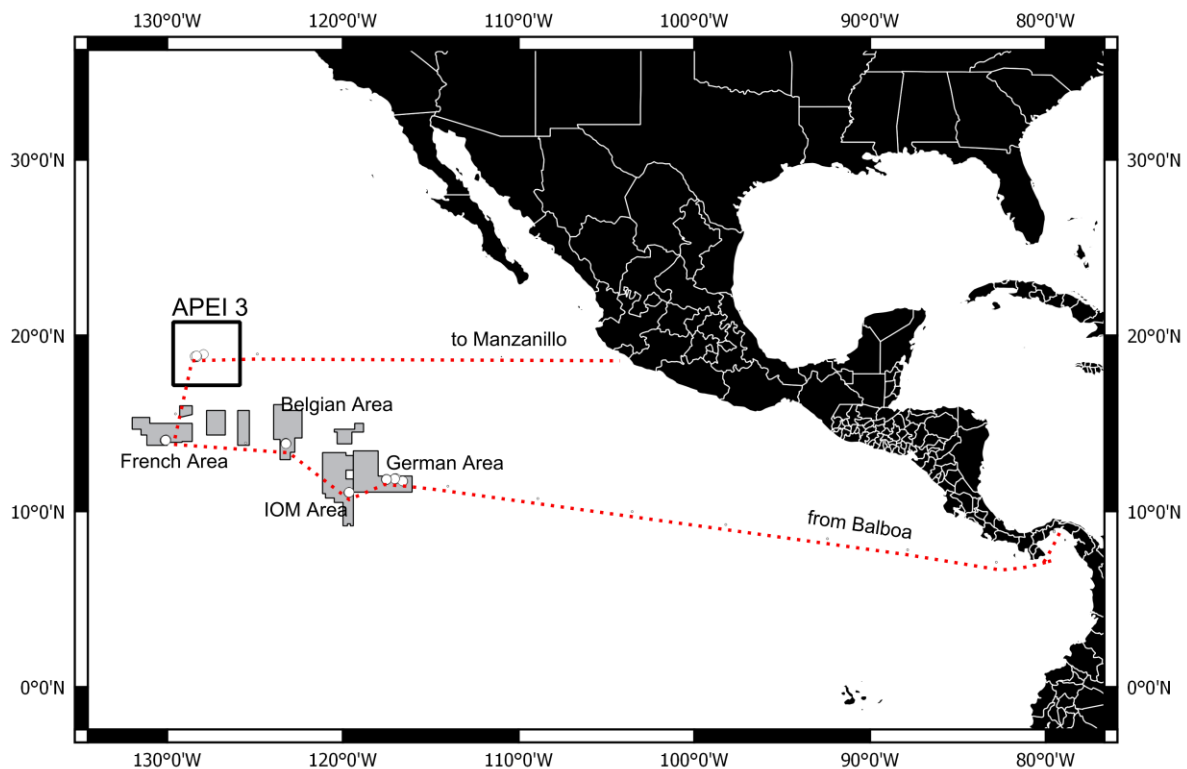


Prof. Dr. Pedro Martínez Arbizu  
Senckenberg am Meer  
Deutsches Zentrum für Marine Biodiversitätsforschung  
Südstrand 44  
26382 Wilhelmshaven

Tel.: +49 4421 9475 100  
Fax: +49 4421 9475 111  
email: pmartinez@senckenberg.de

## Short Cruise Report R.V. Sonne Cruise SO-239

**Balboa, Panama – Manzanillo, Mexico**  
**10<sup>th</sup> March 2015 – 30<sup>th</sup> April 2015**  
**Chief Scientist: Pedro Martínez Arbizu**  
**Captain: Lutz Mallon**



## Objectives

There is an increasing interest for developing an exploitation framework for deep-sea mineral resources. Polymetallic nodules are one of the mineral deposits with potential economic importance, due to its high content of metals like nickel, copper or cobalt, as well as rare earth elements. The area between the Clarion and the Clipperton Fracture zone (short CCZ) harbors the highest known concentration of polymetallic nodules worldwide at depths between 4500 m and 5500 m. The CCZ is managed by the International Seabed Authority (ISA), who has granted contracts to a number of countries (or consortia) for the exploration of marine mineral resources in defined License Areas across the CCZ. The ISA has also defined 9 non-mining areas as Areas of Particular Environmental Interest (APEIs).

Mining activities will result in the removing of the polymetallic nodules and in mechanical alteration of the upper sediment layers, this most probably creating a large sediment plume at the seabed. It is not known which impact these activities will have on the highly diverse benthic and bathypelagic communities in the CCZ. Further, it is not known how large will be the spatial extension of the impacts and how long will take for biodiversity to recover after mining.

The most important factors which influence resilience of benthic communities will be the biodiversity (how many species are there and which dominance patterns are present), connectivity (how are distant populations connected and how is the gene flow?) and life history (how and how often benthic organisms reproduce, do they have larval stages?). On the other hand the extent of the mining impact will depend on how sediments behave after resuspension, how long will the plume expand and how long will stay in suspension? How strong and which predominant direction have bottom currents in this area?

Better understanding of the oceanographic conditions and benthic biodiversity at the seafloor will improve the mitigation of potential harm to the environment provoked by mining activities in future and help to design more environmentally friendly mining operations. The European Joint Project Initiative – Oceans (JPI-O) “Ecological Aspects of Deep-Sea Mining” is designed to address these questions. The present cruise SO-239 “EcoResponse” is a contribution to JPI-O.

Specific objectives of the cruise are:

- To investigate and model deep-sea bottom currents
- To perform baseline studies on biodiversity, sediment geochemistry and water column chemistry at selected sites in the CCZ across a (East-West) productivity gradient.
- To investigate connectivity and gene flow of benthic populations across the CCZ
- To investigate the recovery times of benthic populations after sediment alteration
- To test usefulness of AUV imagery for baseline habitat mapping and future monitoring of impacted sites
- To study the sessile fauna on Seamounts in the CCZ and compare to the fauna attached to polymetallic nodules.
- To perform first baseline studies in an APEI and compare to CCZ sites.

All activities, sampling and measurements performed during this cruise are basic Marine Research on international waters as defined by UNCLOS.

