water
SPS	South Pacific Subtropical gyre
TDN	Total Dissolved Nitrogen
TRR 51	Transregional Collarborative Research Center Roseobacter
UNC	University of North Carolina
UTC	Universal Coordinated Time
UV	UltraViolet light
UVI	Universität Wien
VIS	VISible light
WARM	Pacific WARm pool

11. Appendices

A) Participating Institutions / Liste der teilnehmenden Institutionen

ICBM
Institut für Chemie und Biologie des Meeres
Universität Oldenburg
Carl von Ossietzky Str. 9-11
D-26129 Oldenburg,
Germany
www.icbm.de

HZI
Helmholtz-Zentrum für Infektionsforschung
Department Microbial Communication
Inhoffenstr. 7
D-38124 Braunschweig
Germany
http://www.helmholtz-hzi.de

DSMZ
Deutsche Sammlung von Mikroorganismen und Zellkulturen,
Inhoffenstraße 7B
D-38124 Braunschweig
Germany
www.dsmz.de

G2L
Göttingen Genomics Laboratory
Institut f. Mikrobiologie u. Genetik
Georg-August-Universität Göttingen
Grisebachstr. 8
D-37077 Göttingen
Germany
www.appmibio.uni-goettingen.de/

UVI
Microbial Oceanography Group
Department of Limnology & Bio-Oceanography
University of Vienna
Althanstrasse 14
A-1090 Vienna
Austria
http://www.microbial-oceanography.eu/

UNC
Department of Marine Science
University of North Carolina
3202 Venable and Murray Halls, CB 3300
Chapel Hill, North Carolina 27599-3300
USA
http://marine.unc.edu/people/faculty/arnosti-2/

B) Station list / Stationsliste

Table A1: Station number, start and end of station work, latitude, longitude and water depth of stations. For a detailed list of station work at each station see Table A2.

Station	Start Day / Time UTC	End Day / Time UTC	Latitude	Longitude	Depth (m)
SO248-01	02.05.2016 18:03:17	03.05.2016 01:20:55	29° 59,969' S	176° 59,890' E	4280
SO248-02	03.05.2016 18:00:44	04.05.2016 06:06:18	26° 59,557' S	178° 12,795' E	4202
SO248-03	06.05.2016 22:12:54	07.05.2016 00:15:12	15° 00,002' S	178° 00,044' W	1527
SO248-04	07.05.2016 23:17:24	08.05.2016 10:58:41	10° 20,005' S	176° 30,002' W	4140
SO248-05	09.05.2016 17:46:07	09.05.2016 22:46:03	04° 59,749' S	178° 19,081' W	6031
SO248-06	11.05.2016 09:00:38	12.05.2016 17:10:02	00° 00,015' N	180° 00,000' E	5262
SO248-07	13.05.2016 17:57:42	14.05.2016 00:14:31	04° 39,306' N	179° 23,861' E	6265
SO248-08	15.05.2016 12:55:03	16.05.2016 01:16:00	10° 58,020' N	179° 00,095' E	5469
SO248-09	17.05.2016 01:13:32	17.05.2016 05:31:43	16° 00,096' N	178° 59,642' E	5237
SO248-10	18.05.2016 09:20:35	19.05.2016 02:25:35	21° 57,941' N	178° 19,054' E	3250
SO248-11	20.05.2016 07:45:32	20.05.2016 08:56:17	28° 00,018' N	177° 19,867' E	5162
SO248-12	21.05.2016 15:58:00	22.05.2016 00:57:15	34° 00,002' N	177° 20,010' E	3514
SO248-13	23.05.2016 05:07:01	23.05.2016 08:36:02	40° 00,175' N	177° 19,997' E	5667
SO248-14	24.05.2016 09:00:35	25.05.2016 00:12:27	45° 00,061' N	178° 45,011' E	5915
SO248-15	25.05.2016 16:00:13	25.05.2016 17:02:05	47° 29,988' N	179° 07,989' E	5841
SO248-16	26.05.2016 08:36:58	28.05.2016 03:18:29	50° 00,019' N	179° 33,019' E	5625
SO248-17	28.05.2016 23:06:01	29.05.2016 04:29:05	54° 00,805' N	179° 34,135' E	732
SO248-18	29.05.2016 19:06:54	30.05.2016 05:12:51	57° 00,084' N	179° 34,884' E	3811
SO248-19	30.05.2016 15:10:42	31.05.2016 03:39:02	58° 54,021' N	179° 00,157' W	3352

Table A2: Detailed overview on the equipment used and number of tasks, station number, date, time, device used and action, latitude, longitude and water depth.

Abkürzungen / Abbreviation		Eingesetzte Geräte / Equiopment used	Einsätze / tasks
z.W	zu Wasser / into water		
a.D.	an Deck / on deck	CTD	58
Slmax	(maximale) Seillänge / max. rope-length	Multicorer	10
LT	Lottiefe nach EM 122 / Depth of EM 122	Secchi Disk	15
W ...	eingesetzte Winde / Winch used	Satlantic /UV Profiler	28
nm	Seemeilen / nautical miles	Bongo Netz	17
EM/PS	SIMRAD Multibeam / Parasound	In situ Pumpe	12
rwk / COG:	Rechtweisender Kurs / true course	In situ incubator	2
d:	Distanz / distance		
v:	Geschwindigkeit in Knoten / SOG in knots		
SL:	Seillänge / rope-length		
SZ:	Seilzug / rope tension		
		Σ	142
		Geräteverluste / lost Equipment:	none

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
SO248_1-1	02.05.2016 18:03:17	CTD	station start		29° 59,969' S	176° 59,890' E	4280,1
SO248_1-1	02.05.2016 18:10:03	CTD	in the water		30° 0,056' S	176° 59,968' E	4267,8
SO248_1-1	02.05.2016 18:51:55	CTD	max depth/ on ground	maxSL: 1000m	30° 0,049' S	176° 59,958' E	4268,2
SO248_1-1	02.05.2016 19:01:45	CTD	hoisting	Beg. Hieven	30° 0,050' S	176° 59,959' E	4268,9
SO248_1-1	02.05.2016 19:34:42	CTD	on deck		30° 0,044' S	176° 59,970' E	4265,2
SO248_1-1	02.05.2016 20:10:15	CTD	station end		30° 0,030' S	176° 59,971' E	4270,2

SO248_1-2	02.05.2016 19:16:41	PUMP	station start	IN SITU Pumpe	30° 0,044' S	176° 59,968' E	4273,7
SO248_1-2	02.05.2016 19:18:33	PUMP	in the water		30° 0,048' S	176° 59,967' E	4265,8
SO248_1-2	02.05.2016 19:19:49	PUMP	max depth/ on ground	maxSL: 20m, Beg. Pum-pen	30° 0,050' S	176° 59,970' E	4266,8
SO248_1-2	02.05.2016 22:32:47	PUMP	on deck		30° 0,006' S	177° 0,001' E	4271,9
SO248_1-2	02.05.2016 22:38:00	PUMP	station end		30° 0,008' S	176° 59,999' E	4269,4
SO248_1-3	02.05.2016 20:12:44	NET	station start	Bongo-Netz, mit EL2 über kl. Schiebebalken	30° 0,031' S	176° 59,969' E	4270,9
SO248_1-3	02.05.2016 20:29:11	NET	information	Gerät z. W.	30° 0,025' S	176° 59,957' E	4265,4
SO248_1-3	02.05.2016 20:50:41	NET	information	SLmax: 300 m, SZmax: 1,2 kN	29° 59,998' S	177° 0,001' E	4266,9
SO248_1-3	02.05.2016 20:51:30	NET	information	Hieven	29° 59,999' S	177° 0,002' E	4266,5
SO248_1-3	02.05.2016 21:27:19	NET	information	Gerät an Deck	30° 0,010' S	177° 0,003' E	4265,8
SO248_1-3	02.05.2016 21:30:27	NET	station end		30° 0,008' S	177° 0,001' E	4265,6
SO248_1-4	02.05.2016 21:33:32	CTD	station start		30° 0,006' S	177° 0,002' E	4269,9
SO248_1-4	02.05.2016 21:35:07	CTD	in the water	EL2 über kl. Schiebebal-ken	30° 0,005' S	177° 0,002' E	4261,7
SO248_1-4	02.05.2016 22:10:38	CTD	max depth/ on ground	SL: 1000 m, SZ: 10 kN	29° 59,994' S	176° 59,999' E	4267,3
SO248_1-4	02.05.2016 22:11:00	CTD	hoisting		29° 59,994' S	176° 59,999' E	4273,6
SO248_1-4	02.05.2016 22:42:11	CTD	on deck		30° 0,007' S	177° 0,004' E	4267
SO248_1-4	02.05.2016 22:46:20	CTD	station end		30° 0,008' S	177° 0,004' E	4267,5
SO248_1-5	02.05.2016 22:48:40	Light / Optics	station start	SECCI-Disc	30° 0,007' S	177° 0,004' E	4271
SO248_1-5	02.05.2016 22:49:29	Light / Optics	in the water	BB-achtern über Kran 4	30° 0,008' S	177° 0,004' E	4271,7
SO248_1-5	02.05.2016 23:00:56	Light / Optics	on deck		30° 0,004' S	177° 0,003' E	4269,8
SO248_1-5	02.05.2016 23:01:14	Light / Optics	station end		30° 0,003' S	177° 0,003' E	4269,7
SO248_1-6	02.05.2016 23:02:46	NET	station start	Bongo-Netz, geschleppt über STB-Heck, Kran 3	30° 0,000' S	177° 0,004' E	4267,2

SO248_1-6	02.05.2016 23:18:04	NET	information	Bongo-Netz z. W.	29° 59,988' S	177° 0,055' E	4267,5
SO248_1-6	02.05.2016 23:20:22	NET	information	Schleppfahrt, FdW = 2,5 kn nach Vorgabe Wiss., rwK: 081°	29° 59,980' S	177° 0,125' E	4267,6
SO248_1-6	03.05.2016 00:00:00	NET	information	Gerät a. D.	29° 59,740' S	177° 1,794' E	4258,4
SO248_1-6	03.05.2016 00:00:17	NET	station end		29° 59,740' S	177° 1,795' E	4262
SO248_1-7	03.05.2016 00:17:37	Light / Optics	station start	Satlantic-UV-Profiler	29° 59,730' S	177° 1,860' E	4258,4
SO248_1-7	03.05.2016 00:18:05	Light / Optics	in the water		29° 59,730' S	177° 1,860' E	4264,1
SO248_1-7	03.05.2016 00:25:47	Light / Optics	max depth/ on ground	70m	29° 59,708' S	177° 1,923' E	4270,2
SO248_1-7	03.05.2016 00:37:36	Light / Optics	max depth/ on ground	50m	29° 59,701' S	177° 1,953' E	4259,6
SO248_1-7	03.05.2016 00:44:48	Light / Optics	max depth/ on ground	50m	29° 59,699' S	177° 1,982' E	4267
SO248_1-7	03.05.2016 00:51:36	Light / Optics	on deck		29° 59,709' S	177° 1,986' E	4270,1
SO248_1-7	03.05.2016 00:52:12	Light / Optics	station end		29° 59,710' S	177° 1,988' E	4264,8
SO248_1-8	03.05.2016 00:53:02	Light / Optics	station start	Satlantic-Profiler	29° 59,710' S	177° 1,990' E	4259
SO248_1-8	03.05.2016 00:53:23	Light / Optics	in the water		29° 59,709' S	177° 1,994' E	4260,9
SO248_1-8	03.05.2016 01:06:03	Light / Optics	max depth/ on ground	160m	29° 59,697' S	177° 2,046' E	4261,4
SO248_1-8	03.05.2016 01:10:12	Light / Optics	max depth/ on ground	50m	29° 59,691' S	177° 2,080' E	4263
SO248_1-8	03.05.2016 01:16:05	Light / Optics	max depth/ on ground	50m	29° 59,684' S	177° 2,125' E	4264,9
SO248_1-8	03.05.2016 01:20:25	Light / Optics	on deck		29° 59,677' S	177° 2,165' E	4260,6
SO248_1-8	03.05.2016 01:20:55	Light / Optics	station end		29° 59,676' S	177° 2,169' E	4263,2
SO248_2-1	03.05.2016 18:00:44	CTD	station start		26° 59,557' S	178° 12,795' E	4202,3
SO248_2-1	03.05.2016 18:04:50	CTD	in the water		26° 59,571' S	178° 12,782' E	4201,2
SO248_2-1	03.05.2016 19:40:33	CTD	max depth/ on ground	maxSL: 4167m	26° 59,570' S	178° 12,797' E	4196,7

SO248_2-1	03.05.2016 21:09:56	CTD	on deck		26° 59,563' S	178° 12,794' E	4201,1
SO248_2-1	03.05.2016 21:14:38	CTD	station end		26° 59,563' S	178° 12,791' E	4198,2
SO248_2-2	03.05.2016 22:20:39	CTD	station start		26° 59,570' S	178° 12,796' E	4196,5
SO248_2-2	03.05.2016 22:25:42	CTD	in the water	EL2 , kl. Schiebebalken	26° 59,571' S	178° 12,788' E	4193,1
SO248_2-2	03.05.2016 22:31:01	CTD	max depth / on ground	SL: 20m, ST: 8 kN	26° 59,566' S	178° 12,788' E	4195,9
SO248_2-2	03.05.2016 22:38:44	CTD	on deck		26° 59,565' S	178° 12,792' E	4198,1
SO248_2-2	03.05.2016 22:41:18	CTD	station end		26° 59,559' S	178° 12,796' E	4200,6
SO248_2-3	03.05.2016 23:03:37	CTD	station start		26° 59,562' S	178° 12,790' E	4194,4
SO248_2-3	03.05.2016 23:07:01	CTD	in the water	EL2, kl. Schiebebalken	26° 59,558' S	178° 12,794' E	4198,7
SO248_2-3	03.05.2016 23:12:14	CTD	max depth/ on ground	SL: 20 m, SZ: 8 kN	26° 59,565' S	178° 12,791' E	4197
SO248_2-3	03.05.2016 23:16:05	CTD	on deck		26° 59,558' S	178° 12,792' E	4199,7
SO248_2-3	03.05.2016 23:18:27	CTD	station end		26° 59,556' S	178° 12,793' E	4195,9
SO248_2-4	03.05.2016 23:32:58	CTD	station start		26° 59,566' S	178° 12,795' E	4197,5
SO248_2-4	03.05.2016 23:34:24	CTD	in the water	EL2, kl. Schiebebalken	26° 59,566' S	178° 12,790' E	4194,8
SO248_2-4	04.05.2016 00:06:18	CTD	max depth/ on ground	SL: 998m	26° 59,572' S	178° 12,793' E	4194,9
SO248_2-4	04.05.2016 00:38:21	CTD	on deck		26° 59,565' S	178° 12,797' E	4196,6
SO248_2-4	04.05.2016 00:39:11	CTD	station end		26° 59,564' S	178° 12,797' E	4193,1
SO248_2-5	04.05.2016 00:15:00	Light / Optics	station start		26° 59,562' S	178° 12,798' E	4196,1
SO248_2-5	04.05.2016 00:15:22	Light / Optics	in the water		26° 59,561' S	178° 12,799' E	4198,8
SO248_2-5	04.05.2016 00:27:53	Light / Optics	on deck		26° 59,565' S	178° 12,792' E	4197,6
SO248_2-5	04.05.2016 00:28:24	Light / Optics	station end		26° 59,565' S	178° 12,792' E	4195,6
SO248_2-6	04.05.2016 00:41:26	Light / Optics	station start	UV-Profiler	26° 59,563' S	178° 12,809' E	4198,3
SO248_2-6	04.05.2016 00:45:31	Light / Optics	in the water		26° 59,564' S	178° 12,859' E	4193,6