## **Narrative**

Cruise SO-239 started in Balboa, Panama on March 9<sup>th</sup> with the embarkation of the crew and scientist and loading the containers and instruments. Scientists from 12 different countries came on board. We departed from Balboa on March 11<sup>th</sup> with one day of delay respective to schedule. The transit time to the first working area located in German License Area on the eastern site of the CCZ took 8 days, only interrupted by a test CTD station (and sound velocity measurement to calibrate the multibeam) in international waters on March 14<sup>th</sup>. The long transit time was used to set up the laboratories and the instruments get trained in safety issue and get familiar with the new vessel. Science meetings were held every day until the end of the cruise to discuss on logistic and scientific issues. In total 5 working areas were visited during SO-239. On each area, following set of gears was deployed routinely. The ship's own multibeam system was used to produce bathymetric charts of the study sites. The CTD was used for oceanographic study and water sampling. For the study of benthic diversity the Boxcorer (infauna) and the Epibenthic Sledge 'EBS' (epifauna) were used. For the study of the meiofauna, the protists and the sediment geochemistry the Multicorer was used. A free fall Amphipod Trap was used to study the scavengers. The Gravity Corer (10m) was used to study the geological setting. ROV was used to collect megafauna organisms, as well as to perform video transects and to sample sediments within (old and new) dredge tracks. The AUV was used to do photographic surveys as well as high resolution multibeam mapping and side-scan sonar mapping.

The German License Area, was reached on March 19. The one of the objectives in this area was to study the bottom currents and to logistically support the time-series oceanographic measurements started by the BGR 2 years before. For this, we deployed a BOBO Lander and a DOS Lander equipped by oceanographic measuring instruments and a 400 m long thermistor chain. The DOS Lander was recovered and re-deployed after one week at the bottom. Finally these moorings were left at the bottom, to be recovered 3 months later, during next cruise SO-240. One Amphipod Trap was lost due to a non-responsive Posidonia releaser. The AUV side-scan sonar system proved to be excellent for detecting old dredge tracks in the abyss. We were able to map the exact position of chain dredge and EBS tracks produced by SO-205 and subsequent BGR cruises in the area. Biodiversity and geochemistry was studied in two areas defined by BGR in previous cruises, the so called 'Prospective Areas' and the 'Reference Area'. In both areas also AUV mapping and side-scan sonar maps were produced, as well as photographic surveys. ROV dives were used to collect megafauna at both sides, and for video transecting. Two seamounts were samples and video-documented with the ROV one located eastern of the Prospective Area and one south to the Reference Area. In the Prospective Area we sampled inside a 3 year old chain dredge track. In the Reference Area we sampled with the ROV inside an EBS track produced by us only few days before. IN both sides CTD and Gravity Corer were used. The Amphipod trap collected a great number of Amphipods and some fish at both sites.

The IOM area was reached on 31<sup>th</sup> of March and we performed CTD cast and water sampling followed by multibeam mapping. Main objective in this area was to find the area were IOM performed a Benthic Impact Experiment in 1995, and to resample this area in order to study the recovery of benthic communities after 20 years. The disturbed area was found using the AUVs side-scan sonar and three treatments, viz 'control', 'disturbed' and 'resedimentation' areas were sampled with the Multicorer and the Boxcorer. Additional AUV photographic survey documented old tracks and old and new imprints of the sampling gears. One ROV dive was devoted to sample directly inside an old track in the impacted area. In addition basic biodiversity survey and geological and geochemical sampling of sediments was performed in a non-impacted nodule area east to the BIE site.

After 23 hours of transit, we reached the Belgian License area on April 6<sup>th</sup> was reached. In this area

we performed the routine biodiversity survey and geochemical characterization with Multicorer, Boxcorer, EBS, Gravity Corer, Amphipod trap, CTD and AUV photographic survey. In addition we sampled a chain dredge track produced by DEME 8 months before and a few days old EBS track produced by ourselves. One large seamount was mapped with the multibeam and sampled with the ROV.

We left the Belgian area on April 12<sup>th</sup> and reached to the French License Area one day later. Main objective was to revisit an old chain dredge track produced by OMCO 36 years ago. We had sampled and studied the recovery of this track in 2004 during the French cruise NODINAUT with submersible NAUTILE, and now we should resample it 10 years later. With the aid of the AUV side-scan sonar, we were able to georeferenced this track and some other old tracks, including some EBS tracks produced by us during cruise BIONOD 3 years ago. Both the 36 and the 3 year old tracks were sampled with the ROV. A third ROV dive to sample an additional track was aborted due to bad weather conditions. As in other areas, also a baseline biodiversity study and geochemical characterization was performed in undisturbed areas. The Amphipod trap collected enough material from all areas to study the long range (across 1000 km) gene flow between populations.

Last study site was the APEI number 4 located north of the French License Area outside the CCZ. These APEIs have never been studied before and therefore our objective was to obtain first baseline data about this area in order to compare the biodiversity and the fauna with the core CCZ nodule areas. We arrived at the APEI on April 19<sup>th</sup> and started our sampling design as the previous areas with CTD and multibeam mapping. During this survey a large seamount was discovered in the central part of the APEI. The standard set of gears was used to study the biodiversity, geological and geochemical settings. AUV dives mapped and photographed large areas and the ROV was used to collect megafauna and video document the benthic communities in the abyssal plain. The Seamount discovered with the multibeam was sampled with the ROV. Due to bad weather conditions a final Gravity corer and one Multicorer could not be taken and we departed to Manzanillo on April 25<sup>th</sup>, counting since beginning of this cruise 214 gear operations in total.

We arrived in Manzanillo in the morning of the 30<sup>th</sup> April 2015. Container logistics and, in special, shipping of frozen samples turned out to be very complicated due to severe harbour regulations. This could be only solved after few days and provoked a delay in the departure of the next cruise SO-240

## **Acknowledgements**

This cruise was financed by BMBF in the context of the EU-Project JPI-O 'Ecological aspects of Deep-Sea Mining'. We acknowledge Captain Mallon and the Crew for the excellent support during this cruise.