SO248_2-6	04.05.2016 00:48:53	Light / Optics	max depth/ on ground	110m	26° 59,567' S	178° 12,911' E	4198,4
SO248_2-6	04.05.2016 01:09:37	Light / Optics	max depth/ on ground	50m	26° 59,574' S	178° 13,148' E	4197,8
SO248_2-6	04.05.2016 01:18:33	Light / Optics	on deck		26° 59,581' S	178° 13,336' E	4201,8
SO248_2-6	04.05.2016 01:18:41	Light / Optics	station end		26° 59,581' S	178° 13,339' E	4197,5
SO248_2-7	04.05.2016 01:21:18	Light / Optics	station start	Satlantic-Profiler	26° 59,582' S	178° 13,379' E	4197,8
SO248_2-7	04.05.2016 01:21:29	Light / Optics	in the water		26° 59,583' S	178° 13,381' E	4201,4
SO248_2-7	04.05.2016 01:30:06	Light / Optics	max depth/ on ground	150m	26° 59,587' S	178° 13,514' E	4198
SO248_2-7	04.05.2016 01:40:07	Light / Optics	max depth/ on ground	50m	26° 59,592' S	178° 13,675' E	4198,9
SO248_2-7	04.05.2016 01:45:18	Light / Optics	max depth/ on ground	50m	26° 59,594' S	178° 13,744' E	4198,6
SO248_2-7	04.05.2016 01:48:43	Light / Optics	on deck		26° 59,597' S	178° 13,803' E	4205,2
SO248_2-7	04.05.2016 01:48:55	Light / Optics	station end		26° 59,597' S	178° 13,807' E	4184,6
SO248_2-8	04.05.2016 02:37:03	MUC	station start		26° 59,596' S	178° 13,826' E	4185
SO248_2-8	04.05.2016 02:38:23	MUC	in the water		26° 59,593' S	178° 13,829' E	4181,1
SO248_2-8	04.05.2016 04:27:03	MUC	max depth/ on ground	maxSL: 4255m	26° 59,601' S	178° 13,819' E	4185,2
SO248_2-8	04.05.2016 04:30:52	MUC	hoisting	maxSZ: 54,4kN	26° 59,596' S	178° 13,819' E	4181,8
SO248_2-8	04.05.2016 06:05:30	MUC	on deck		26° 59,607' S	178° 13,820' E	4207,2
SO248_2-8	04.05.2016 06:06:18	MUC	station end		26° 59,606' S	178° 13,822' E	4205,7
SO248_3-1	06.05.2016 22:12:54	CTD	station start	EL2, kl. Schiebebalken	15° 0,002' S	178° 0,044' W	5298,4
SO248_3-1	06.05.2016 22:18:29	CTD	in the water		15° 0,012' S	177° 59,997' W	1516,6
SO248_3-1	06.05.2016 22:49:11	CTD	max depth/ on ground	SL: 1032 m, SZ: 11 kN	14° 59,998' S	178° 0,000' W	1526,6
SO248_3-1	06.05.2016 23:21:54	CTD	on deck		14° 59,996' S	178° 0,002' W	1523,7
SO248_3-1	06.05.2016 23:22:05	CTD	station end		14° 59,996' S	178° 0,002' W	1529

SO248_3-2	06.05.2016 22:36:05	Light / Optics	station start	SECCI-Disc über Kran 4 / Heck	14° 59,999' S	177° 59,995' W	1524,3
SO248_3-2	06.05.2016 22:38:42	Light / Optics	in the water		14° 59,995' S	177° 59,998' W	1526,5
SO248_3-2	06.05.2016 22:50:13	Light / Optics	max depth/ on ground	SL: 50 m	14° 59,999' S	177° 59,999' W	1524,6
SO248_3-2	06.05.2016 22:54:26	Light / Optics	on deck		15° 0,002' S	177° 59,997' W	1526,2
SO248_3-2	06.05.2016 22:59:21	Light / Optics	station end		14° 59,999' S	177° 59,997' W	1524,4
SO248_3-3	06.05.2016 23:27:00	Light / Optics	station start	UV-Profiler	15° 0,005' S	177° 59,957' W	1508,6
SO248_3-3	06.05.2016 23:27:06	Light / Optics	in the water		15° 0,006' S	177° 59,955' W	1510,2
SO248_3-3	06.05.2016 23:33:07	Light / Optics	max depth/ on ground	90m	15° 0,030' S	177° 59,847' W	1495,5
SO248_3-3	06.05.2016 23:39:31	Light / Optics	max depth/ on ground	50m	15° 0,052' S	177° 59,749' W	1493,8
SO248_3-3	06.05.2016 23:44:39	Light / Optics	max depth/ on ground	50m	15° 0,071' S	177° 59,671' W	1492,8
SO248_3-3	06.05.2016 23:47:32	Light / Optics	on deck		15° 0,082' S	177° 59,622' W	1498,3
SO248_3-3	06.05.2016 23:47:43	Light / Optics	station end		15° 0,082' S	177° 59,619' W	1498,8
SO248_3-4	06.05.2016 23:48:54	Light / Optics	station start	Satlantic-Profiler	15° 0,088' S	177° 59,598' W	1509,7
SO248_3-4	06.05.2016 23:49:03	Light / Optics	in the water		15° 0,088' S	177° 59,596' W	1507
SO248_3-4	06.05.2016 23:55:54	Light / Optics	max depth/ on ground	140m	15° 0,116' S	177° 59,471' W	1502,9
SO248_3-4	07.05.2016 00:05:11	Light / Optics	max depth /on ground	55m	15° 0,150' S	177° 59,323' W	1550,2
SO248_3-4	07.05.2016 00:10:40	Light / Optics	max depth/ on ground	55m	15° 0,168' S	177° 59,244' W	1552,4
SO248_3-4	07.05.2016 00:14:54	Light / Optics	on deck		15° 0,184' S	177° 59,171' W	1550
SO248_3-4	07.05.2016 00:15:12	Light / Optics	station end		15° 0,186' S	177° 59,166' W	1544
SO248_4-1	07.05.2016 23:17:24	CTD	station start		10° 20,005' S	176° 30,002' W	4139,7
SO248_4-1	07.05.2016 23:28:20	CTD	in the water		10° 20,002' S	176° 29,998' W	4141
SO248_4-1	08.05.2016 00:02:22	CTD	max depth/ on ground	SL: 998m	10° 20,001' S	176° 29,997' W	4141,5

SO248_4-1	08.05.2016 00:34:09	CTD	on deck		10° 20,002' S	176° 30,009' W	4142,7
SO248_4-1	08.05.2016 00:34:19	CTD	station end		10° 20,002' S	176° 30,009' W	4142,6
SO248_4-2	08.05.2016 00:40:20	NET	station start	Bongo-Netz geschleppt	10° 20,003' S	176° 30,008' W	4142,1
SO248_4-2	08.05.2016 00:47:07	NET	information	zu Wasser	10° 20,001' S	176° 29,933' W	4137,7
SO248_4-2	08.05.2016 01:32:45	NET	information	an Deck	10° 20,005' S	176° 28,601' W	4131,4
SO248_4-2	08.05.2016 01:33:01	NET	station end		10° 20,005' S	176° 28,594' W	4132,4
SO248_4-3	08.05.2016 01:41:52	CTD	station start		10° 19,999' S	176° 28,516' W	4131,9
SO248_4-3	08.05.2016 01:43:59	CTD	in the water		10° 19,995' S	176° 28,517' W	4128,5
SO248_4-3	08.05.2016 03:09:28	CTD	max depth/ on ground	SL: 4114m	10° 19,999' S	176° 28,516' W	4128,9
SO248_4-3	08.05.2016 04:42:02	CTD	on deck		10° 20,011' S	176° 28,521' W	4130,1
SO248_4-3	08.05.2016 04:43:43	CTD	station end		10° 20,011' S	176° 28,520' W	4128,8
SO248_4-4	08.05.2016 02:09:38	Light / Optics	station start	Secchi-Disk	10° 20,005' S	176° 28,518' W	4129,5
SO248_4-4	08.05.2016 02:09:47	Light / Optics	in the water		10° 20,005' S	176° 28,517' W	4128,4
SO248_4-4	08.05.2016 02:15:04	Light / Optics	max depth /on ground	50m	10° 20,002' S	176° 28,518' W	4130,3
SO248_4-4	08.05.2016 02:23:40	Light / Optics	on deck		10° 20,001' S	176° 28,517' W	4130,1
SO248_4-4	08.05.2016 02:23:52	Light / Optics	station end		10° 20,001' S	176° 28,517' W	4129,9
SO248_4-5	08.05.2016 05:48:29	CTD	station start		10° 19,998' S	176° 28,512' W	4131
SO248_4-5	08.05.2016 05:50:33	CTD	in the water		10° 19,997' S	176° 28,515' W	4130,4
SO248_4-5	08.05.2016 06:37:45	CTD	max depth/ on ground	maxSL: 1997m	10° 20,002' S	176° 28,509' W	4130,8
SO248_4-5	08.05.2016 07:24:55	CTD	on deck		10° 19,999' S	176° 28,511' W	4128,9
SO248_4-5	08.05.2016 07:26:05	CTD	station end		10° 19,998' S	176° 28,513' W	4130,6
SO248_4-5	08.05.2016 07:26:05	CTD	station end		10° 19,995' S	176° 28,516' W	4130,1
SO248_4-6	08.05.2016 07:30:02	MUC	station start	FW1/SPW1, Schiebebal-ken	10° 19,996' S	176° 28,515' W	4129,9

SO248_4-6	08.05.2016 07:36:20	MUC	in the water		10° 19,997' S	176° 28,518' W	4129,4
SO248_4-6	08.05.2016 09:27:25	MUC	max depth/ on ground	SL: 4132 m, SZ: 36 kN	10° 20,012' S	176° 28,522' W	4130
SO248_4-6	08.05.2016 09:30:31	MUC	hoisting	SZmax: 49 kN bei SL: 4155 m	10° 20,010' S	176° 28,519' W	4128,9
SO248_4-6	08.05.2016 10:56:28	MUC	on deck		10° 19,996' S	176° 28,512' W	4130,3
SO248_4-6	08.05.2016 10:58:41	MUC	station end		10° 19,996' S	176° 28,515' W	4128,9
SO248_5-1	09.05.2016 17:46:07	CTD	station start		4° 59,749' S	178° 19,081' W	6030,6
SO248_5-1	09.05.2016 17:48:53	CTD	in the water		4° 59,746' S	178° 19,095' W	6055,1
SO248_5-1	09.05.2016 18:19:55	CTD	max depth/ on ground	maxSL: 1005m	4° 59,792' S	178° 19,069' W	6032
SO248_5-1	09.05.2016 18:53:37	CTD	on deck		4° 59,801' S	178° 19,060' W	6064,9
SO248_5-1	09.05.2016 18:55:07	CTD	station end		4° 59,800' S	178° 19,060' W	6004,4
SO248_5-2	09.05.2016 17:55:47	PUMP	station start	In Situ Pump	4° 59,757' S	178° 19,089' W	6064,1
SO248_5-2	09.05.2016 17:57:36	PUMP	in the water		4° 59,762' S	178° 19,084' W	6049,8
SO248_5-2	09.05.2016 18:01:40	PUMP	max depth/ on ground	maxSL: 60m, Beg. Pum-pen	4° 59,774' S	178° 19,081' W	6026,7
SO248_5-2	09.05.2016 21:15:40	PUMP	information	Start hieven INSITU-Pumpe	4° 59,814' S	178° 19,057' W	6006,5
SO248_5-2	09.05.2016 21:20:31	PUMP	at surface		4° 59,814' S	178° 19,058' W	5999,1
SO248_5-2	09.05.2016 21:24:40	PUMP	on deck		4° 59,812' S	178° 19,058' W	6015,6
SO248_5-2	09.05.2016 21:25:29	PUMP	station end		4° 59,812' S	178° 19,057' W	5992,2
SO248_5-3	09.05.2016 21:35:12	Light / Optics	information	SECCI-Disk, über BB-Heck/Kran 4	4° 59,813' S	178° 19,056' W	6005,6
SO248_5-3	09.05.2016 21:36:26	Light / Optics	in the water		4° 59,813' S	178° 19,056' W	5998,7
SO248_5-3	09.05.2016 21:43:13	Light / Optics	max depth/ on ground	SLmax: 35 m,	4° 59,813' S	178° 19,055' W	5991,3
SO248_5-3	09.05.2016 21:46:53	Light / Optics	on deck		4° 59,812' S	178° 19,057' W	5991,7
SO248_5-3	09.05.2016 21:48:12	Light / Optics	station end		4° 59,812' S	178° 19,057' W	5996,8

SO248_5-4	09.05.2016 21:49:00	Light / Optics	station start	UV-Profiler, BB-Heck	4° 59,812' S	178° 19,057' W	6000
SO248_5-4	09.05.2016 21:56:20	Light / Optics	in the water		4° 59,804' S	178° 19,045' W	6030,4
SO248_5-4	09.05.2016 22:00:04	Light / Optics	max depth/ on ground	SL: 83 m	4° 59,799' S	178° 19,036' W	6029,1
SO248_5-4	09.05.2016 22:05:13	Light / Optics	at surface		4° 59,792' S	178° 19,025' W	6044,8
SO248_5-4	09.05.2016 22:07:19	Light / Optics	max depth/ on ground	SL: 79 m	4° 59,787' S	178° 19,017' W	6001,5
SO248_5-4	09.05.2016 22:10:33	Light / Optics	at surface		4° 59,782' S	178° 19,006' W	5986,9
SO248_5-4	09.05.2016 22:12:41	Light / Optics	max depth/ on ground	SL: 50 m	4° 59,778' S	178° 19,000' W	5954,6
SO248_5-4	09.05.2016 22:16:03	Light / Optics	on deck		4° 59,772' S	178° 18,990' W	6011,6
SO248_5-4	09.05.2016 22:17:04	Light / Optics	station end		4° 59,771' S	178° 18,988' W	6002,3
SO248_5-5	09.05.2016 22:18:23	Light / Optics	station start	S-Profiler, BB-Heck	4° 59,768' S	178° 18,984' W	5984,6
SO248_5-5	09.05.2016 22:19:48	Light / Optics	in the water		4° 59,768' S	178° 18,980' W	5978,5
SO248_5-5	09.05.2016 22:23:35	Light / Optics	max depth/ on ground	SL: 180 m	4° 59,761' S	178° 18,971' W	6016,1
SO248_5-5	09.05.2016 22:34:38	Light / Optics	at surface		4° 59,745' S	178° 18,936' W	5998,4
SO248_5-5	09.05.2016 22:36:25	Light / Optics	max depth/ on ground	SL: 50 m	4° 59,741' S	178° 18,931' W	5985,7
SO248_5-5	09.05.2016 22:40:31	Light / Optics	at surface		4° 59,735' S	178° 18,919' W	5958,3
SO248_5-5	09.05.2016 22:41:19	Light / Optics	max depth/ on ground	SL: 50 m	4° 59,733' S	178° 18,916' W	5941,8
SO248_5-5	09.05.2016 22:45:12	Light / Optics	on deck		4° 59,727' S	178° 18,904' W	5970,9
SO248_5-5	09.05.2016 22:46:03	Light / Optics	station end		4° 59,726' S	178° 18,903' W	5973,6
SO248_6-1	11.05.2016 09:00:38	MUC	station start		0° 1,938' S	179° 59,579' W	5283,5
SO248_6-1	11.05.2016 09:06:09	MUC	in the water	FW1/SPW1, Schiebebal-ken	0° 1,931' S	179° 59,585' W	5286,2
SO248_6-1	11.05.2016 11:26:54	MUC	max depth/ on ground	SL: 5328m	0° 1,901' S	179° 59,357' W	5285
SO248_6-1	11.05.2016 11:30:45	MUC	hoisting	SZmax: 60kN	0° 1,901' S	179° 59,358' W	5286,2