## Teilnehmerliste

<b>Nr.</b>	<b>Name</b>	<b>Institute</b>	<b>Team/task</b>
1	Pedro Martinez Arbizu	Senckenberg	Chief Scientist
2	Timm Schoening	U Bielefeld	DIAS Database, Imaging
3	Dan Vasiliu	GeoEcoMar	Water column PI
4	Pedro Miguel de Azevedo Ribeiro	IMAR	Seamounts
5	Henry Robert	RBINS	Scavengers PI
6	Andrea Fioretti	Conisma	Microbiology, metagenomics
7	Uwe Raschka	Senckenberg	Meiofauna
8	Ann Vanreusel	U Gent	Meiofauna PI
9	Lara Macheriotou	U Gent	Meiofauna
10	Brygida Wydoska	Uszczecin	Meiofauna
11	Daniel Kersken	Senckenberg	Megafauna
12	Ana Hilario	U Aveiro	Megafauna / macrofauna
13	Jens Greinert	Geomar	mapping / lander /mooring PI
14	Tim Weiss	Geomar	mapping / lander /mooring
15	Lenaick Menot	Ifremer	Infauna PI
16	Paulo Bonifacio	Ifremer	Infauna
17	Lenka Nealova	U Gothenburg	Infauna
18	Jessica Volz	AWI	Geochemistry PI
19	Benjamin Löffler	AWI	Geochemistry
20	Vincent OZEGOWSKI	AWI	Geochemistry
21	Inken-Marie Preuss	JUB	Geochemistry
22	Annika Moje	JUB	Geochemistry
23	Magdalena Błażewicz-Paskowycz	U Lodz	Epifauna/infauna
24	Stefanie Kaiser	Senckenberg	Epifauna, PI
25	Sarah Schnurr	Senckenberg	Epifauna
26	Marcel Rothenbeck	Geomar	AUV PI
27	Emanuel Wenzlaff	Geomar	AUV
28	Steinführer, Anja	Geomar	AUV
29	Lars Triebe	Geomar	AUV
30	Fritz Abegg	Geomar	ROV PI
31	Martin Pieper	Geomar	ROV
32	Hannes Huusmann	Geomar	ROV
33	Patrick Cuno	Geomar	ROV
34	Inken Suck	Geomar	ROV
35	Jan Hennke	Geomar	ROV
36	Miriam Ploeger	Geomar	ROV
37	Matthias BODENDORFER	Geomar	ROV
38	Sven Hoffmann	Senckenberg	TA, GKG, EBS, MUC
39	Sahar Khodami	Senckenberg	DNA Lab
40	Jennifer Ciomber	AWI	Geochemistry technician

Senckenberg: Senckenberg Gesellschaft für Naturforschung, Institute Senckenberg am Meer, Wilhelmshaven und Forschungsinstitut und Naturmuseum, Frankfurt am Main.

JUB: Jacobs University Bremen, Germany

AWI: Alfred Wegener Institut für Polar- und Meeresforschung, Bremerhaven, Germany

U Bielefeld: Universität Bielefeld, Germany

GeoEcoMar: National Research and Development Institute for Marine Geology and Geoecology, Bucarest, Romania

IMAR: Institute of Marine Research, University of Azores, Portugal

RBINS: Royal Belgian Institute of Natural Sciences, Brussels, Belgium

Conisma: Consorzio Nazionale Interuniversitario per la Scienze del Mare, Ancona, Italy

U Gent: University of Gent, Gent, Belgium

U Szczecin: University of Szczecin, Poland

U Aveiro: University of Aveiro, Portugal

Geomar: Helmholtz-Zentrum für Ozeanforschung, Kiel, Germany

Ifremer: Institut français de recherche pour l'exploitation de la mer, Brest, France

U Gothenburg: University of Gothenburg, Sweden

U Lodz: University Lodz, Poland

## Stationsliste

Station	Date	UTC	PositionLat	PositionLon	Depth [m]	Code	Action	Remarks
SO239/001-1	14.03.2015	15:04	8° 14,06' N	90° 57,08' W	3488.5	CTD	zu Wasser	Winch EL 2
SO239/002-1	19.03.2015	14:57	11° 50,66' N	116° 57,79' W	4100.2	MOR	Aktion	Auftriebskörper z/W
SO239/002-1	19.03.2015	15:09	11° 50,65' N	116° 57,77' W	4101	MOR	Aktion	Strömungsmesser
SO239/003-1	19.03.2015	15:47	11° 50,66' N	116° 57,76' W	4102.1	CTD	zu Wasser	
SO239/003-1	19.03.2015	17:17	11° 50,69' N	116° 57,68' W	4098.2	CTD	zu Wasser	Hydrophon
SO239/004-1	19.03.2015	20:48	11° 51,28' N	116° 59,67' W	4117.4	BOBO	zu Wasser	BOBO
SO239/005-1	19.03.2015	21:23	11° 51,48' N	117° 0,16' W	4115.6	DOS	zu Wasser	DOS
SO239/006-1	19.03.2015	21:55	11° 52,20' N	117° 0,87' W	4112.1	MOR	zu Wasser	LBL 1
SO239/007-1	19.03.2015	22:36	11° 50,29' N	117° 0,28' W	4125.2	MOR	zu Wasser	LBL 2
SO239/009-1	20.03.2015	04:50	11° 51,70' N	117° 1,90' W	0	AUV	zu Wasser	
SO239/010-1	20.03.2015	07:00	11° 51,54' N	117° 0,59' W	0	CTD	zu Wasser	
SO239/011-1	20.03.2015	11:07	11° 51,37' N	117° 3,52' W	4122.1	ATC	zu Wasser	Amphipod trap BE
SO239/012-1	20.03.2015	13:18	11° 50,83' N	117° 3,56' W	4117.6	BC	auf dem Grund	SL: 4160m, SZ: 64,4kN
SO239/013-1	20.03.2015	18:18	11° 51,06' N	117° 1,97' W	0	ROV	auf Tiefe	Bosi: 4115 m
SO239/013-1	20.03.2015	22:00	11° 51,06' N	117° 1,90' W	0	ROV	tauchen auf	Beginn Auftauchen
SO239/015-1	21.03.2015	06:16	11° 50,66' N	117° 3,13' W	4132.6	BC	auf dem Grund	SLmax: 4161m
SO239/016-1	21.03.2015	09:57	11° 51,44' N	117° 3,12' W	4122.1	BC	auf dem Grund	SLmax: 4156m, SZmax: 62kN
SO239/017-1	21.03.2015	13:47	11° 50,63' N	117° 3,57' W	4134.3	GC	am Grund	SL: 4189m, SZ: 74,1kN
SO239/018-1	21.03.2015	16:08	11° 50,63' N	117° 3,57' W	0	ATC	zu Wasser	Amphipod trap DE
SO239/019-1	21.03.2015	18:11	11° 51,70' N	117° 2,04' W	0	AUV	zu Wasser	
SO239/020-1	21.03.2015	22:06	11° 49,81' N	117° 0,28' W	0	EBS	am Grund	SL: 4050m
SO239/020-1	22.03.2015	01:19	11° 50,31' N	116° 58,78' W	4093	EBS	vom Grund	SL: 4145m
SO239/021-1	22.03.2015	06:00	11° 51,21' N	117° 3,57' W	0	BC	auf dem Grund	SLmax: 4146m
SO239/023-1	22.03.2015	11:42	11° 51,00' N	117° 3,16' W	4122	BC	auf dem Grund	SL: 4155m, SZ: 63,1kN
SO239/024-1	22.03.2015	16:01	11° 51,52' N	117° 1,19' W	0	EBS	am Grund	
SO239/024-1	22.03.2015	18:59	11° 51,87' N	116° 59,74' W	0	EBS	vom Grund	
SO239/025-1	22.03.2015	21:40	11° 51,32' N	117° 0,88' W	4120.6	CTD	zu Wasser	Transponder bei SL: 50m
SO 239/029-1	23.03.2015	18:02	11° 43,04' N	116° 36,49' W	0	ROV	auf Tiefe	BoSi: 3000 m
SO239/025-1	23.03.2015	00:25	11° 51,63' N	117° 0,64' W	0	CTD	zu Wasser	Ende Track, Beg. hieven, SL: 4122m
SO239/026-1	23.03.2015	02:55	11° 51,64' N	117° 0,63' W	4121	CTD	zu Wasser	
SO239/027-1	23.03.2015	08:30	11° 50,69' N	117° 3,54' W	0	MUC	am Grund	SLmax: 4151m
SO239/028-1	23.03.2015	10:51	11° 51,72' N	117° 1,92' W	0	AUV	zu Wasser	
SO 239/029-1	24.03.2015	01:55	11° 42,73' N	116° 35,94' W	0	ROV	tauchen auf	
SO 239/031-1	24.03.2015	10:01	11° 51,06' N	117° 3,46' W	0	MUC	am Grund	SLmax: 4143m

SO 239/032-1	24.03.2015	13:57	11° 51,28' N	117° 3,38' W	4127	MUC	auf Position	Boko, SL: 4144m BOKO - SLmax: 4153m; Hieven - SZmax: 52kN
SO 239/034-1	24.03.2015	19:23	11° 50,46' N	117° 3,22' W	0	MUC	auf Position	BOKO - SLmax: 4143m; Hieven - SZmax: 52kN
SO 239/035-1	24.03.2015	22:46	11° 51,09' N	117° 3,05' W	0	MUC	auf Position	rwk: 090°, d: 7sm
SO 239/036-1	25.03.2015	00:35	11° 50,73' N	117° 4,87' W	4126	HS_PS	Beginn Track	
SO 239/036-1	25.03.2015	02:28	11° 48,56' N	116° 59,98' W	4142.7	HS_PS	Profil Ende	
SO 239/037-1	25.03.2015	01:30	11° 50,58' N	116° 59,82' W	0	DOS	ausgelöst	DOS
SO 239/038-1	25.03.2015	04:00	11° 51,71' N	117° 1,94' W	4122.7	AUV	zu Wasser	
SO 239/039-1	25.03.2015	08:12	11° 50,47' N	117° 3,50' W	0	MUC	auf Position	BOSI - SL: 4150m Boko, SL: 4150m
SO 239/039-1	25.03.2015	11:12	11° 50,64' N	117° 3,44' W	4132	MUC	auf Position	
SO 239/040-1	25.03.2015	13:15	11° 50,64' N	117° 3,44' W	4131.3	PLA	zu Wasser	
SO 239/040-1	25.03.2015	14:04	11° 50,65' N	117° 3,52' W	4132.5	PLA	auf Tiefe	SL: 500m
SO 239/040-1	25.03.2015	15:03	11° 50,62' N	117° 3,69' W	4134.2	PLA	an Deck	
SO 239/041-1	25.03.2015	19:32	11° 50,55' N	117° 3,46' W	0	ROV	auf Tiefe	BOSI
SO 239/041-1	26.03.2015	02:03	11° 50,47' N	117° 3,47' W	4131	ROV	tauchen auf	
SO 239/044-1	26.03.2015	05:13	11° 51,47' N	117° 0,19' W	4114.6	DOS	zu Wasser	DOS
SO 239/044-1	26.03.2015	07:16	11° 51,44' N	117° 0,18' W	0	DOS	am Grund	DOS rwk: 270°, d: 14nm
SO 239/046-1	26.03.2015	09:57	11° 41,03' N	117° 21,90' W	4294	HS_PS	Beginn Track	
SO 239/046-1	26.03.2015	15:27	11° 53,03' N	117° 36,54' W	4227.6	HS_PS	Profil Ende	
SO 239/047-1	26.03.2015	16:25	11° 49,77' N	117° 31,89' W	4349.5	MOR	zu Wasser	LBL 1
SO 239/047-1	26.03.2015	17:05	11° 47,34' N	117° 31,19' W	4348.2	MOR	zu Wasser	LBL 2 Beginn Einmessun g LBL 1 Ende
SO 239/048-1	26.03.2015	18:00	11° 49,80' N	117° 31,89' W	0	REL	zu Wasser	Einmessun g LBL 1 Beginn Einmessun g LBL 2 Ende
SO 239/048-1	26.03.2015	19:57	11° 49,58' N	117° 32,64' W	0	REL	zu Wasser	Einmessun g LBL 1 Beginn Einmessun g LBL 2 Ende
SO 239/048-1	26.03.2015	20:15	11° 47,38' N	117° 32,02' W	0	REL	zu Wasser	Einmessun g LBL 2
SO 239/048-1	26.03.2015	20:57	11° 47,19' N	117° 31,98' W	0	REL	zu Wasser	g LBL 2
SO 239/049-1	26.03.2015	21:33	11° 48,54' N	117° 32,21' W	0	ATC	zu Wasser	
SO 239/050-1	27.03.2015	02:33	11° 49,92' N	117° 29,31' W	4330.3	EBS	vom Grund	SL: 4285m SLmax: 4393m, SZmax: 67kN
SO 239/051-1	27.03.2015	07:21	11° 49,42' N	117° 31,42' W	4347.8	BC	auf dem Grund	
SO 239/052-1	27.03.2015	10:44	11° 48,65' N	117° 32,54' W	4325	PLA	zu Wasser	
SO 239/052-1	27.03.2015	11:08	11° 48,65' N	117° 32,54' W	4336.5	PLA	auf Tiefe	SLmax: 250m
SO 239/052-1	27.03.2015	11:31	11° 48,65' N	117° 32,54' W	4333	PLA	an Deck	
SO 239/053-1	27.03.2015	12:22	11° 48,65' N	117° 32,54' W	4335	AUV	zu Wasser	
SO 239/054-1	27.03.2015	17:16	11° 41,93' N	117° 27,23' W	3349.9	ROV	auf Tiefe	BoSi bei 3348m
SO 239/054-1	28.03.2015	02:07	11° 40,75' N	117° 27,06' W	2979	ROV	tauchen auf	
SO 239/056-1	28.03.2015	07:12	11° 48,45' N	117° 31,46' W	4368	CTD	zu Wasser	
SO 239/057-1	28.03.2015	12:38	11° 48,45' N	117° 31,46' W	4369.5	BC	auf dem Grund	SLmax: 4399m , SZmax:



SO 239/058-1	28.03.2015	16:34	11° 49,23' N	117° 32,50' W	0	BC	auf dem Grund	68kN SLmax: 4380m
SO 239/059-1	28.03.2015	20:57	11° 48,22' N	117° 30,42' W	0	EBS	am Grund	SL: 4420m
SO 239/059-1	28.03.2015	23:38	11° 48,55' N	117° 29,03' W	0	EBS	vom Grund	SL: 4270m
SO 239/060-1	29.03.2015	04:18	11° 48,46' N	117° 33,02' W	4324.5	BC	auf dem Grund	SLmax: 4325m SLmax: 4387m , SZmax: 61kN
SO 239/061-1	29.03.2015	08:14	11° 47,67' N	117° 32,18' W	4335.1	BC	auf dem Grund	SL: 4372m, SZ: 77,1kN
SO 239/062-1	29.03.2015	12:26	11° 49,12' N	117° 33,22' W	4312.2	GC	am Grund	BOSI
SO 239/064-1	29.03.2015	19:15	11° 48,97' N	117° 30,13' W	4346.3	ROV	auf Tiefe	
SO 239/064-1	30.03.2015	01:53	11° 48,31' N	117° 30,13' W	4355.4	ROV	tauchen auf	
SO 239/065-1	30.03.2015	05:00	11° 48,61' N	117° 32,53' W	4335.7	AUV	zu Wasser	
SO 239/066-1	30.03.2015	10:35	11° 49,13' N	117° 33,13' W	4314.8	MUC	auf Position	BOKO - SLmax: 4353m, Hieven - SZmax: 53kN
SO 239/067-1	30.03.2015	14:26	11° 49,37' N	117° 32,00' W	4347	MUC	auf Position	Boko, SL: 4383m SLmax: 4374m
SO 239/068-1	30.03.2015	19:00	11° 47,40' N	117° 32,72' W	4351.5	MUC	am Grund	BOKO - SLmax: 4371m, Hieven - SZmax: 51kN
SO 239/069-1	30.03.2015	22:50	11° 47,62' N	117° 31,62' W	4347.9	MUC	auf Position	SLmax: 4380m
SO 239/071-1	31.03.2015	03:33	11° 47,88' N	117° 30,62' W	4354.5	MUC	auf Position	Transpond er bei SL 50m rwK: 270°, d: 7nm
SO 239/074-1	31.03.2015	17:32	11° 4,62' N	119° 39,52' W	4434.5	CTD	zu Wasser	
SO 239/075-1	31.03.2015	21:47	11° 3,24' N	119° 35,47' W	4292.7	HS_PS	Beginn Track	
SO 239/075-1	31.03.2015	22:54	11° 3,26' N	119° 42,32' W	4385.5	HS_PS	Profil Ende	
SO 239/076-1	31.03.2015	23:31	11° 3,68' N	119° 39,27' W	4419.4	MOR	zu Wasser	LBL 1
SO 239/077-1	31.03.2015	23:53	11° 4,99' N	119° 39,44' W	4403.6	MOR	zu Wasser	LBL 2
SO 239/079-1	01.04.2015	04:52	11° 4,48' N	119° 40,66' W	4414.5	AUV	zu Wasser	
SO 239/080-1	01.04.2015	05:39	11° 3,01' N	119° 41,06' W	4388.9	ATC	zu Wasser	
SO 239/081-1	01.04.2015	09:14	11° 3,97' N	119° 37,67' W	4365.7	EBS	am Grund	SL: 4423m
SO 239/081-1	01.04.2015	11:58	11° 4,29' N	119° 36,29' W	4346.4	EBS	vom Grund	SL: 4330m BoSi bei 4355m
SO 239/082-1	01.04.2015	17:11	11° 3,45' N	119° 37,89' W	4363.6	ROV	auf Tiefe	
SO 239/082-1	02.04.2015	01:27	11° 3,66' N	119° 37,65' W	4366.5	ROV	tauchen auf	
SO 239/084-1	02.04.2015	06:03	11° 4,73' N	119° 39,48' W	4430.8	MUC	am Grund	SLmax: 4465m SLmax: 4468m
SO 239/085-1	02.04.2015	09:21	11° 4,63' N	119° 39,60' W	4433.6	MUC	am Grund	SL: 4466m, SZ: 58,2kN
SO 239/086-1	02.04.2015	13:03	11° 4,52' N	119° 39,81' W	4439.2	MUC	am Grund	SLmax: 4475m
SO 239/087-1	02.04.2015	16:15	11° 4,54' N	119° 39,83' W	4436	GC	am Grund	SLmax: 4467m, SZmax: 67kN
SO 239/088-1	02.04.2015	19:42	11° 4,74' N	119° 39,53' W	4432.9	BC	auf dem Grund	SL: 4472m, SZ: 67,7kN
SO 239/089-1	02.04.2015	23:13	11° 4,55' N	119° 39,65' W	4436.5	BC	auf dem Grund	