SO248_6-1	11.05.2016 13:17:14	MUC	on deck		0° 1,902' S	179° 59,328' W	5289,2
SO248_6-1	11.05.2016 13:29:10	MUC	station end		0° 1,912' S	179° 59,323' W	5291,1
SO248_6-2	11.05.2016 14:00:21	CTD	station start	CTD 01	0° 0,015' N	179° 59,885' E	5258,1
SO248_6-2	11.05.2016 14:03:15	CTD	in the water		0° 0,015' N	179° 59,885' E	5244,7
SO248_6-2	11.05.2016 15:52:10	CTD	max depth/ on ground	maxSL: 5227m	0° 0,007' N	180° 0,000' E	5261,6
SO248_6-2	11.05.2016 17:45:35	CTD	on deck		0° 0,007' N	179° 59,998' W	5263,5
SO248_6-2	11.05.2016 17:46:22	CTD	station end		0° 0,007' N	179° 59,999' W	5261,2
SO248_6-3	11.05.2016 19:00:03	CTD	station start	CTD 02	0° 0,008' S	180° 0,000' W	5265,2
SO248_6-3	11.05.2016 19:04:47	CTD	in the water	EL2, kl. Schiebebalken	0° 0,009' S	179° 59,998' E	5260
SO248_6-3	11.05.2016 19:40:14	CTD	max depth/ on ground	SL: 1003 m, SZ: 10 kN	0° 0,002' N	179° 59,996' W	5262,8
SO248_6-3	11.05.2016 20:10:29	CTD	on deck		0° 0,000' N	179° 59,998' W	5262,9
SO248_6-3	11.05.2016 20:11:02	CTD	station end		0° 0,000' N	179° 59,998' W	5262,9
SO248_6-4	11.05.2016 20:46:27	CTD	station start	CTD 03	0° 0,005' S	179° 59,998' W	5260,4
SO248_6-4	11.05.2016 20:49:38	CTD	in the water	EL2 / Kl. Schiebebalken	0° 0,007' S	179° 59,999' E	5263,2
SO248_6-4	11.05.2016 21:09:03	CTD	max depth /on ground	SL: 482 m, SZ: 8 kN	0° 0,008' S	179° 59,999' E	5259,2
SO248_6-4	11.05.2016 21:29:44	CTD	on deck		0° 0,007' S	179° 59,997' E	5260,6
SO248_6-4	11.05.2016 21:30:34	CTD	station end		0° 0,007' S	179° 59,997' E	5264,7
SO248_6-5	11.05.2016 21:55:06	CTD	station start	CTD 04	0° 0,005' S	180° 0,000' E	5264,7
SO248_6-5	11.05.2016 21:57:13	CTD	in the water		0° 0,003' S	179° 59,999' E	5261,4
SO248_6-5	11.05.2016 22:29:14	CTD	max depth/ on ground	SL: 1005 m, SZ: 10 kN	0° 0,008' S	179° 59,999' E	5260,6
SO248_6-5	11.05.2016 23:00:35	CTD	on deck		0° 0,003' N	179° 59,999' W	5265
SO248_6-5	11.05.2016 23:03:10	CTD	station end		0° 0,009' N	180° 0,000' W	5264,8
SO248_6-6	11.05.2016 23:14:01	Light / Optics	station start	UV-Profiler	0° 0,006' N	179° 59,998' E	5264,2

SO248_6-6	11.05.2016 23:14:12	Light / Optics	in the water		0° 0,006' N	179° 59,998' E	5264,2
SO248_6-6	11.05.2016 23:19:43	Light / Optics	max depth/ on ground	70m	0° 0,006' N	179° 59,999' E	5264,3
SO248_6-6	11.05.2016 23:24:34	Light / Optics	max depth/ on ground	50m	0° 0,003' N	179° 59,999' E	5263,1
SO248_6-6	11.05.2016 23:31:11	Light / Optics	max depth/ on ground	50m	0° 0,006' N	180° 0,000' W	5262,2
SO248_6-6	11.05.2016 23:35:25	Light / Optics	on deck		0° 0,004' N	179° 59,999' W	5266,8
SO248_6-6	11.05.2016 23:35:36	Light / Optics	station end		0° 0,003' N	179° 59,999' W	5265
SO248_6-7	11.05.2016 23:36:19	Light / Optics	station start	Satlantic-Profiler	0° 0,003' N	179° 59,999' W	5265,5
SO248_6-7	11.05.2016 23:36:29	Light / Optics	in the water		0° 0,003' N	179° 59,999' W	5266
SO248_6-7	11.05.2016 23:45:24	Light / Optics	max depth/ on ground	130m	0° 0,004' N	180° 0,000' E	5263,9
SO248_6-7	12.05.2016 00:00:02	Light / Optics	max depth/ on ground	50m	0° 0,007' S	179° 59,999' W	5264,6
SO248_6-7	12.05.2016 00:05:00	Light / Optics	max depth/ on ground	50m	0° 0,008' S	180° 0,000' W	5260
SO248_6-7	12.05.2016 00:09:57	Light / Optics	on deck		0° 0,008' S	179° 59,999' W	5262,7
SO248_6-7	12.05.2016 00:10:05	Light / Optics	station end		0° 0,008' S	179° 59,999' W	5262,7
SO248_6-8	12.05.2016 00:11:09	Light / Optics	station start	Secchi-Disk	0° 0,008' S	179° 59,999' W	5262,3
SO248_6-8	12.05.2016 00:11:28	Light / Optics	in the water		0° 0,008' S	179° 59,999' W	5261,6
SO248_6-8	12.05.2016 00:17:17	Light / Optics	max depth/ on ground	25m	0° 0,009' S	179° 59,999' W	5263,4
SO248_6-8	12.05.2016 00:19:04	Light / Optics	on deck		0° 0,008' S	179° 59,999' W	5261
SO248_6-8	12.05.2016 00:19:12	Light / Optics	station end		0° 0,008' S	179° 59,999' W	5263,5
SO248_6-9	12.05.2016 00:30:00	PUMP	station start	InSitu	0° 0,008' S	179° 59,999' W	5262
SO248_6-9	12.05.2016 00:31:12	PUMP	in the water		0° 0,008' S	179° 59,999' W	5261,3
SO248_6-9	12.05.2016 00:34:22	PUMP	max depth/ on ground	60m	0° 0,008' S	179° 59,999' W	5262,8
SO248_6-9	12.05.2016 03:42:53	PUMP	information	Pumpen beendet, Beg. Hieven	0° 0,008' N	179° 59,999' W	5264,4

SO248_6-9	12.05.2016 03:49:52	PUMP	on deck		0° 0,002' N	179° 59,999' W	5262,8
SO248_6-9	12.05.2016 03:51:43	PUMP	station end		0° 0,001' N	179° 59,999' W	5266,2
SO248_6-10	12.05.2016 01:32:53	CTD	station start		0° 0,004' S	180° 0,000' E	5262,3
SO248_6-10	12.05.2016 01:33:03	CTD	in the water		0° 0,004' S	180° 0,000' E	5262,9
SO248_6-10	12.05.2016 01:54:19	CTD	max depth/ on ground	SL: 500m	0° 0,004' S	179° 59,999' E	5262
SO248_6-10	12.05.2016 02:12:25	CTD	on deck		0° 0,005' S	179° 59,999' W	5263,2
SO248_6-10	12.05.2016 02:12:29	CTD	station end		0° 0,004' S	179° 59,999' W	5261,3
SO248_6-11	12.05.2016 04:26:08	CTD	station start		0° 0,000' S	179° 59,999' E	5266,9
SO248_6-11	12.05.2016 04:27:25	CTD	in the water		0° 0,001' S	180° 0,000' E	5262,5
SO248_6-11	12.05.2016 04:47:13	CTD	max depth/ on ground	SL: 500 m, SZ: 8 kN	0° 0,002' N	180° 0,000' E	5265,1
SO248_6-11	12.05.2016 05:09:19	CTD	on deck		0° 0,006' N	179° 59,999' E	5265,5
SO248_6-11	12.05.2016 05:10:30	CTD	station end		0° 0,007' N	179° 59,998' E	5264,6
SO248_6-12	12.05.2016 05:16:44	NET	station start	Bongo Netz	0° 0,006' N	179° 59,998' W	5266,7
SO248_6-12	12.05.2016 05:19:20	NET	information	Bongo Netz zu Wasser	0° 0,005' N	180° 0,000' E	5263,7
SO248_6-12	12.05.2016 06:06:25	NET	information	Bongo Netz an Deck	0° 0,008' N	179° 59,999' E	5261,4
SO248_6-12	12.05.2016 06:07:18	NET	station end		0° 0,008' N	179° 59,999' E	5266,2
SO248_6-13	12.05.2016 07:27:13	CTD	station start		0° 0,001' S	179° 59,999' E	5261,1
SO248_6-13	12.05.2016 07:30:00	CTD	in the water	EL2, kl. Schiebebalken	0° 0,002' N	180° 0,000' W	5267,3
SO248_6-13	12.05.2016 07:53:28	CTD	max depth/ on ground	SL: 500 m, SZ: 7 kN	0° 0,004' N	179° 59,998' E	5262,1
SO248_6-13	12.05.2016 08:11:07	CTD	on deck		0° 0,007' N	179° 59,999' E	5265,2
SO248_6-13	12.05.2016 08:12:24	CTD	station end		0° 0,008' N	179° 59,999' E	5265,2
SO248_6-14	12.05.2016 10:21:06	CTD	station start		0° 0,005' S	180° 0,000' E	5263,2
SO248_6-14	12.05.2016 10:23:12	CTD	in the water	EL2, kl. Schiebebalken	0° 0,004' S	179° 59,999' W	5262,7

SO248_6-14	12.05.2016 10:48:26	CTD	max depth/ on ground	SL: 500 m, SZ: 9 kN	0° 0,007' N	179° 59,999' W	5265
SO248_6-14	12.05.2016 11:09:21	CTD	on deck		0° 0,001' S	179° 59,997' W	6827,7
SO248_6-14	12.05.2016 11:09:28	CTD	station end		0° 0,001' S	179° 59,997' W	6827,7
SO248_6-15	12.05.2016 13:22:30	CTD	station start		0° 0,007' N	179° 59,998' E	5265
SO248_6-15	12.05.2016 13:22:45	CTD	in the water		0° 0,007' N	179° 59,998' E	5262,7
SO248_6-15	12.05.2016 13:47:04	CTD	max depth/ on ground	SL: 500m	0° 0,002' N	179° 59,997' W	5265,3
SO248_6-15	12.05.2016 14:05:57	CTD	on deck		0° 0,006' N	179° 59,998' W	5262,5
SO248_6-15	12.05.2016 14:06:12	CTD	station end		0° 0,006' N	179° 59,998' W	5263,4
SO248_6-16	12.05.2016 16:26:39	CTD	station start		0° 0,004' S	179° 59,994' W	5263,1
SO248_6-16	12.05.2016 16:28:06	CTD	in the water		0° 0,003' S	179° 59,995' W	5264,6
SO248_6-16	12.05.2016 16:49:14	CTD	max depth/ on ground	maxSL: 498m	0° 0,003' N	179° 59,997' W	5264,5
SO248_6-16	12.05.2016 17:08:16	CTD	on deck		0° 0,006' N	179° 59,997' E	5265,1
SO248_6-16	12.05.2016 17:10:02	CTD	station end		0° 0,007' N	179° 59,997' E	5264,4
SO248_7-1	13.05.2016 17:57:42	CTD	station start		4° 39,306' N	179° 23,861' E	6276,7
SO248_7-1	13.05.2016 18:00:19	CTD	in the water		4° 39,308' N	179° 23,866' E	6264,6
SO248_7-1	13.05.2016 18:32:10	CTD	max depth/ on ground	maxSL: 999m	4° 39,305' N	179° 23,867' E	6229,6
SO248_7-1	13.05.2016 19:00:24	CTD	on deck		4° 39,314' N	179° 23,867' E	6209,6
SO248_7-1	13.05.2016 19:03:06	CTD	station end		4° 39,316' N	179° 23,866' E	6215,1
SO248_7-2	13.05.2016 20:24:20	CTD	station start	EL2, kl. Schiebebalken	4° 30,829' N	179° 15,161' E	5634,4
SO248_7-2	13.05.2016 20:26:52	CTD	in the water		4° 30,832' N	179° 15,164' E	5632,8
SO248_7-2	13.05.2016 20:42:41	CTD	max depth/ on ground	SL: 299 m, SZ: 8 kN	4° 30,826' N	179° 15,209' E	6070,6
SO248_7-2	13.05.2016 20:55:29	CTD	on deck		4° 30,813' N	179° 15,244' E	5640,2
SO248_7-2	13.05.2016 20:56:12	CTD	station end		4° 30,812' N	179° 15,243' E	5643,6

SO248_7-3	13.05.2016 21:16:37	CTD	station start		4° 30,791' N	179° 15,320' E	5643,8
SO248_7-3	13.05.2016 21:18:30	CTD	in the water	EL2, kl. Schiebebalken	4° 30,788' N	179° 15,331' E	5642,1
SO248_7-3	13.05.2016 21:34:01	CTD	max depth/ on ground	SL: 300 m, SZ: 7 kN	4° 30,775' N	179° 15,383' E	5642,1
SO248_7-3	13.05.2016 21:48:17	CTD	on deck		4° 30,775' N	179° 15,375' E	5637,6
SO248_7-3	13.05.2016 21:49:35	CTD	station end		4° 30,775' N	179° 15,376' E	5637,1
SO248_7-4	13.05.2016 22:18:13	CTD	station start		4° 30,788' N	179° 15,372' E	5637,3
SO248_7-4	13.05.2016 22:20:15	CTD	in the water		4° 30,789' N	179° 15,372' E	5630
SO248_7-4	13.05.2016 22:36:13	CTD	max depth/ on ground	SL: 299 m, SZ: 8 kN	4° 30,786' N	179° 15,365' E	5638,6
SO248_7-4	13.05.2016 22:50:30	CTD	on deck		4° 30,779' N	179° 15,364' E	5638,6
SO248_7-4	13.05.2016 22:51:43	CTD	station end		4° 30,779' N	179° 15,364' E	5641
SO248_7-5	13.05.2016 22:52:46	Light / Optics	station start	SECCI-Disk	4° 30,778' N	179° 15,363' E	5638,7
SO248_7-5	13.05.2016 22:58:17	Light / Optics	in the water		4° 30,784' N	179° 15,370' E	5638,5
SO248_7-5	13.05.2016 23:06:23	Light / Optics	max depth/ on ground	SL: 52 m	4° 30,787' N	179° 15,372' E	5640,1
SO248_7-5	13.05.2016 23:10:39	Light / Optics	on deck		4° 30,789' N	179° 15,371' E	5638,1
SO248_7-5	13.05.2016 23:10:51	Light / Optics	station end		4° 30,789' N	179° 15,371' E	5639,7
SO248_7-6	13.05.2016 23:15:53	Light / Optics	station start	UV-Profiler	4° 30,792' N	179° 15,398' E	5632,9
SO248_7-6	13.05.2016 23:16:14	Light / Optics	in the water		4° 30,792' N	179° 15,404' E	5639,9
SO248_7-6	13.05.2016 23:22:15	Light / Optics	max depth/ on ground	83m	4° 30,798' N	179° 15,479' E	5630,9
SO248_7-6	13.05.2016 23:29:54	Light / Optics	max depth/ on ground	64m	4° 30,805' N	179° 15,557' E	5623,4
SO248_7-6	13.05.2016 23:35:22	Light / Optics	max depth/ on ground	60m	4° 30,811' N	179° 15,623' E	5631,8
SO248_7-6	13.05.2016 23:43:51	Light / Optics	on deck		4° 30,821' N	179° 15,733' E	5626,9
SO248_7-6	13.05.2016 23:43:57	Light / Optics	station end		4° 30,821' N	179° 15,734' E	5629,1

SO248_7-7	13.05.2016 23:45:01	Light / Optics	station start	Satlantic-Profiler	4° 30,822' N	179° 15,747' E	5630,9
SO248_7-7	13.05.2016 23:45:27	Light / Optics	in the water		4° 30,823' N	179° 15,752' E	5632,6
SO248_7-7	13.05.2016 23:51:16	Light / Optics	max depth/ on ground	150m	4° 30,828' N	179° 15,819' E	5629,7
SO248_7-7	14.05.2016 00:03:06	Light / Optics	max depth/ on ground	50m	4° 30,838' N	179° 15,942' E	5634,4
SO248_7-7	14.05.2016 00:09:04	Light / Optics	max depth/ on ground	50m	4° 30,844' N	179° 16,009' E	5634,5
SO248_7-7	14.05.2016 00:14:07	Light / Optics	on deck		4° 30,848' N	179° 16,061' E	5632,9
SO248_7-7	14.05.2016 00:14:31	Light / Optics	station end		4° 30,848' N	179° 16,064' E	5635,2
SO248_8-1	15.05.2016 12:55:03	MUC	station start		10° 58,020' N	179° 0,095' E	5468,5
SO248_8-1	15.05.2016 12:55:24	MUC	in the water		10° 58,020' N	179° 0,096' E	5469
SO248_8-1	15.05.2016 15:18:59	MUC	max depth/ on ground	maxSL: 5436m	10° 58,014' N	179° 0,098' E	5402,2
SO248_8-1	15.05.2016 15:21:49	MUC	hoisting	maxSZ: 59,2kN	10° 58,016' N	179° 0,098' E	5356,1
SO248_8-1	15.05.2016 17:10:35	MUC	on deck		10° 58,012' N	179° 0,093' E	5405,8
SO248_8-1	15.05.2016 17:11:31	MUC	station end		10° 58,012' N	179° 0,094' E	5414,4
SO248_8-2	15.05.2016 17:42:45	CTD	station start		11° 0,034' N	178° 59,994' E	5222,7
SO248_8-2	15.05.2016 17:44:03	CTD	in the water		11° 0,032' N	178° 59,993' E	5224,5
SO248_8-2	15.05.2016 18:16:41	CTD	max depth/ on ground	maxSL: 998m	10° 59,994' N	179° 0,001' E	5218,5
SO248_8-2	15.05.2016 18:50:33	CTD	on deck		10° 59,996' N	179° 0,003' E	5238,7
SO248_8-2	15.05.2016 18:51:21	CTD	station end		10° 59,997' N	179° 0,003' E	5214,8
SO248_8-3	15.05.2016 17:50:13	PUMP	station start	In Situ Pump	11° 0,030' N	178° 59,989' E	5224,2
SO248_8-3	15.05.2016 17:53:03	PUMP	in the water		11° 0,033' N	178° 59,987' E	5236,4
SO248_8-3	15.05.2016 17:55:26	PUMP	max depth/ on ground	maxSL: 60m, Beg. Pum-pen	11° 0,035' N	178° 59,988' E	5212,1
SO248_8-3	15.05.2016 21:15:52	PUMP	on deck		10° 59,996' N	178° 59,997' E	5215,4

SO248_8-3	15.05.2016 21:20:07	PUMP	station end		11° 0,002' N	178° 59,997' E	5212,4
SO248_8-4	15.05.2016 19:54:13	CTD	station start	EL2, kl. Schiebebalken	10° 59,992' N	179° 0,000' E	5214,4
SO248_8-4	15.05.2016 19:56:02	CTD	in the water		10° 59,993' N	179° 0,000' E	5216,4
SO248_8-4	15.05.2016 21:42:19	CTD	max depth/ on ground	SL: 5224 m, SZ: 27 kN, (laut Wiss. CTD 10 m über Grund)	11° 0,002' N	178° 59,999' E	5213,4
SO248_8-4	15.05.2016 21:43:57	CTD	hoisting		11° 0,002' N	178° 59,998' E	5208,7
SO248_8-4	15.05.2016 23:33:09	CTD	on deck		11° 0,005' N	179° 0,000' E	5213,8
SO248_8-4	15.05.2016 23:33:18	CTD	station end		11° 0,006' N	179° 0,000' E	5208,2
SO248_8-5	15.05.2016 21:26:26	Light / Optics	station start	SECCI-Disk	11° 0,007' N	179° 0,000' E	5199
SO248_8-5	15.05.2016 21:27:36	Light / Optics	in the water	Heck über Kran 4 mit Block + Winde	11° 0,006' N	179° 0,000' E	5216
SO248_8-5	15.05.2016 21:32:36	Light / Optics	max depth/ on ground	SLmax: 52 m	11° 0,003' N	178° 59,997' E	5204,4
SO248_8-5	15.05.2016 21:36:32	Light / Optics	on deck		11° 0,001' N	179° 0,000' E	5200,3
SO248_8-5	15.05.2016 21:37:16	Light / Optics	station end		11° 0,001' N	179° 0,000' E	5209,2
SO248_8-6	15.05.2016 23:37:02	Light / Optics	station start	UV-Profiler	11° 0,007' N	179° 0,016' E	5210,8
SO248_8-6	15.05.2016 23:37:16	Light / Optics	in the water		11° 0,007' N	179° 0,018' E	5203,4
SO248_8-6	15.05.2016 23:40:39	Light / Optics	max depth/ on ground	85m	11° 0,008' N	179° 0,046' E	5213,2
SO248_8-6	15.05.2016 23:47:35	Light / Optics	max depth/ on ground	50m	11° 0,007' N	179° 0,090' E	5212,4
SO248_8-6	15.05.2016 23:51:38	Light / Optics	max depth/ on ground	50m	11° 0,008' N	179° 0,110' E	5211,4
SO248_8-6	15.05.2016 23:55:10	Light / Optics	on deck		11° 0,008' N	179° 0,125' E	5207,2
SO248_8-6	15.05.2016 23:55:21	Light / Optics	station end		11° 0,008' N	179° 0,126' E	5207,2
SO248_8-7	15.05.2016 23:57:07	Light / Optics	station start	Satlantic-Profiler	11° 0,008' N	179° 0,132' E	5212,8
SO248_8-7	15.05.2016 23:57:29	Light / Optics	in the water		11° 0,008' N	179° 0,134' E	5216,8
SO248_8-7	16.05.2016 00:03:01	Light / Optics	max depth/ on ground	195m	11° 0,008' N	179° 0,151' E	5219,4

SO248_8-7	16.05.2016 00:15:26	Light / Optics	max depth/ on ground	50m	11° 0,008' N	179° 0,225' E	5216
SO248_8-7	16.05.2016 00:20:21	Light / Optics	max depth/ on ground	50m	11° 0,008' N	179° 0,257' E	5223,4
SO248_8-7	16.05.2016 00:22:31	Light / Optics	on deck		11° 0,008' N	179° 0,271' E	5224,1
SO248_8-7	16.05.2016 00:22:50	Light / Optics	station end		11° 0,008' N	179° 0,273' E	5221,2
SO248_8-8	16.05.2016 00:30:35	NET	station start	Bongo-Netz	11° 0,008' N	179° 0,322' E	5219,6
SO248_8-8	16.05.2016 00:34:47	NET	information	zu Wasser	11° 0,008' N	179° 0,331' E	5220,7
SO248_8-8	16.05.2016 01:12:01	NET	information	an Deck	11° 0,012' N	179° 1,361' E	5247,4
SO248_8-8	16.05.2016 01:16:00	NET	station end		11° 0,009' N	179° 1,360' E	5246,8
SO248_9-1	17.05.2016 01:13:32	Light / Optics	station start	UV-Profiler	16° 0,096' N	178° 59,642' E	5236,7
SO248_9-1	17.05.2016 01:13:39	Light / Optics	in the water		16° 0,096' N	178° 59,642' E	5236,7
SO248_9-1	17.05.2016 01:18:08	Light / Optics	max depth/ on ground	85m	16° 0,083' N	178° 59,690' E	5230,8
SO248_9-1	17.05.2016 01:24:01	Light / Optics	max depth/ on ground	55m	16° 0,069' N	178° 59,739' E	5226,7
SO248_9-1	17.05.2016 01:28:17	Light / Optics	max depth/ on ground	55m	16° 0,065' N	178° 59,756' E	5222,7
SO248_9-1	17.05.2016 01:32:11	Light / Optics	on deck		16° 0,059' N	178° 59,776' E	5216,9
SO248_9-1	17.05.2016 01:32:25	Light / Optics	station end		16° 0,059' N	178° 59,778' E	5217,2
SO248_9-2	17.05.2016 01:33:35	Light / Optics	station start	Satlantic-Profiler	16° 0,058' N	178° 59,783' E	5217,2
SO248_9-2	17.05.2016 01:34:01	Light / Optics	in the water		16° 0,057' N	178° 59,784' E	5216,3
SO248_9-2	17.05.2016 01:40:04	Light / Optics	max depth/on ground	197m	16° 0,048' N	178° 59,821' E	5204,3
SO248_9-2	17.05.2016 01:49:50	Light / Optics	max depth/ on ground	50m	16° 0,035' N	178° 59,872' E	5218,6
SO248_9-2	17.05.2016 01:53:04	Light / Optics	max depth/ on ground	50m	16° 0,029' N	178° 59,893' E	5215,9
SO248_9-2	17.05.2016 01:56:54	Light / Optics	on deck		16° 0,019' N	178° 59,929' E	5192,7
SO248_9-2	17.05.2016 01:57:04	Light / Optics	station end		16° 0,019' N	178° 59,931' E	5193,4

SO248_9-3	17.05.2016 02:01:50	CTD	station start		16° 0,005' N	178° 59,982' E	5193,4
SO248_9-3	17.05.2016 02:02:01	CTD	in the water		16° 0,004' N	178° 59,983' E	5197,1
SO248_9-3	17.05.2016 02:33:00	CTD	max depth/ on ground	maxSL: 998m	16° 0,001' N	178° 59,986' E	5181,3
SO248_9-3	17.05.2016 02:56:28	CTD	on deck		15° 59,997' N	178° 59,984' E	5193,4
SO248_9-3	17.05.2016 02:57:17	CTD	station end		15° 59,998' N	178° 59,985' E	5192,6
SO248_9-4	17.05.2016 02:08:01	Light / Optics	station start	Secchi-Disc	16° 0,004' N	178° 59,990' E	5197,6
SO248_9-4	17.05.2016 02:10:18	Light / Optics	in the water		16° 0,004' N	178° 59,990' E	5169,4
SO248_9-4	17.05.2016 02:19:04	Light / Optics	max depth/ on ground	maxSL: 44m	16° 0,004' N	178° 59,987' E	5196,2
SO248_9-4	17.05.2016 02:22:17	Light / Optics	on deck		16° 0,004' N	178° 59,988' E	5169,9
SO248_9-4	17.05.2016 02:23:38	Light / Optics	station end		16° 0,004' N	178° 59,987' E	5169,2
SO248_9-5	17.05.2016 03:16:45	CTD	station start		16° 0,011' N	178° 59,989' E	5206
SO248_9-5	17.05.2016 03:18:22	CTD	in the water		16° 0,010' N	178° 59,990' E	5206,3
SO248_9-5	17.05.2016 03:48:58	CTD	max depth/ on ground	SL: 998 m, SZ: 11 kN	15° 59,997' N	178° 59,985' E	5196,7
SO248_9-5	17.05.2016 03:50:35	CTD	hoisting		15° 59,997' N	178° 59,983' E	5199,3
SO248_9-5	17.05.2016 04:12:07	CTD	on deck		16° 0,003' N	178° 59,986' E	5211,2
SO248_9-5	17.05.2016 04:13:31	CTD	station end		16° 0,004' N	178° 59,986' E	5179,3
SO248_9-6	17.05.2016 04:29:28	CTD	station start		15° 59,999' N	178° 59,986' E	5194,8
SO248_9-6	17.05.2016 04:31:11	CTD	in the water		16° 0,002' N	178° 59,988' E	5201,9
SO248_9-6	17.05.2016 05:02:08	CTD	max depth/ on ground	maxSL: 999m	15° 59,996' N	178° 59,981' E	5179,4
SO248_9-6	17.05.2016 05:30:36	CTD	on deck		16° 0,012' N	178° 59,989' E	5172,3
SO248_9-6	17.05.2016 05:31:43	CTD	station end		16° 0,012' N	178° 59,988' E	5172,1
SO248_10-1	18.05.2016 09:20:35	MUC	station start		21° 57,941' N	178° 19,054' E	3250,4
SO248_10-1	18.05.2016 09:25:52	MUC	in the water	FW1/SPW1, Schiebebak-ken	21° 57,939' N	178° 18,999' E	3250,3

SO248_10-1	18.05.2016 10:58:29	MUC	max depth/ on ground	SL: 3294m	21° 57,998' N	178° 18,999' E	3257,6
SO248_10-1	18.05.2016 11:02:29	MUC	hoisting	SZmax: 40kN	21° 57,996' N	178° 19,001' E	3258,6
SO248_10-1	18.05.2016 12:09:11	MUC	on deck		21° 58,005' N	178° 19,003' E	3260,3
SO248_10-1	18.05.2016 12:12:01	MUC	station end		21° 58,006' N	178° 19,004' E	3258,8
SO248_10-2	18.05.2016 12:43:56	CTD	station start	mit in situ Incubator und Pumpe	22° 0,020' N	178° 18,990' E	2775
SO248_10-2	18.05.2016 12:44:40	CTD	in the water		22° 0,019' N	178° 18,992' E	2754,3
SO248_10-2	18.05.2016 13:52:05	CTD	max depth/ on ground	SL: 1997m	22° 0,010' N	178° 18,997' E	2755,7
SO248_10-2	18.05.2016 22:12:25	CTD	lowering		22° 0,002' N	178° 19,008' E	2889,9
SO248_10-2	18.05.2016 22:32:36	CTD	max depth/ on ground	SL: 2798m	22° 0,006' N	178° 18,995' E	2884,6
SO248_10-2	18.05.2016 23:37:16	CTD	on deck		22° 0,003' N	178° 19,004' E	2864,8
SO248_10-2	18.05.2016 23:37:26	CTD	station end		22° 0,003' N	178° 19,004' E	2856
SO248_10-3	18.05.2016 23:50:19	NET	station start	Bongo-Netz	22° 0,015' N	178° 18,989' E	2875,5
SO248_10-3	18.05.2016 23:52:42	NET	information	zu Wasser	22° 0,047' N	178° 18,985' E	2854,2
SO248_10-3	19.05.2016 00:47:26	NET	information	an Deck	22° 1,773' N	178° 18,787' E	3492,2
SO248_10-3	19.05.2016 00:47:41	NET	station end		22° 1,778' N	178° 18,787' E	3494,3
SO248_10-4	19.05.2016 00:56:55	Light / Optics	station start	Sechi Disc	22° 1,792' N	178° 18,784' E	3455
SO248_10-4	19.05.2016 00:57:27	Light / Optics	in the water		22° 1,793' N	178° 18,784' E	3472,6
SO248_10-4	19.05.2016 01:03:16	Light / Optics	max depth/ on ground	40m	22° 1,794' N	178° 18,779' E	3471,1
SO248_10-4	19.05.2016 01:06:29	Light / Optics	on deck		22° 1,793' N	178° 18,778' E	3476,5
SO248_10-4	19.05.2016 01:06:35	Light / Optics	station end		22° 1,793' N	178° 18,778' E	3462,7
SO248_10-5	19.05.2016 00:59:45	CTD	station start		22° 1,795' N	178° 18,783' E	3476,5
SO248_10-5	19.05.2016 01:00:03	CTD	in the water		22° 1,795' N	178° 18,783' E	3453,8
SO248_10-5	19.05.2016 01:16:31	CTD	max depth/	SL: 300m	22° 1,788' N	178° 18,780' E	3478,9