SO 239/090-1	03.04.2015	02:35	11° 4,44' N	119° 39,85' W	4433.9	BC	auf dem Grund	SL:4469m, SZ: 68,3kN
SO 239/091-1	03.04.2015	06:00	11° 4,39' N	119° 39,34' W	4418.8	MUC	am Grund	SLmax: 4456m
SO 239/092-1	03.04.2015	09:17	11° 4,38' N	119° 39,35' W	4422.7	MUC	am Grund	SLmax: 4458m
SO 239/093-1	03.04.2015	12:35	11° 4,42' N	119° 39,33' W	4413.5	MUC	am Grund	SL: 4448m
SO 239/094-1	03.04.2015	15:53	11° 4,42' N	119° 39,33' W	4414.4	BC	auf dem Grund	SLmax: 4451m
SO 239/095-1	03.04.2015	19:08	11° 4,41' N	119° 39,35' W	4418.3	BC	auf dem Grund	SLmax: 4456m, SZmax: 69kN
SO 239/097-1	04.04.2015	00:58	11° 4,37' N	119° 39,37' W	4420.6	BC	auf dem Grund	SLmax: 4460m
SO 239/098-1	04.04.2015	03:14	11° 4,50' N	119° 40,63' W	4431.9	AUV	zu Wasser	
SO 239/099-1	04.04.2015	06:30	11° 2,28' N	119° 40,89' W	4401.4	EBS	am Grund	SL: 4468m
SO 239/099-1	04.04.2015	09:12	11° 2,61' N	119° 39,52' W	4397.9	EBS	vom Grund	SL: 4390m
SO 239/100-1	04.04.2015	13:25	11° 4,29' N	119° 39,33' W	4427.5	MUC	am Grund	SL: 4459m
SO 239/101-1	04.04.2015	18:04	11° 4,49' N	119° 39,39' W	4444.6	ROV	auf Tiefe	BoSi bei 4443m
SO 239/101-1	05.04.2015	01:39	11° 4,73' N	119° 39,48' W	4411.8	ROV	tauchen auf	
SO 239/103-1	05.04.2015	07:40	11° 4,30' N	119° 39,32' W	4424.9	MUC	am Grund	SLmax: 4456m
SO 239/104-1	05.04.2015	12:16	11° 3,89' N	119° 39,18' W	4424.4	MUC	am Grund	SL: 4457m
SO 239/105-1	05.04.2015	15:45	11° 4,27' N	119° 39,32' W	4423.4	BC	auf dem Grund	SLmax: 4460m
SO 239/106-1	05.04.2015	19:09	11° 4,30' N	119° 39,29' W	4425.3	BC	auf dem Grund	BOKO - SLmax: 4455m, Hieven - SZmax: 69kN
SO 239/107-1	05.04.2015	22:26	11° 4,33' N	119° 39,27' W	4424.7	BC	auf dem Grund	SLmax: 4455m, SZmax: 70kN
SO 239/110-1	07.04.2015	00:36	13° 51,72' N	123° 14,75' W	4511.6	CTD	zu Wasser	
SO 239/111-1	07.04.2015	04:40	13° 52,72' N	123° 15,72' W	4540.1	MOR	zu Wasser	LBL 1
SO 239/112-1	07.04.2015	05:26	13° 50,59' N	123° 15,71' W	4540.5	MOR	zu Wasser	LBL 2
SO 239/113-1	07.04.2015	05:54	13° 52,67' N	123° 16,61' W	4548	HS_PS	Beginn Track	rwK: 360°, d: 10nm
SO 239/113-1	07.04.2015	12:52	13° 50,80' N	123° 19,33' W	4491.8	HS_PS	Profil Ende	
SO 239/115-1	07.04.2015	16:28	13° 51,75' N	123° 16,44' W	4520.1	AUV	zu Wasser	
SO 239/116-1	07.04.2015	17:28	13° 52,32' N	123° 16,36' W	4529.1	ATC	zu Wasser	
SO 239/117-1	07.04.2015	20:03	13° 52,39' N	123° 15,30' W	4496.3	EBS	am Grund	SL: 4550m
SO 239/117-1	07.04.2015	23:08	13° 52,78' N	123° 13,82' W	4513.1	EBS	vom Grund	SL: 4500m
SO 239/118-1	08.04.2015	01:29	13° 52,38' N	123° 15,09' W	4511.7	CTD	zu Wasser	
SO 239/119-1	08.04.2015	08:06	13° 51,55' N	123° 15,16' W	4516.2	BC	auf dem Grund	SLmax: 4550m, SZmax: 64kN
SO 239/121-1	08.04.2015	12:51	13° 51,25' N	123° 15,30' W	4517.7	MUC	am Grund	SL: 4555m
SO 239/122-2	08.04.2015	18:11	13° 51,23' N	123° 15,29' W	4517.7	GC	am Grund	SLmax: 4563m
SO 239/124-1	08.04.2015	23:39	13° 51,28' N	123° 14,69' W	4510.8	MUC	am Grund	SL: 4548m
SO 239/125-1	09.04.2015	03:00	13° 51,06' N	123° 14,22' W	4510.8	MUC	am Grund	SL: 4548m
SO 239/126-1	09.04.2015	05:00	13° 50,51' N	123° 14,99' W	4516.3	ATC	zu Wasser	
SO 239/127-1	09.04.2015	06:43	13° 50,66' N	123° 14,76' W	4513.9	BC	auf dem Grund	SL: 4554m
SO 239/128-1	09.04.2015	10:05	13° 51,10' N	123° 15,12' W	4510.7	BC	auf dem Grund	SLmax: 4552m, SZmax: 67kN
SO 239/129-1	09.04.2015	12:05	13° 50,99' N	123° 13,06' W	4485.9	HS_PS	Beginn Track	rwk: 045°, d: 7sm