			on ground				
SO248_10-5	19.05.2016 01:37:16	CTD	on deck		22° 1,788' N	178° 18,779' E	3475,6
SO248_10-5	19.05.2016 01:37:29	CTD	station end		22° 1,788' N	178° 18,779' E	3483,2
SO248_10-6	19.05.2016 01:43:00	Light / Optics	station start	UV-Profiler	22° 1,807' N	178° 18,781' E	3431
SO248_10-6	19.05.2016 01:43:22	Light / Optics	in the water		22° 1,812' N	178° 18,782' E	3448,3
SO248_10-6	19.05.2016 01:46:39	Light / Optics	max depth/ on ground	95m	22° 1,844' N	178° 18,786' E	3447,8
SO248_10-6	19.05.2016 01:53:18	Light / Optics	max depth/ on ground	50m	22° 1,890' N	178° 18,792' E	3410,2
SO248_10-6	19.05.2016 01:57:26	Light / Optics	max depth/ on ground	50m	22° 1,936' N	178° 18,797' E	3387,8
SO248_10-6	19.05.2016 02:00:12	Light / Optics	on deck		22° 1,963' N	178° 18,800' E	3346,4
SO248_10-6	19.05.2016 02:00:29	Light / Optics	station end		22° 1,965' N	178° 18,801' E	3343,3
SO248_10-7	19.05.2016 02:01:56	Light / Optics	station start	Satlantic-Profiler	22° 1,979' N	178° 18,803' E	3345,4
SO248_10-7	19.05.2016 02:02:25	Light / Optics	in the water		22° 1,983' N	178° 18,803' E	3352,9
SO248_10-7	19.05.2016 02:09:12	Light / Optics	max depth/ on ground	140m	22° 2,046' N	178° 18,811' E	3420,5
SO248_10-7	19.05.2016 02:15:31	Light / Optics	at surface		22° 2,106' N	178° 18,819' E	3455,3
SO248_10-7	19.05.2016 02:17:50	Light / Optics	max depth/ on ground	50m	22° 2,128' N	178° 18,822' E	3453,3
SO248_10-7	19.05.2016 02:19:03	Light / Optics	at surface		22° 2,140' N	178° 18,823' E	3454,5
SO248_10-7	19.05.2016 02:21:15	Light / Optics	max depth/ on ground	50m	22° 2,160' N	178° 18,826' E	3454,5
SO248_10-7	19.05.2016 02:24:34	Light / Optics	on deck		22° 2,190' N	178° 18,830' E	3455,2
SO248_10-7	19.05.2016 02:25:35	Light / Optics	station end		22° 2,200' N	178° 18,829' E	3454,9
SO248_11-1	20.05.2016 07:45:32	CTD	station start		28° 0,018' N	177° 19,867' E	5717,2
SO248_11-1	20.05.2016 07:52:59	CTD	in the water	EL2, kl. Schiebebalken	28° 0,030' N	177° 19,925' E	5162,4
SO248_11-1	20.05.2016 08:26:26	CTD	max depth/ on ground	SL: 998 m, SZ: 10 kN	28° 0,000' N	177° 20,008' E	5155,7

SO248_11-1	20.05.2016 08:55:17	CTD	on deck		27° 59,996' N	177° 20,007' E	5157,9
SO248_11-1	20.05.2016 08:56:17	CTD	station end		27° 59,997' N	177° 20,005' E	5156,3
SO248_12-1	21.05.2016 15:58:00	CTD	station start		33° 59,996' N	177° 19,978' E	3517,1
SO248_12-1	21.05.2016 15:59:16	CTD	in the water		33° 59,997' N	177° 19,974' E	3514
SO248_12-1	21.05.2016 17:19:03	CTD	max depth/ on ground	maxSL: 3499m	33° 59,999' N	177° 20,007' E	3516,6
SO248_12-1	21.05.2016 18:34:45	CTD	on deck		34° 0,002' N	177° 20,010' E	3517,4
SO248_12-1	21.05.2016 18:36:57	CTD	station end		34° 0,004' N	177° 20,009' E	3518,4
SO248_12-2	21.05.2016 16:06:12	PUMP	station start	In Situ Pump	33° 59,999' N	177° 19,993' E	3514,1
SO248_12-2	21.05.2016 16:07:41	PUMP	in the water		34° 0,001' N	177° 19,998' E	3516,6
SO248_12-2	21.05.2016 16:08:53	PUMP	max depth/ on ground	SL: 20m, Beg. Pumpen	34° 0,002' N	177° 20,000' E	3519,5
SO248_12-2	21.05.2016 19:22:13	PUMP	on deck		33° 59,996' N	177° 19,993' E	3517,2
SO248_12-2	21.05.2016 19:23:02	PUMP	station end		33° 59,995' N	177° 19,993' E	3518,8
SO248_12-3	21.05.2016 19:30:31	CTD	station start		33° 59,996' N	177° 19,991' E	3517,5
SO248_12-3	21.05.2016 19:32:16	CTD	in the water		33° 59,997' N	177° 19,991' E	3516,4
SO248_12-3	21.05.2016 19:43:45	CTD	max depth/ on ground	SL: 200 m, SZ: 8 kN	33° 59,999' N	177° 19,991' E	3512,5
SO248_12-3	21.05.2016 19:57:43	CTD	on deck		33° 59,999' N	177° 19,991' E	3515,4
SO248_12-3	21.05.2016 19:58:45	CTD	station end		33° 59,999' N	177° 19,991' E	3516,3
SO248_12-4	21.05.2016 20:00:22	NET	station start	Bongo - Netz	33° 59,999' N	177° 19,991' E	3515,2
SO248_12-4	21.05.2016 20:08:02	NET	information	Netz z. W., FdW: 1,5 kn nach Vorgabe Wiss., rwK: 165°	33° 59,912' N	177° 20,018' E	3516
SO248_12-4	21.05.2016 20:56:42	NET	information	Bongo-Netz a. D.	33° 58,791' N	177° 20,385' E	3496,8
SO248_12-4	21.05.2016 21:10:41	NET	station end		33° 58,786' N	177° 20,388' E	3493,6
SO248_12-5	21.05.2016 21:12:23	Light / Optics	station start	UV-Profiler	33° 58,779' N	177° 20,390' E	3489,9

SO248_12-5	21.05.2016 21:16:40	Light / Optics	in the water	BB-Heck, FdW: 0,7 kn nach Vorgabe Wiss., rwK: 165°	33° 58,744' N	177° 20,400' E	3488,2
SO248_12-5	21.05.2016 21:23:00	Light / Optics	information	SLmax: 57 m, hieven an die Oberfläche	33° 58,678' N	177° 20,419' E	3493,9
SO248_12-5	21.05.2016 21:26:59	Light / Optics	information	SL: 50 m, hieven an die Oberfläche	33° 58,633' N	177° 20,435' E	3491,5
SO248_12-5	21.05.2016 21:30:02	Light / Optics	information	SL: 50 m, hieven an die Oberfläche	33° 58,597' N	177° 20,444' E	3490,7
SO248_12-5	21.05.2016 21:33:33	Light / Optics	information	UV-Profiler a. D.	33° 58,557' N	177° 20,458' E	3491,5
SO248_12-5	21.05.2016 21:34:25	Light / Optics	station end		33° 58,548' N	177° 20,462' E	3489,4
SO248_12-6	21.05.2016 21:35:51	Light / Optics	station start	Satlantic-Profiler	33° 58,532' N	177° 20,467' E	3491,9
SO248_12-6	21.05.2016 21:36:04	Light / Optics	in the water		33° 58,530' N	177° 20,468' E	3487,7
SO248_12-6	21.05.2016 21:38:48	Light / Optics	max depth/ on ground	SL: 70 m, hieven an die Oberfläche	33° 58,499' N	177° 20,477' E	3489,8
SO248_12-6	21.05.2016 21:41:05	Light / Optics	information	SL: 50 m, hieven an die Oberfläche	33° 58,474' N	177° 20,487' E	3488,9
SO248_12-6	21.05.2016 21:43:39	Light / Optics	information	SL: 50 m, hieven an die Oberfläche	33° 58,448' N	177° 20,494' E	3489
SO248_12-6	21.05.2016 21:47:09	Light / Optics	information	SL: 50 m, hieven an die Oberfläche	33° 58,407' N	177° 20,509' E	3481,9
SO248_12-6	21.05.2016 21:49:56	Light / Optics	on deck		33° 58,372' N	177° 20,518' E	3481,7
SO248_12-6	21.05.2016 21:50:40	Light / Optics	station end		33° 58,365' N	177° 20,521' E	3486,6
SO248_12-7	21.05.2016 21:52:10	Light / Optics	information	Secci-Disk	33° 58,349' N	177° 20,528' E	3485,7
SO248_12-7	21.05.2016 21:53:15	Light / Optics	in the water	BB-Heck	33° 58,348' N	177° 20,528' E	3479,5
SO248_12-7	21.05.2016 21:56:40	Light / Optics	max depth/ on ground	SL: 14 m	33° 58,350' N	177° 20,529' E	3485
SO248_12-7	21.05.2016 21:57:36	Light / Optics	on deck		33° 58,351' N	177° 20,530' E	3485,6
SO248_12-7	21.05.2016 22:00:36	Light / Optics	station end		33° 58,354' N	177° 20,529' E	3487,5
SO248_12-8	21.05.2016 22:05:57	MUC	station start		33° 58,356' N	177° 20,528' E	3477,6
SO248_12-8	21.05.2016 22:08:12	MUC	in the water		33° 58,356' N	177° 20,528' E	3481,3

SO248_12-8	21.05.2016 23:38:27	MUC	max depth/ on ground	SL: 3516m	33° 58,351' N	177° 20,525' E	3486,4
SO248_12-8	21.05.2016 23:42:33	MUC	hoisting	SZ: 43kN	33° 58,353' N	177° 20,525' E	3478,2
SO248_12-8	22.05.2016 00:52:10	MUC	on deck		33° 58,351' N	177° 20,529' E	3479,3
SO248_12-8	22.05.2016 00:57:15	MUC	station end		33° 58,348' N	177° 20,527' E	3484
SO248_13-1	23.05.2016 05:07:01	NET	station start	Bongo Netz (geschleppt)	40° 0,175' N	177° 19,997' E	5666,9
SO248_13-1	23.05.2016 05:09:32	NET	information	zu Wasser	40° 0,179' N	177° 20,000' E	5651,6
SO248_13-1	23.05.2016 05:15:22	NET	information	Beg. Schleppen, SL: 15m	40° 0,103' N	177° 19,980' E	5659,5
SO248_13-1	23.05.2016 06:09:13	NET	information	Bongo-Netz a. D.	39° 58,597' N	177° 19,666' E	5646,3
SO248_13-1	23.05.2016 06:18:31	NET	station end		39° 58,338' N	177° 19,620' E	5644,7
SO248_13-2	23.05.2016 06:23:32	PUMP	station start	INSITU-Pumpe	39° 58,240' N	177° 19,609' E	5658,8
SO248_13-2	23.05.2016 06:25:47	PUMP	in the water		39° 58,231' N	177° 19,604' E	5655,9
SO248_13-2	23.05.2016 06:27:26	PUMP	max depth/ on ground	SL: 20 m	39° 58,229' N	177° 19,603' E	5655,9
SO248_13-2	23.05.2016 09:42:21	PUMP	information	INSITU-Pumpe a. D.	39° 58,229' N	177° 19,611' E	5657,1
SO248_13-2	23.05.2016 09:46:46	PUMP	station end		39° 58,189' N	177° 19,599' E	5650,9
SO248_13-3	23.05.2016 06:30:45	CTD	station start		39° 58,228' N	177° 19,605' E	5653,8
SO248_13-3	23.05.2016 06:45:06	CTD	in the water		39° 58,235' N	177° 19,598' E	5656,1
SO248_13-3	23.05.2016 07:18:52	CTD	max depth/ on ground	SL: 999 m, SZ: 10 kN	39° 58,236' N	177° 19,602' E	5646,7
SO248_13-3	23.05.2016 07:19:42	CTD	hoisting		39° 58,236' N	177° 19,602' E	5647
SO248_13-3	23.05.2016 07:50:08	CTD	on deck		39° 58,233' N	177° 19,599' E	5649,9
SO248_13-3	23.05.2016 07:52:16	CTD	station end		39° 58,233' N	177° 19,597' E	5657,8
SO248_13-4	23.05.2016 08:00:56	NET	station start	Bongo-Netz, über EL2, kl. Schiebebalken	39° 58,239' N	177° 19,602' E	5656,5
SO248_13-4	23.05.2016 08:06:58	NET	information	Bongo-Netz z.W.	39° 58,237' N	177° 19,597' E	5658,4
SO248_13-4	23.05.2016 08:18:29	NET	information	SLmax: 150 m, SZ: 0,6 kN	39° 58,226' N	177° 19,611' E	5648,1

SO248_13-4	23.05.2016 08:35:27	NET	information	Bongo-Netz a. D.	39° 58,237' N	177° 19,603' E	5648,1
SO248_13-4	23.05.2016 08:36:02	NET	station end		39° 58,237' N	177° 19,603' E	5658,6
SO248_14-1	24.05.2016 09:00:35	MUC	station start	FW1/SPW1, Schiebebal-ken	45° 0,061' N	178° 45,011' E	5915,5
SO248_14-1	24.05.2016 09:06:54	MUC	in the water		45° 0,024' N	178° 45,007' E	5912,3
SO248_14-1	24.05.2016 11:44:55	MUC	max depth/ on ground	SLmax: 5942m	45° 0,001' N	178° 44,999' E	5909,4
SO248_14-1	24.05.2016 11:48:33	MUC	hoisting	SZmax: 66kN	45° 0,000' N	178° 44,998' E	5909,8
SO248_14-1	24.05.2016 13:44:31	MUC	on deck		45° 0,001' N	178° 44,992' E	5913
SO248_14-1	24.05.2016 13:46:26	MUC	station end		45° 0,001' N	178° 44,995' E	5908,4
SO248_14-2	24.05.2016 13:50:16	NET	station start		45° 0,000' N	178° 44,997' E	5907,5
SO248_14-2	24.05.2016 13:52:37	NET	information	zu Wasser	45° 0,004' N	178° 44,993' E	5916,9
SO248_14-2	24.05.2016 14:09:30	NET	information	SL: 150m	45° 0,002' N	178° 44,990' E	5909,2
SO248_14-2	24.05.2016 14:27:46	NET	information	an Deck	45° 0,002' N	178° 45,008' E	5909,4
SO248_14-2	24.05.2016 14:28:06	NET	station end		45° 0,002' N	178° 45,008' E	5909,4
SO248_14-3	24.05.2016 14:37:53	CTD	station start		44° 59,997' N	178° 45,006' E	5912,1
SO248_14-3	24.05.2016 14:39:25	CTD	in the water		44° 59,998' N	178° 45,010' E	5909,3
SO248_14-3	24.05.2016 16:34:43	CTD	max depth/ on ground	maxSL: 5863m	45° 0,007' N	178° 44,995' E	5909,3
SO248_14-3	24.05.2016 18:35:41	CTD	on deck		45° 0,003' N	178° 45,010' E	5912,2
SO248_14-3	24.05.2016 18:36:35	CTD	station end		45° 0,002' N	178° 45,010' E	5908,8
SO248_14-4	24.05.2016 16:05:05	PUMP	information	In Situ Pump	45° 0,000' N	178° 44,990' E	5913,8
SO248_14-4	24.05.2016 16:07:34	PUMP	in the water		45° 0,003' N	178° 44,988' E	5907,1
SO248_14-4	24.05.2016 16:08:56	PUMP	max depth/ on ground	maxSL: 20m, Beg. Pum-pen	45° 0,004' N	178° 44,989' E	5907,3
SO248_14-4	24.05.2016 19:19:01	PUMP	information	Beginn hieven	44° 59,996' N	178° 45,002' E	5911,1
SO248_14-4	24.05.2016 19:21:35	PUMP	on deck		44° 59,996' N	178° 44,996' E	5902,2

SO248_14-4	24.05.2016 19:22:04	PUMP	station end		44° 59,995' N	178° 44,995' E	5906,6
SO248_14-5	24.05.2016 19:47:30	CTD	station start	EL2, kl. Schiebebalken	45° 0,003' N	178° 44,988' E	5899,6
SO248_14-5	24.05.2016 19:50:17	CTD	in the water		45° 0,000' N	178° 44,985' E	5899,5
SO248_14-5	24.05.2016 19:56:35	CTD	max depth/ on ground	SL: 19 m, SZ: 7 kN	45° 0,002' N	178° 44,994' E	5912,4
SO248_14-5	24.05.2016 19:57:46	CTD	hoisting		45° 0,000' N	178° 44,997' E	5905,9
SO248_14-5	24.05.2016 20:00:17	CTD	on deck		45° 0,002' N	178° 45,002' E	5892,9
SO248_14-5	24.05.2016 20:01:45	CTD	station end		45° 0,000' N	178° 45,000' E	5909,1
SO248_14-6	24.05.2016 20:23:44	CTD	station start		45° 0,000' N	178° 44,999' E	5888,9
SO248_14-6	24.05.2016 20:25:29	CTD	in the water	EL2, kl. Schiebebalken	44° 59,996' N	178° 44,996' E	5909,2
SO248_14-6	24.05.2016 20:31:27	CTD	max depth/ on ground	SL: 18 m, SZ: 6 kN	44° 59,999' N	178° 44,990' E	5907,9
SO248_14-6	24.05.2016 20:32:58	CTD	hoisting		45° 0,003' N	178° 44,994' E	5908
SO248_14-6	24.05.2016 20:35:14	CTD	on deck		45° 0,002' N	178° 44,992' E	5906,2
SO248_14-6	24.05.2016 20:36:18	CTD	station end		45° 0,000' N	178° 44,993' E	5909,2
SO248_14-7	24.05.2016 20:53:20	CTD	station start	EL2, kl. Schiebebalken	45° 0,000' N	178° 44,990' E	5906,9
SO248_14-7	24.05.2016 20:54:34	CTD	in the water		45° 0,004' N	178° 44,992' E	5913,3
SO248_14-7	24.05.2016 21:11:32	CTD	max depth/ on ground	SL: 298 m, SZ: 7 kN	45° 0,001' N	178° 44,999' E	5909,8
SO248_14-7	24.05.2016 21:12:25	CTD	hoisting		45° 0,001' N	178° 44,999' E	5912,8
SO248_14-7	24.05.2016 21:31:50	CTD	on deck		45° 0,001' N	178° 44,991' E	5893,4
SO248_14-7	24.05.2016 21:33:01	CTD	station end		45° 0,000' N	178° 44,987' E	5909,6
SO248_14-8	24.05.2016 21:36:36	NET	information	Bongo-Netz, BB-Heck über Kran 4, Winde	45° 0,004' N	178° 44,993' E	5911,4
SO248_14-8	24.05.2016 21:40:12	NET	information	Bongo-Netz z. W.	45° 0,001' N	178° 44,989' E	6022,5
SO248_14-8	24.05.2016 22:32:14	NET	information	an Deck	44° 59,246' N	178° 45,005' E	5936,3
SO248_14-8	24.05.2016 22:33:53	NET	station end		44° 59,253' N	178° 45,009' E	5936,7

SO248_14-9	24.05.2016 22:42:03	CTD	station start		44° 59,254' N	178° 45,001' E	6125,5
SO248_14-9	24.05.2016 22:43:15	CTD	in the water		44° 59,259' N	178° 45,000' E	5939
SO248_14-9	24.05.2016 23:33:16	CTD	max depth/ on ground	SLmax: 1995m	44° 59,250' N	178° 45,001' E	5935
SO248_14-9	25.05.2016 00:12:04	CTD	on deck		44° 59,262' N	178° 44,993' E	5907,8
SO248_14-9	25.05.2016 00:12:27	CTD	station end		44° 59,261' N	178° 44,996' E	5933,9
SO248_15-1	25.05.2016 16:00:13	CTD	station start		47° 29,988' N	179° 7,989' E	5840,6
SO248_15-1	25.05.2016 16:02:27	CTD	in the water		47° 29,995' N	179° 7,978' E	5842,3
SO248_15-1	25.05.2016 16:32:07	CTD	max depth/ on ground	maxSL: 997m	47° 29,986' N	179° 7,979' E	5853,5
SO248_15-1	25.05.2016 17:00:43	CTD	on deck		47° 29,994' N	179° 7,977' E	5846,1
SO248_15-1	25.05.2016 17:02:05	CTD	station end		47° 29,995' N	179° 7,975' E	5854,5
SO248_16-1	26.05.2016 08:36:58	MUC	station start		50° 0,019' N	179° 33,019' E	5625,2
SO248_16-1	26.05.2016 08:40:58	MUC	in the water	FW1/SPW1, Schiebebal-ken	50° 0,003' N	179° 32,999' E	5613,4
SO248_16-1	26.05.2016 11:00:24	MUC	max depth/ on ground	SLmax: 5673m	49° 59,998' N	179° 32,995' E	5621,2
SO248_16-1	26.05.2016 11:03:27	MUC	hoisting	SZmax: 67kN	49° 59,995' N	179° 33,003' E	5646,2
SO248_16-1	26.05.2016 12:59:25	MUC	on deck		50° 0,003' N	179° 33,001' E	5647
SO248_16-1	26.05.2016 13:01:19	MUC	station end		50° 0,001' N	179° 33,001' E	5640,5
SO248_16-2	26.05.2016 13:27:45	CTD	station start		49° 59,998' N	179° 33,006' E	5634,1
SO248_16-2	26.05.2016 13:28:16	CTD	in the water		49° 59,998' N	179° 33,007' E	5638,1
SO248_16-2	26.05.2016 15:21:03	CTD	max depth/ on ground	maxSL: 5591m	49° 59,997' N	179° 33,001' E	5631,2
SO248_16-2	26.05.2016 17:11:04	CTD	on deck		50° 0,002' N	179° 33,002' E	5628,7
SO248_16-2	26.05.2016 17:12:53	CTD	station end		50° 0,001' N	179° 32,993' E	5628,2
SO248_16-3	26.05.2016 18:43:54	CTD	station start		49° 59,992' N	179° 32,995' E	5630,5
SO248_16-3	26.05.2016 18:50:19	CTD	in the water	EL2, kl. Schiebebalken	49° 59,996' N	179° 33,007' E	5633

SO248_16-3	26.05.2016 19:22:20	CTD	max depth/ on ground	SL: 998 m, SZ: 10 kN	49° 59,993' N	179° 32,993' E	5626
SO248_16-3	26.05.2016 19:24:29	CTD	hoisting		49° 59,995' N	179° 32,992' E	5632,9
SO248_16-3	26.05.2016 19:57:23	CTD	on deck		50° 0,004' N	179° 32,989' E	5627,6
SO248_16-3	26.05.2016 19:58:46	CTD	station end		50° 0,001' N	179° 32,987' E	5629,6
SO248_16-4	26.05.2016 20:00:19	NET	station start	Bongo-Netz, über BB-Heck, Kran 4	50° 0,001' N	179° 32,989' E	5629,8
SO248_16-4	26.05.2016 20:14:48	NET	information	Bongo-Netz z. W.	49° 59,982' N	179° 32,933' E	5623,4
SO248_16-4	26.05.2016 20:17:15	NET	information	SLmax: 20 m	49° 59,967' N	179° 32,892' E	5866,9
SO248_16-4	26.05.2016 21:04:01	NET	information	hieven	49° 59,493' N	179° 31,598' E	5594,9
SO248_16-4	26.05.2016 21:07:30	NET	information	Bongo-Netz a. D.	49° 59,458' N	179° 31,500' E	5573,2
SO248_16-4	26.05.2016 21:22:28	NET	station end		49° 59,435' N	179° 31,469' E	5571,8
SO248_16-5	26.05.2016 21:48:52	CTD	station start	CTD M-S2	49° 59,454' N	179° 31,461' E	5578
SO248_16-5	26.05.2016 21:51:27	CTD	in the water	EL2, kl. Schiebebalken	49° 59,451' N	179° 31,464' E	5570,7
SO248_16-5	26.05.2016 22:21:51	CTD	max depth/ on ground	SL: 995m	49° 59,450' N	179° 31,453' E	5577,6
SO248_16-5	26.05.2016 22:49:47	CTD	on deck		49° 59,447' N	179° 31,473' E	5574,8
SO248_16-5	26.05.2016 22:49:56	CTD	station end		49° 59,448' N	179° 31,474' E	5571,3
SO248_16-6	26.05.2016 23:18:47	NET	station start	Bongo-Netz	49° 59,462' N	179° 31,442' E	5568,1
SO248_16-6	26.05.2016 23:19:23	NET	information	zu Wasser	49° 59,463' N	179° 31,441' E	5582,5
SO248_16-6	26.05.2016 23:31:50	NET	information	SL: 150m	49° 59,462' N	179° 31,444' E	5570,3
SO248_16-6	26.05.2016 23:51:30	NET	information	an Deck	49° 59,461' N	179° 31,449' E	5568,7
SO248_16-6	27.05.2016 00:00:27	NET	station end		49° 59,466' N	179° 31,430' E	5581,4
SO248_16-7	27.05.2016 01:18:42	CTD	station start		49° 59,457' N	179° 31,439' E	5571,3
SO248_16-7	27.05.2016 01:19:11	CTD	in the water		49° 59,457' N	179° 31,441' E	5568
SO248_16-7	27.05.2016 01:40:56	CTD	max depth/ on ground	SL: 496m	49° 59,453' N	179° 31,439' E	5580,3

SO248_16-7	27.05.2016 01:57:01	CTD	on deck		49° 59,454' N	179° 31,442' E	5584,5
SO248_16-7	27.05.2016 01:57:09	CTD	station end		49° 59,454' N	179° 31,442' E	5584,5
SO248_16-8	27.05.2016 01:25:33	PUMP	station start	in situ pump	49° 59,459' N	179° 31,442' E	5579,5
SO248_16-8	27.05.2016 01:26:09	PUMP	in the water		49° 59,457' N	179° 31,439' E	5576,1
SO248_16-8	27.05.2016 01:28:37	PUMP	max depth/ on ground	SL: 20m	49° 59,460' N	179° 31,441' E	5576,2
SO248_16-8	27.05.2016 04:36:31	PUMP	information	Beg. Hieven	49° 59,453' N	179° 31,451' E	5579,8
SO248_16-8	27.05.2016 04:42:52	PUMP	on deck		49° 59,458' N	179° 31,441' E	5579,2
SO248_16-8	27.05.2016 04:43:05	PUMP	station end		49° 59,458' N	179° 31,441' E	5579,2
SO248_16-9	27.05.2016 02:18:03	CTD	station start		49° 59,461' N	179° 31,439' E	5570,4
SO248_16-9	27.05.2016 02:20:12	CTD	in the water		49° 59,462' N	179° 31,436' E	5574
SO248_16-9	27.05.2016 02:42:01	CTD	max depth/ on ground	maxSL: 497m	49° 59,456' N	179° 31,444' E	5574,9
SO248_16-9	27.05.2016 02:57:00	CTD	on deck		49° 59,465' N	179° 31,436' E	5588,6
SO248_16-9	27.05.2016 02:58:25	CTD	station end		49° 59,466' N	179° 31,434' E	5582
SO248_16-10	27.05.2016 04:13:04	CTD	station start		49° 59,453' N	179° 31,448' E	5578,1
SO248_16-10	27.05.2016 04:21:38	CTD	in the water		49° 59,455' N	179° 31,436' E	5567,4
SO248_16-10	27.05.2016 04:44:04	CTD	max depth/ on ground	maxSL: 498m	49° 59,458' N	179° 31,440' E	5578,3
SO248_16-10	27.05.2016 05:01:48	CTD	on deck		49° 59,462' N	179° 31,445' E	5576,3
SO248_16-10	27.05.2016 05:02:14	CTD	station end		49° 59,460' N	179° 31,443' E	6563,5
SO248_16-11	27.05.2016 06:26:49	PUMP	station start	INSITU-Pumpe	49° 59,458' N	179° 31,445' E	5579,2
SO248_16-11	27.05.2016 06:28:14	PUMP	in the water	STB-Heck, Kran 3	49° 59,459' N	179° 31,441' E	5571,4
SO248_16-11	27.05.2016 06:32:06	PUMP	max depth/ on ground	SL: 60 m	49° 59,458' N	179° 31,434' E	5568,8
SO248_16-11	27.05.2016 09:48:58	PUMP	on deck		49° 59,453' N	179° 31,446' E	5582,6
SO248_16-11	27.05.2016 09:50:27	PUMP	station end		49° 59,455' N	179° 31,450' E	5578,8

SO248_16-12	27.05.2016 07:14:42	CTD	station start	CTD S1, EL2, kl. Schie-bebalken	49° 59,459' N	179° 31,443' E	5570,3
SO248_16-12	27.05.2016 07:16:28	CTD	in the water		49° 59,460' N	179° 31,444' E	5577,8
SO248_16-12	27.05.2016 07:40:26	CTD	max depth/ on ground	SL: 498 m, SZ: 9 kN	49° 59,467' N	179° 31,439' E	5580,2
SO248_16-12	27.05.2016 07:56:44	CTD	on deck		49° 59,454' N	179° 31,439' E	5578,2
SO248_16-12	27.05.2016 07:57:17	CTD	station end		49° 59,453' N	179° 31,435' E	5580,1
SO248_16-13	27.05.2016 10:16:35	CTD	station start		49° 59,461' N	179° 31,458' E	5578,2
SO248_16-13	27.05.2016 10:19:21	CTD	in the water		49° 59,452' N	179° 31,448' E	5574,6
SO248_16-13	27.05.2016 10:43:48	CTD	max depth/ on ground	SL: 498m	49° 59,455' N	179° 31,444' E	5577,2
SO248_16-13	27.05.2016 11:01:48	CTD	on deck		49° 59,456' N	179° 31,442' E	5584
SO248_16-13	27.05.2016 11:02:55	CTD	station end		49° 59,456' N	179° 31,441' E	5583,8
SO248_16-14	27.05.2016 13:15:26	CTD	station start		49° 59,457' N	179° 31,435' E	5577,3
SO248_16-14	27.05.2016 13:16:07	CTD	in the water		49° 59,459' N	179° 31,438' E	5577,1
SO248_16-14	27.05.2016 13:40:37	CTD	max depth/ on ground	SL: 497m	49° 59,455' N	179° 31,444' E	5573,5
SO248_16-14	27.05.2016 13:57:17	CTD	on deck		49° 59,463' N	179° 31,440' E	5578,4
SO248_16-14	27.05.2016 13:57:25	CTD	station end		49° 59,463' N	179° 31,439' E	5578,4
SO248_16-15	27.05.2016 16:14:04	CTD	station start		49° 59,453' N	179° 31,450' E	5563
SO248_16-15	27.05.2016 16:15:37	CTD	in the water		49° 59,453' N	179° 31,453' E	5543,8
SO248_16-15	27.05.2016 16:38:34	CTD	max depth/ on ground	maxSL: 498m	49° 59,455' N	179° 31,440' E	5567,8
SO248_16-15	27.05.2016 16:55:31	CTD	on deck		49° 59,466' N	179° 31,438' E	5563,7
SO248_16-15	27.05.2016 16:56:24	CTD	station end		49° 59,468' N	179° 31,441' E	5563,2
SO248_16-16	27.05.2016 17:36:34	CTD	station start	In Situ Incubator	49° 59,460' N	179° 31,434' E	5561,8
SO248_16-16	27.05.2016 17:37:57	CTD	in the water		49° 59,461' N	179° 31,432' E	5561,2
SO248_16-16	27.05.2016 18:09:42	CTD	max depth/	SL: 997 m, SZ: 11 kN	49° 59,462' N	179° 31,438' E	5562,9