SO 239/129-1	09.04.2015	13:30	13° 51,58' N	123° 16,36' W	4532.9	HS_PS	Profil Ende	
SO 239/130-1	09.04.2015	15:16	13° 51,68' N	123° 16,37' W	4529.9	AUV	zu Wasser	
SO 239/131-1	09.04.2015	17:47	13° 52,39' N	123° 15,03' W	0	ROV	auf Tiefe	BoSi: 4508m
SO 239/131-1	10.04.2015	02:12	13° 52,44' N	123° 14,88' W	0	ROV	tauchen auf	
SO 239/133-1	10.04.2015	09:55	13° 50,98' N	123° 15,07' W	0	EBS	am Grund	SL: 4550m
SO 239/133-1	10.04.2015	12:29	13° 51,31' N	123° 13,73' W	4507	EBS	vom Grund	SL: 4485m
SO 239/134-1	10.04.2015	15:00	13° 51,76' N	123° 16,46' W	4530.6	AUV	zu Wasser	
SO 239/135-1	10.04.2015	18:21	13° 58,69' N	123° 8,94' W	0	ROV	auf Tiefe	BoSi bei 3912m
SO 239/135-1	11.04.2015	02:13	13° 59,06' N	123° 8,64' W	0	ROV	tauchen auf	
SO 239/137-1	11.04.2015	07:43	13° 51,36' N	123° 14,28' W	4509.7	BC	auf dem Grund	SLmax: 4551m, SZmax: 64kN SL: 4550m, SZ: 73,0kN
SO 239/138-1	11.04.2015	11:16	13° 50,89' N	123° 14,08' W	4503.1	BC	auf dem Grund	
SO 239/140-1	11.04.2015	16:00	13° 51,71' N	123° 16,46' W	4533.3	AUV	zu Wasser	
SO 239/141-1	11.04.2015	18:16	13° 52,03' N	123° 15,33' W	4506.6	ROV	auf Tiefe	BoSi bei 4510m
SO 239/141-1	12.04.2015	02:14	13° 52,19' N	123° 15,25' W	0	ROV	tauchen auf	
SO 239/145-1	12.04.2015	08:40	13° 50,80' N	123° 14,66' W	4513.3	MUC	am Grund	SLmax: 4548m
SO 239/146-1	12.04.2015	11:59	13° 50,74' N	123° 15,10' W	4511.4	MUC	am Grund	SL: 4549m
SO 239/147-1	13.04.2015	21:20	14° 2,66' N	130° 5,92' W	5028.7	CTD	zu Wasser	
SO 239/148-1	14.04.2015	01:31	14° 3,27' N	130° 6,78' W	4967.2	MOR	zu Wasser	LBL 2
SO 239/149-1	14.04.2015	02:03	14° 1,58' N	130° 6,80' W	4970.9	MOR	zu Wasser	LBL 1 rwk: 270°, d: 5sm
SO 239/150-1	14.04.2015	02:28	14° 2,65' N	130° 4,32' W	5032	HS_PS	Beginn Track	
SO 239/150-1	14.04.2015	03:25	14° 2,66' N	130° 10,41' W	4899.8	HS_PS	Profil Ende	
SO 239/152-1	14.04.2015	05:40	14° 2,61' N	130° 7,57' W	4959.6	AUV	zu Wasser	
SO 239/153-1	14.04.2015	06:20	14° 2,75' N	130° 7,93' W	4934.4	ATC	zu Wasser	
SO 239/154-1	14.04.2015	08:21	14° 3,00' N	130° 8,32' W	4889.6	MUC	am Grund	SLmax: 4927m
SO 239/155-1	14.04.2015	11:59	14° 2,97' N	130° 7,85' W	4940	MUC	am Grund	SL: 4975m
SO 239/157-1	14.04.2015	17:27	14° 2,09' N	130° 7,13' W	0	ROV	auf Tiefe	BoSi: 4982m
SO 239/157-1	14.04.2015	23:56	14° 2,19' N	130° 6,82' W	0	ROV	tauchen auf	
SO 239/158-1	15.04.2015	04:58	14° 3,41' N	130° 7,99' W	4946	EBS	am Grund	SL: 5018m
SO 239/158-1	15.04.2015	08:29	14° 3,81' N	130° 6,48' W	4977.3	EBS	vom Grund	SL: 4970m SL: 4955m, SZ: 64,8kN
SO 239/159-1	15.04.2015	13:02	14° 2,94' N	130° 8,06' W	4921	BC	auf dem Grund	
SO 239/160-1	15.04.2015	15:10	14° 2,39' N	130° 5,61' W	5029.8	AUV	zu Wasser	
SO 239/161-1	15.04.2015	19:00	14° 2,07' N	130° 5,60' W	5030.7	ROV	auf Tiefe	BoSi bei 5034m
SO 239/161-1	16.04.2015	02:00	14° 2,41' N	130° 5,72' W	5028.1	ROV	tauchen auf	
SO 239/162-1	16.04.2015	06:19	14° 2,94' N	130° 7,56' W	4950.7	BC	auf dem Grund	SLmax: 4988m
SO 239/164-1	16.04.2015	11:55	14° 3,00' N	130° 7,42' W	4954.9	MUC	am Grund	SL: 4992m SLmax: 4978m
SO 239/165-1	16.04.2015	15:36	14° 2,63' N	130° 8,39' W	4922.7	GC	am Grund	
SO 239/166-1	16.04.2015	18:24	14° 2,62' N	130° 8,39' W	4924.1	AUV	zu Wasser	
SO 239/167-1	16.04.2015	20:14	14° 2,62' N	130° 8,32' W	4918.8	MUC	am Grund	SLmax: 4967m
SO 239/168-1	16.04.2015	23:48	14° 2,60' N	130° 7,82' W	4948.3	MUC	am Grund	SL: 4986m SLmax: 5000m
SO 239/169-1	17.04.2015	03:14	14° 2,53' N	130° 7,64' W	4963.7	BC	auf dem Grund	
SO 239/171-1	17.04.2015	08:00	14° 2,68' N	130° 5,97' W	5030.2	EBS	am Grund	SL: 5060m
SO 239/171-1	17.04.2015	11:04	14° 3,20' N	130° 4,61' W	5015	EBS	vom Grund	SL: 4995m
SO 239/172-1	17.04.2015	13:32	14° 3,20' N	130° 4,61' W	5014.4	AUV	zu Wasser	
SO 239/174-1	17.04.2015	18:34	14° 2,44' N	130° 5,10' W	5005.5	GC	am Grund	SLmax:

SO 239/175-1	17.04.2015	22:09	14° 2,45' N	130° 5,11' W	5008	MUC	am Grund	5052 m SLmax: 5043m
SO 239/176-1	18.04.2015	01:40	14° 2,54' N	130° 5,13' W	5012.3	MUC	am Grund	SL: 5050m SLmax: 4981m, SZmax: 69kN SL: 4946m, SZ: 68,9kN SL: 5001m, SZ: 70,3kN
SO 239/180-1	18.04.2015	07:39	14° 2,50' N	130° 8,18' W	4936.4	BC	auf dem Grund	
SO 239/181-1	18.04.2015	11:03	14° 2,79' N	130° 8,49' W	4896.3	BC	auf dem Grund	
SO 239/182-1	18.04.2015	14:17	14° 2,54' N	130° 7,65' W	4957.3	BC	auf dem Grund	
SO 239/183-1	19.04.2015	13:55	18° 2,39' N	128° 41,91' W	4763	CTD	zu Wasser	
SO 239/184-1	19.04.2015	17:56	18° 3,62' N	128° 41,91' W	4796.9	HS_PS	Beginn Track	
SO 239/184-1	20.04.2015	11:30	18° 45,42' N	128° 22,58' W	0	HS_PS	Profil Ende	
SO 239/185-1	20.04.2015	04:23	18° 46,13' N	128° 21,77' W	4835.5	MOR	zu Wasser	LBL 1
SO 239/186-1	20.04.2015	04:51	18° 48,27' N	128° 21,76' W	4826.9	MOR	zu Wasser	LBL 2
SO 239/188-1	20.04.2015	14:01	18° 47,53' N	128° 22,58' W	4818.2	AUV	zu Wasser	
SO 239/189-1	20.04.2015	17:45	18° 47,80' N	128° 18,53' W	4933.4	ROV	auf Tiefe	BoSi bei 4925m
SO 239/189-1	21.04.2015	02:30	18° 48,13' N	128° 18,20' W	4964	ROV	tauchen auf	
SO 239/191-1	21.04.2015	06:12	18° 46,88' N	128° 19,98' W	4854.7	ATC	zu Wasser	
SO 239/192-1	21.04.2015	09:00	18° 44,81' N	128° 21,87' W	0	EBS	am Grund	SL: 4860m, rwK: 071°
SO 239/192-1	21.04.2015	12:00	18° 45,34' N	128° 20,42' W	0	EBS	vom Grund	SL: 4810m
SO 239/193-1	21.04.2015	14:49	18° 47,52' N	128° 22,56' W	4808.1	AUV	zu Wasser	
SO 239/194-1	21.04.2015	16:46	18° 47,54' N	128° 22,33' W	4815.5	GC	am Grund	SLmax: 4865m SLmax: 4874m, SZmax: 67kN SL: 4880m, SZ: 66,3kN SL: 4844m, rwk: 073°
SO 239/195-1	21.04.2015	20:08	18° 47,75' N	128° 21,73' W	4833.4	BC	auf dem Grund	
SO 239/196-1	21.04.2015	23:33	18° 47,83' N	128° 20,77' W	4847.2	BC	auf dem Grund	
SO 239/197-1	22.04.2015	03:35	18° 48,66' N	128° 22,75' W	4805.5	EBS	am Grund	
SO 239/197-1	22.04.2015	06:30	18° 49,09' N	128° 21,29' W	4822.2	EBS	vom Grund	SL: 4810m
SO 239/199-1	22.04.2015	12:07	18° 47,46' N	128° 22,42' W	4816.6	MUC	am Grund	SL: 4848m BoSi: 4700 m
SO 239/200-1	22.04.2015	16:54	18° 49,22' N	128° 25,55' W	4698	ROV	auf Tiefe	
SO 239/200-1	23.04.2015	02:13	18° 49,60' N	128° 25,48' W	4696.1	ROV	tauchen auf	
SO 239/201-1	23.04.2015	05:00	18° 47,47' N	128° 22,59' W	4807.7	AUV	zu Wasser	
SO 239/202-1	23.04.2015	07:00	18° 47,35' N	128° 21,26' W	4843.7	MUC	am Grund	SLmax: 4881m SLmax: 4881m, SZmax: 68kN SL: 4852m, SZ: 63,7kN SL: 4891m SLmax: 4860m SL: 4859m, SZ: 65,1kN
SO 239/203-1	23.04.2015	10:23	18° 46,44' N	128° 21,19' W	4843.1	BC	auf dem Grund	
SO 239/204-1	23.04.2015	13:45	18° 46,40' N	128° 20,17' W	4815.9	BC	auf dem Grund	
SO 239/206-1	23.04.2015	17:56	18° 47,23' N	128° 20,24' W	4857	MUC	am Grund	
SO 239/207-1	23.04.2015	21:33	18° 46,43' N	128° 22,42' W	4825	MUC	am Grund	
SO 239/209-1	24.04.2015	01:54	18° 47,07' N	128° 22,35' W	4819.1	BC	auf dem Grund	
SO 239/210-1	24.04.2015	06:15	18° 49,27' N	128° 25,80' W	4700	EBS	am Grund	SL: 4750m
SO 239/210-1	24.04.2015	09:33	18° 49,92' N	128° 24,40' W	4735.7	EBS	vom Grund	SL: 4725m

SO 239/211-1	24.04.2015	12:22	18° 47,51' N	128° 22,60' W	4806.2	AUV	zu Wasser	
SO 239/212-1	24.04.2015	15:43	18° 32,83' N	128° 44,88' W	1853.1	ROV	auf Tiefe	BoSi bei SL 1873m
SO 239/212-1	24.04.2015	22:09	18° 32,57' N	128° 44,93' W	1713.7	ROV	tauchen auf	
SO 239/213-1	25.04.2015	03:05	18° 46,59' N	128° 20,63' W	4827.6	MUC	am Grund	SL: 4863m

## Summary of deployments

<u>Gear</u>	<u>Code</u>	<u>Number</u>
CTD	CTD	11
Thermistor Mooring	Thst	1
BOBO Lander	BOBO	1
DOS Lander	DOS	2
LBL Mooring	LBL	12
Autonomous Underwater Vehicle	AUV	20
Remote operated vehicle	ROV	15
Boxcorer	BC	35
Gravity Corer	SL	7
Epibenthos sledge	EBS	13
Plankton Net	PLN	2
Multicorer	MUC	37
Amphipod Trap	ATC	7