			on ground				
SO248_16-16	28.05.2016 02:12:45	CTD	hoisting		49° 59,458' N	179° 31,441' E	5569
SO248_16-16	28.05.2016 02:35:09	CTD	on deck		49° 59,461' N	179° 31,445' E	5561,6
SO248_16-16	28.05.2016 02:36:26	CTD	station end		49° 59,461' N	179° 31,449' E	5552,8
SO248_16-17	27.05.2016 23:11:18	Light / Optics	station start	Secchi-Disk	49° 59,459' N	179° 31,450' E	5548,4
SO248_16-17	27.05.2016 23:11:45	Light / Optics	in the water		49° 59,459' N	179° 31,452' E	5564,4
SO248_16-17	27.05.2016 23:15:58	Light / Optics	max depth/ on ground	17m	49° 59,456' N	179° 31,449' E	5560,3
SO248_16-17	27.05.2016 23:17:56	Light / Optics	on deck		49° 59,455' N	179° 31,448' E	5559,8
SO248_16-17	27.05.2016 23:18:03	Light / Optics	station end		49° 59,455' N	179° 31,447' E	5562,7
SO248_16-18	28.05.2016 02:41:53	Light / Optics	station start	UV-Profiler	49° 59,459' N	179° 31,436' E	5560,4
SO248_16-18	28.05.2016 02:44:24	Light / Optics	in the water		49° 59,452' N	179° 31,420' E	5536
SO248_16-18	28.05.2016 02:48:16	Light / Optics	max depth/ on ground	SL: 65m, Beg. Hieven	49° 59,426' N	179° 31,386' E	5550,8
SO248_16-18	28.05.2016 02:50:24	Light / Optics	at surface		49° 59,412' N	179° 31,365' E	5513,3
SO248_16-18	28.05.2016 02:52:16	Light / Optics	max depth/ on ground	SL: 50m, Beg. Hieven	49° 59,399' N	179° 31,348' E	5508,4
SO248_16-18	28.05.2016 02:54:07	Light / Optics	at surface		49° 59,387' N	179° 31,336' E	5512,8
SO248_16-18	28.05.2016 02:55:51	Light / Optics	max depth/ on ground	SL: 50m, Beg. Hieven	49° 59,376' N	179° 31,324' E	5507,8
SO248_16-18	28.05.2016 03:00:05	Light / Optics	on deck		49° 59,341' N	179° 31,276' E	5466,4
SO248_16-18	28.05.2016 03:00:13	Light / Optics	station end		49° 59,340' N	179° 31,273' E	5466,4
SO248_16-19	28.05.2016 03:01:06	Light / Optics	station start	Satlantic-Profiler	49° 59,331' N	179° 31,258' E	5458,1
SO248_16-19	28.05.2016 03:02:07	Light / Optics	in the water		49° 59,322' N	179° 31,244' E	5442,8
SO248_16-19	28.05.2016 03:04:09	Light / Optics	max depth/ on ground	SL: 70m, Beg. Hieven	49° 59,305' N	179° 31,216' E	5436,9
SO248_16-19	28.05.2016 03:07:10	Light / Optics	at surface		49° 59,279' N	179° 31,177' E	5420,9
SO248_16-19	28.05.2016 03:09:26	Light / Optics	max depth/	SL: 50m, Beg. Hieven	49° 59,259' N	179° 31,145' E	5413,1

			on ground				
SO248_16-19	28.05.2016 03:11:27	Light / Optics	at surface		49° 59,242' N	179° 31,117' E	5399,6
SO248_16-19	28.05.2016 03:13:39	Light / Optics	max depth/ on ground	SL: 50m, Beg. Hieven	49° 59,221' N	179° 31,083' E	5410,9
SO248_16-19	28.05.2016 03:17:03	Light / Optics	on deck		49° 59,182' N	179° 31,026' E	5397,3
SO248_16-19	28.05.2016 03:18:29	Light / Optics	station end		49° 59,169' N	179° 31,009' E	5389,8
SO248_17-1	28.05.2016 23:06:01	Light / Optics	station start	UV-Profiler	54° 0,805' N	179° 34,135' E	732
SO248_17-1	28.05.2016 23:06:29	Light / Optics	in the water		54° 0,800' N	179° 34,140' E	733
SO248_17-1	28.05.2016 23:09:28	Light / Optics	max depth/ on ground	55m	54° 0,761' N	179° 34,182' E	730,3
SO248_17-1	28.05.2016 23:16:11	Light / Optics	max depth/ on ground	52m	54° 0,647' N	179° 34,308' E	727
SO248_17-1	28.05.2016 23:23:23	Light / Optics	max depth/ on ground	50m	54° 0,534' N	179° 34,420' E	731,4
SO248_17-1	28.05.2016 23:30:48	Light / Optics	on deck		54° 0,412' N	179° 34,542' E	729
SO248_17-1	28.05.2016 23:30:57	Light / Optics	station end		54° 0,410' N	179° 34,544' E	732
SO248_17-2	28.05.2016 23:31:30	Light / Optics	station start	Satlantic-Profiler	54° 0,402' N	179° 34,552' E	738,2
SO248_17-2	28.05.2016 23:31:57	Light / Optics	in the water		54° 0,397' N	179° 34,558' E	730,8
SO248_17-2	28.05.2016 23:33:56	Light / Optics	max depth/ on ground	55m	54° 0,378' N	179° 34,576' E	729,8
SO248_17-2	28.05.2016 23:37:42	Light / Optics	max depth/ on ground	55m	54° 0,347' N	179° 34,608' E	729,6
SO248_17-2	28.05.2016 23:42:10	Light / Optics	max depth/ on ground	50m	54° 0,294' N	179° 34,662' E	728,2
SO248_17-2	28.05.2016 23:47:09	Light / Optics	on deck		54° 0,200' N	179° 34,757' E	727,5
SO248_17-2	28.05.2016 23:47:17	Light / Optics	station end		54° 0,197' N	179° 34,760' E	728
SO248_17-3	28.05.2016 23:58:01	PUMP	station start	in situ pump	54° 0,085' N	179° 34,887' E	726,3
SO248_17-3	28.05.2016 23:59:21	PUMP	in the water		54° 0,086' N	179° 34,883' E	725,3
SO248_17-3	29.05.2016 00:00:49	PUMP	max depth/ on ground	20m	54° 0,085' N	179° 34,879' E	727,8

SO248_17-3	29.05.2016 03:08:30	PUMP	information	Ende Pumpen, Beg. Hie-ven	54° 0,084' N	179° 34,890' E	729,5
SO248_17-3	29.05.2016 03:12:05	PUMP	on deck		54° 0,081' N	179° 34,892' E	727,2
SO248_17-3	29.05.2016 03:13:28	PUMP	station end		54° 0,081' N	179° 34,892' E	726
SO248_17-4	29.05.2016 00:09:59	CTD	station start		54° 0,077' N	179° 34,878' E	725,9
SO248_17-4	29.05.2016 00:11:07	CTD	in the water		54° 0,077' N	179° 34,878' E	725,3
SO248_17-4	29.05.2016 00:42:26	CTD	max depth/ on ground	SL: 700m	54° 0,088' N	179° 34,880' E	726,6
SO248_17-4	29.05.2016 01:07:02	CTD	on deck		54° 0,088' N	179° 34,899' E	725,1
SO248_17-4	29.05.2016 01:08:18	CTD	station end		54° 0,088' N	179° 34,901' E	727
SO248_17-5	29.05.2016 03:18:03	Light / Optics	station start	Secchi-Disk	54° 0,081' N	179° 34,887' E	728,5
SO248_17-5	29.05.2016 03:19:20	Light / Optics	in the water		54° 0,079' N	179° 34,885' E	727,8
SO248_17-5	29.05.2016 03:22:50	Light / Optics	max depth/ on ground	maxSL: 12m	54° 0,074' N	179° 34,886' E	725,8
SO248_17-5	29.05.2016 03:23:20	Light / Optics	on deck		54° 0,073' N	179° 34,886' E	727
SO248_17-5	29.05.2016 03:24:30	Light / Optics	station end		54° 0,074' N	179° 34,883' E	727,1
SO248_17-6	29.05.2016 03:27:46	NET	station start	Bongo-Netz (geschleppt)	54° 0,077' N	179° 34,878' E	726,2
SO248_17-6	29.05.2016 03:30:11	NET	information	im Wasser	54° 0,081' N	179° 34,889' E	728,5
SO248_17-6	29.05.2016 04:23:09	NET	information	an Deck	53° 59,081' N	179° 35,951' E	720,1
SO248_17-6	29.05.2016 04:29:05	NET	station end		53° 59,084' N	179° 35,789' E	725,2
SO248_18-1	29.05.2016 19:06:54	MUC	station start		57° 0,084' N	179° 34,884' E	3819,1
SO248_18-1	29.05.2016 19:10:42	MUC	in the water	über FW1/SPW1, Schie-bebalken	57° 0,089' N	179° 34,922' E	3817,1
SO248_18-1	29.05.2016 20:50:50	MUC	max depth/ on ground	SL: 3831 m, SZ: 40/33 kN	56° 59,997' N	179° 35,008' E	3811
SO248_18-1	29.05.2016 20:53:22	MUC	hoisting		56° 59,999' N	179° 35,007' E	3810
SO248_18-1	29.05.2016 22:15:56	MUC	on deck		56° 59,992' N	179° 34,990' E	3810,9
SO248_18-1	29.05.2016 22:17:26	MUC	station end		56° 59,993' N	179° 34,991' E	3818,8

SO248_18-2	29.05.2016 21:49:33	PUMP	station start	in situ pump	56° 59,992' N	179° 34,999' E	3814,8
SO248_18-2	29.05.2016 21:50:11	PUMP	in the water		56° 59,992' N	179° 34,998' E	3818,2
SO248_18-2	29.05.2016 21:51:24	PUMP	max depth/ on ground	20m	56° 59,992' N	179° 34,995' E	3811,6
SO248_18-2	30.05.2016 01:06:14	PUMP	information	Ende Pumpen, Beg. Hie-ven	57° 0,000' N	179° 35,013' E	3811,5
SO248_18-2	30.05.2016 01:07:30	PUMP	on deck		56° 59,999' N	179° 35,011' E	3817,7
SO248_18-2	30.05.2016 01:08:16	PUMP	station end		56° 59,999' N	179° 35,010' E	3813,8
SO248_18-3	29.05.2016 22:23:32	CTD	station start		56° 59,994' N	179° 34,990' E	3812,3
SO248_18-3	29.05.2016 22:24:29	CTD	in the water		56° 59,995' N	179° 34,987' E	3811,8
SO248_18-3	29.05.2016 23:43:11	CTD	max depth/ on ground	SL: 3778m	56° 59,996' N	179° 35,007' E	3815
SO248_18-3	30.05.2016 01:03:29	CTD	on deck		57° 0,002' N	179° 35,002' E	3813,5
SO248_18-3	30.05.2016 01:03:36	CTD	station end		57° 0,002' N	179° 35,003' E	3813,5
SO248_18-4	30.05.2016 01:30:39	Light / Optics	station start	Secchi-Disk	56° 59,993' N	179° 35,009' E	3816,5
SO248_18-4	30.05.2016 01:31:38	Light / Optics	in the water		56° 59,993' N	179° 35,004' E	3811,1
SO248_18-4	30.05.2016 01:34:36	Light / Optics	max depth/ on ground	maxSL: 16m	56° 59,990' N	179° 34,999' E	3819,7
SO248_18-4	30.05.2016 01:35:32	Light / Optics	on deck		56° 59,993' N	179° 34,994' E	3811,3
SO248_18-4	30.05.2016 01:36:25	Light / Optics	station end		56° 59,994' N	179° 34,994' E	3813,5
SO248_18-5	30.05.2016 02:02:19	CTD	station start		56° 59,997' N	179° 35,004' E	3816,9
SO248_18-5	30.05.2016 02:03:42	CTD	in the water		56° 59,995' N	179° 35,001' E	3820,4
SO248_18-5	30.05.2016 02:18:35	CTD	max depth/ on ground	maxSL: 298m	56° 59,989' N	179° 34,999' E	3821,3
SO248_18-5	30.05.2016 02:32:35	CTD	on deck		56° 59,995' N	179° 34,990' E	3819,5
SO248_18-5	30.05.2016 02:33:53	CTD	station end		56° 59,997' N	179° 34,993' E	3812
SO248_18-6	30.05.2016 02:40:10	NET	station start	Bongo-Netz (geschleppt)	56° 59,996' N	179° 35,002' E	3819
SO248_18-6	30.05.2016 02:41:53	NET	information	zu Wasser	56° 59,988' N	179° 35,036' E	3821,7

SO248_18-6	30.05.2016 03:27:25	NET	information	hieven	56° 59,630' N	179° 36,502' E	3809,7
SO248_18-6	30.05.2016 03:33:36	NET	information	Bongo-Netz an Deck	56° 59,549' N	179° 36,749' E	3821,5
SO248_18-6	30.05.2016 03:34:00	NET	station end		56° 59,543' N	179° 36,763' E	3810,6
SO248_18-7	30.05.2016 03:42:46	Light / Optics	station start	UV-Profiler	56° 59,513' N	179° 36,799' E	3816,1
SO248_18-7	30.05.2016 03:43:52	Light / Optics	in the water		56° 59,506' N	179° 36,816' E	3819,8
SO248_18-7	30.05.2016 03:48:05	Light / Optics	max depth/ on ground	SL: 50m	56° 59,473' N	179° 36,884' E	3822,7
SO248_18-7	30.05.2016 03:49:13	Light / Optics	at surface		56° 59,465' N	179° 36,904' E	3808,6
SO248_18-7	30.05.2016 03:52:48	Light / Optics	max depth/ on ground	SL: 50m	56° 59,432' N	179° 36,987' E	3816,2
SO248_18-7	30.05.2016 03:54:34	Light / Optics	at surface		56° 59,415' N	179° 37,039' E	3819,8
SO248_18-7	30.05.2016 03:56:39	Light / Optics	max depth/ on ground	SL: 50m	56° 59,398' N	179° 37,090' E	3807,4
SO248_18-7	30.05.2016 04:00:47	Light / Optics	on deck		56° 59,352' N	179° 37,195' E	3818,2
SO248_18-7	30.05.2016 04:01:01	Light / Optics	station end		56° 59,350' N	179° 37,201' E	3821,6
SO248_18-8	30.05.2016 04:02:37	Light / Optics	station start	Satlantic-Profiler	56° 59,336' N	179° 37,241' E	3816
SO248_18-8	30.05.2016 04:03:00	Light / Optics	in the water		56° 59,332' N	179° 37,251' E	3819,5
SO248_18-8	30.05.2016 04:05:16	Light / Optics	max depth/ on ground	SL: 65m	56° 59,308' N	179° 37,307' E	3816
SO248_18-8	30.05.2016 04:07:54	Light / Optics	at surface		56° 59,282' N	179° 37,354' E	3819,4
SO248_18-8	30.05.2016 04:10:16	Light / Optics	max depth/ on ground	SL: 50m	56° 59,263' N	179° 37,379' E	3813,4
SO248_18-8	30.05.2016 04:11:50	Light / Optics	at surface		56° 59,248' N	179° 37,394' E	3812,2
SO248_18-8	30.05.2016 04:13:31	Light / Optics	max depth/ on ground	SL: 50m	56° 59,232' N	179° 37,407' E	3807,9
SO248_18-8	30.05.2016 04:16:51	Light / Optics	on deck		56° 59,196' N	179° 37,462' E	3810,5
SO248_18-8	30.05.2016 04:17:04	Light / Optics	station end		56° 59,194' N	179° 37,466' E	3818,4
SO248_18-9	30.05.2016 04:32:18	NET	station start	Bongo-Netz	56° 59,195' N	179° 37,478' E	3817,4

SO248_18-9	30.05.2016 04:36:43	NET	information	zu Wasser	56° 59,189' N	179° 37,475' E	3816,6
SO248_18-9	30.05.2016 04:50:46	NET	information	maxSL: 150m	56° 59,189' N	179° 37,476' E	3816,4
SO248_18-9	30.05.2016 05:08:32	NET	information	Bongo-Netz an Deck	56° 59,194' N	179° 37,479' E	3818,2
SO248_18-9	30.05.2016 05:12:51	NET	station end		56° 59,186' N	179° 37,474' E	3816,7
SO248_19-1	30.05.2016 15:10:42	CTD	station start		58° 54,021' N	179° 0,157' W	3351,6
SO248_19-1	30.05.2016 15:12:59	CTD	in the water		58° 54,017' N	179° 0,158' W	3353,8
SO248_19-1	30.05.2016 16:22:23	CTD	max depth/ on ground	maxSL: 3308m	58° 53,998' N	178° 59,998' W	3349,3
SO248_19-1	30.05.2016 17:35:10	CTD	on deck		58° 53,995' N	178° 59,998' W	3349,7
SO248_19-1	30.05.2016 17:36:44	CTD	station end		58° 53,995' N	178° 59,999' W	3346,9
SO248_19-2	30.05.2016 18:36:52	CTD	station start		58° 54,002' N	178° 59,992' W	3345,9
SO248_19-2	30.05.2016 18:40:06	CTD	in the water	EL2, kl. Schiebebalken	58° 54,004' N	178° 59,994' W	3348
SO248_19-2	30.05.2016 18:56:37	CTD	max depth/ on ground	SL: 299 m, SZ: 8 kN	58° 54,003' N	178° 59,997' W	3351,1
SO248_19-2	30.05.2016 19:12:48	CTD	on deck		58° 53,995' N	179° 0,001' W	3349
SO248_19-2	30.05.2016 19:14:07	CTD	station end		58° 53,997' N	179° 0,001' W	3347,4
SO248_19-3	30.05.2016 19:30:27	NET	station start	Bongo-Netz	58° 53,996' N	178° 59,993' W	3347,6
SO248_19-3	30.05.2016 19:39:08	NET	information	Bongo-Netz z. W., über BB-Heck, Kran 4, rwK: 082°, FdW: 1,5 kn	58° 54,002' N	178° 59,823' W	3343,7
SO248_19-3	30.05.2016 20:00:05	NET	information	Bongo-Netz a. D.	58° 54,101' N	178° 58,697' W	3327,1
SO248_19-3	30.05.2016 20:26:32	NET	information	Bongo-Netz a. D.	58° 54,218' N	178° 57,341' W	3315,8
SO248_19-3	30.05.2016 20:36:15	NET	station end		58° 54,242' N	178° 56,949' W	3309,8
SO248_19-4	30.05.2016 21:01:42	Light / Optics	station start	UV-Profiler	58° 54,255' N	178° 56,934' W	3309,2
SO248_19-4	30.05.2016 21:02:42	Light / Optics	in the water		58° 54,262' N	178° 56,918' W	3311,3
SO248_19-4	30.05.2016 21:05:16	Light / Optics	max depth/ on ground	45m	58° 54,281' N	178° 56,858' W	3310,2

SO248_19-4	30.05.2016 21:09:22	Light / Optics	max depth/ on ground	42m	58° 54,300' N	178° 56,731' W	3309,3
SO248_19-4	30.05.2016 21:13:51	Light / Optics	max depth/ on ground	45m	58° 54,323' N	178° 56,579' W	3309,2
SO248_19-4	30.05.2016 21:18:52	Light / Optics	on deck		58° 54,351' N	178° 56,398' W	3307,8
SO248_19-4	30.05.2016 21:19:00	Light / Optics	station end		58° 54,352' N	178° 56,393' W	3303,8
SO248_19-5	30.05.2016 21:20:26	Light / Optics	station start	Satlantic-Profiler	58° 54,363' N	178° 56,336' W	3303,3
SO248_19-5	30.05.2016 21:20:39	Light / Optics	in the water		58° 54,364' N	178° 56,328' W	3303,2
SO248_19-5	30.05.2016 21:22:32	Light / Optics	max depth/ on ground	46m	58° 54,378' N	178° 56,256' W	3301,5
SO248_19-5	30.05.2016 21:26:11	Light / Optics	max depth/ on ground	44m	58° 54,401' N	178° 56,137' W	3305,4
SO248_19-5	30.05.2016 21:30:31	Light / Optics	max depth/ on ground	49m	58° 54,429' N	178° 55,985' W	3302,9
SO248_19-5	30.05.2016 21:35:38	Light / Optics	on deck		58° 54,466' N	178° 55,785' W	3304,2
SO248_19-5	30.05.2016 21:35:45	Light / Optics	station end		58° 54,467' N	178° 55,782' W	3304,3
SO248_19-6	30.05.2016 21:45:30	PUMP	station start	in situ pump	58° 54,480' N	178° 55,748' W	3303,7
SO248_19-6	30.05.2016 21:45:50	PUMP	in the water		58° 54,480' N	178° 55,748' W	3304
SO248_19-6	30.05.2016 21:47:27	PUMP	max depth/ on ground	20m	58° 54,481' N	178° 55,753' W	3305,5
SO248_19-6	31.05.2016 01:03:28	PUMP	station end		58° 54,481' N	178° 55,760' W	3300,2
SO248_19-7	30.05.2016 21:57:12	Light / Optics	station start	Secchi-Disk	58° 54,478' N	178° 55,753' W	3300,1
SO248_19-7	30.05.2016 21:57:45	Light / Optics	in the water		58° 54,476' N	178° 55,752' W	3301,1
SO248_19-7	30.05.2016 22:02:05	Light / Optics	max depth/ on ground	17m	58° 54,476' N	178° 55,764' W	3302,3
SO248_19-7	30.05.2016 22:03:49	Light / Optics	on deck		58° 54,475' N	178° 55,765' W	3305,3
SO248_19-7	30.05.2016 22:04:03	Light / Optics	station end		58° 54,474' N	178° 55,766' W	3301,4
SO248_19-8	30.05.2016 22:14:51	MUC	station start		58° 54,474' N	178° 55,770' W	3301
SO248_19-8	30.05.2016 22:17:03	MUC	in the water		58° 54,476' N	178° 55,766' W	3304,8

SO248_19-8	30.05.2016 23:47:53	MUC	max depth/ on ground	SLmax: 3306m	58° 54,471' N	178° 55,755' W	3299,8
SO248_19-8	30.05.2016 23:48:45	MUC	hoisting	SZmax: 39kN	58° 54,471' N	178° 55,754' W	3308,7
SO248_19-8	31.05.2016 00:59:30	MUC	on deck		58° 54,479' N	178° 55,752' W	3305,9
SO248_19-8	31.05.2016 01:03:00	MUC	station end		58° 54,481' N	178° 55,760' W	3305,5
SO248_19-9	31.05.2016 01:22:43	NET	station start	Bongo-Netz	58° 54,470' N	178° 55,754' W	3304,9
SO248_19-9	31.05.2016 01:24:43	NET	information	zu Wasser	58° 54,468' N	178° 55,748' W	3301,3
SO248_19-9	31.05.2016 01:37:47	NET	information	maxSL: 150m	58° 54,472' N	178° 55,749' W	3301,5
SO248_19-9	31.05.2016 01:52:50	NET	information	an Deck	58° 54,475' N	178° 55,744' W	3303,2
SO248_19-9	31.05.2016 01:53:29	NET	station end		58° 54,475' N	178° 55,743' W	3306,5
SO248_19-10	31.05.2016 03:27:51	CTD	station start		58° 54,477' N	178° 55,757' W	3299,8
SO248_19-10	31.05.2016 03:29:03	CTD	in the water		58° 54,478' N	178° 55,756' W	3301,4
SO248_19-10	31.05.2016 03:31:17	CTD	max depth/ on ground	maxSL: 20m	58° 54,479' N	178° 55,759' W	3299,7
SO248_19-10	31.05.2016 03:38:02	CTD	on deck		58° 54,476' N	178° 55,759' W	3304
SO248_19-10	31.05.2016 03:39:02	CTD	station end		58° 54,476' N	178° 55,757' W	3304,2

Table A3: List of the main parameters sampled by the dark ocean team of the Department of Limnology and Bio-Oceanography, University of Vienna during SO248.

Stn	Depth (m)	^{3}H-Leu	MAR ^{3}H-Leu	DI^{14}C	MAR DI^{14}C	PTIO	PA	SAGs	CARD-FISH	DNA	Omics	AA	Click-it
2	4200			x						x			
2	4175						x	x		x		x	x
2	4000						x	x	x	x		x	x
2	3000			x			x	x		x		x	x
2	2000			x			x	x	x	x		x	x
2	1000			x			x	x	x	x		x	x
2	500			x			x	x	x	x		x	x
2	200			x			x	x		x		x	x
2	100						x	x				x	x
3	1000	x											x
3	500	x											x
3	300												x
3	200	x											x
3	100												x
4	4130	x		x					x	x			
4	4120	x	x				x	x	x	x		x	x
4	4000	x	x				x	x	x	x		x	
4	3000	x	x	x			x	x	x	x		x	
4	2000	x	x	x			x	x	x	x	x	x	x
4	1000	x	x	x		x	x	x	x	x		x	x
4	500	x	x	x		x	x	x	x	x		x	x
4	350			x				x	x				
4	300							x	x				x
4	200	x	x	x		x	x	x	x	x		x	x
4	100						x	x	x			x	x
5	1000			x									x
5	500			x									x
5	300			x									x
5	200			x									x
5	100												x
6	5236	x					x	x	x	x		x	x
6	5000	x	x				x	x	x	x		x	
6	4000	x	x				x	x	x	x		x	x
6	3000	x	x				x	x	x	x		x	
6	2000	x	x	x	x		x	x	x	x		x	x
6	1000	x	x	x	x		x	x	x	x		x	x
6	500	x	x	x	x		x	x	x	x		x	x
6	400	x	x	x	x			x	x	x	x	x	
6	300												x
6	200	x	x	x			x	x	x	x		x	x
6	100						x	x	x		x	x	x
7	1000	x		x									x
7	500	x		x									x
7	300	x		x									x
7	250	x		x									
7	200												x
7	100	x											x
7	60	x											
7	20	x											
8	5220	x	x						x	x			
8	5233	x	x				x	x	x	x		x	x
8	5000	x	x				x	x	x	x		x	
8	4000	x	x				x	x	x	x		x	x
8	3000	x	x				x	x	x	x		x	
8	2000	x	x	x			x	x	x	x		x	x
8	1000	x	x	x		x	x	x	x	x		x	x
8	500	x	x	x		x	x	x	x	x		x	x
8	300							x	x				x
8	250	x	x	x		x		x	x	x			
8	200	x	x	x		x	x	x	x	x		x	x
8	100						x	x	x			x	x
9	1000			x							x		x
9	500			x									x
9	300			x									x
9	200			x									x
9	100												x
10	2810	x	x					x		x			

Stn	Depth (m)	^{3}H-Leu	MAR ^{3}H-Leu	DI^{14}C	MAR DI^{14}C	PTIO	PA	SAGs	CARD-FISH	DNA	Omics	AA	Click-it
10	2800	x	x				x	x	x	x		x	x
10	2700	x	x					x	x	x			
10	2000	x	x	x	x		x	x	x	x		x	x
10	1000	x	x	x	x		x	x	x	x		x	x
10	500	x	x	x	x		x	x	x	x		x	x
10	300				x								x
10	200	x	x	x			x	x	x	x		x	x
10	100						x	x	x			x	x
11	1000			x									x
11	500			x									x
11	300			x									x
11	200			x									x
11	100												x
12	3514	x	x					x	x	x			
12	3504	x	x				x	x	x	x		x	x
12	3000	x	x				x	x	x	x		x	
12	2000	x	x	x	x		x	x	x	x		x	x
12	1000	x	x	x	x	x	x	x	x	x		x	x
12	500	x	x	x	x	x	x	x	x	x		x	x
12	300			x	x			x	x			x	x
12	200	x	x	x	x	x	x	x	x	x		x	x
12	100	x					x	x	x			x	x
12	40	x						x	x				
12	20	x						x	x				
13	1000			x									x
13	500			x									x
13	300			x									x
13	200			x									x
13	100												x
14	5909	x	x	x				x		x			
14	5873	x	x				x	x	x	x		x	x
14	5000	x	x				x	x	x	x		x	
14	4000	x	x				x	x	x	x		x	x
14	3000	x	x				x	x	x	x		x	
14	2000	x	x	x	x		x	x	x	x	x	x	x
14	1000	x	x	x	x		x	x	x	x		x	x
14	500	x	x	x	x		x	x	x	x		x	x
14	300			x	x			x	x				x
14	200	x	x	x	x		x	x	x	x		x	x
14	100	x					x	x	x			x	x
14	40	x						x	x				
14	20	x						x	x				
15	1000			x									x
15	500			x									x
15	300			x									x
15	200			x									x
15	100												x
16	5628	x	x						x	x			
16	5603	x					x	x	x	x		x	x
16	5000	x	x				x	x	x	x		x	
16	4000	x	x				x	x	x	x		x	x
16	3000	x	x				x	x	x	x		x	
16	2000	x	x	x	x		x	x	x	x		x	x
16	1000	x	x	x	x	x	x	x	x	x		x	x
16	500	x	x	x	x		x	x	x	x	x	x	x
16	300			x	x			x	x				x
16	200	x	x	x	x	x	x	x	x	x		x	x
16	100	x					x	x	x			x	x
16	40	x						x	x				
16	20	x						x	x				
17	703			x									x
17	500			x									x
17	300			x									x
17	200			x									x
17	100												x
18	3786	x	x				x	x	x	x		x	
18	3000	x	x				x	x	x	x		x	
18	2000	x	x	x		x	x	x	x	x		x	
18	1000	x	x	x		x	x	x	x	x		x	
18	500	x	x	x		x	x	x	x			x	
18	300			x		x		x	x			x	

Stn	Depth (m)	^{3}H-Leu	MAR ^{3}H-Leu	DI^{14}C	MAR DI^{14}C	PTIO	PA	SAGs	CARD-FISH	DNA	Omics	AA	Click-it
18	200	x	x	x		x	x	x	x	x		x	
18	100	x					x	x	x			x	
18	40	x						x	x				
18	20	x						x	x				
19	3312		x				x	x	x	x		x	x
19	3000		x				x	x	x	x		x	
19	2000		x				x	x	x	x		x	x
19	1000	x	x				x	x	x	x		x	x
19	500	x	x				x	x	x	x		x	x
19	300							x	x				x
19	200	x	x				x	x	x	x		x	x
19	100	x					x	x	x			x	x
19	40	x						x	x				
19	20	x						x	x				

Abbreviations:
Stn: Station
^{3}H-Leu: incorporation of ^{3}H labelled leucine
MAR: Microautoradiography combined with Fluorescence in situ Hybridization
DI^{14}C: incorporation of ^{14}C labeled bicarbonate
PTIO: inhibitor experiments
PA: prokaryotic abundance
SAGs: Single Cell Genomes
CARD-FISH: Catalyzed Reporter Deposition Fluorescence in situ Hybridization
OMICS: includes metagenomics and exo-proteomics
AA: Amino Acids