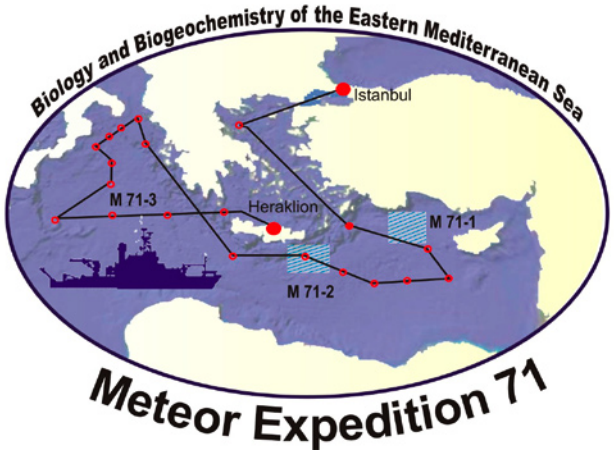
Meteor-Cruise M71/1

Short Cruise Report

11 - 24 December 2006



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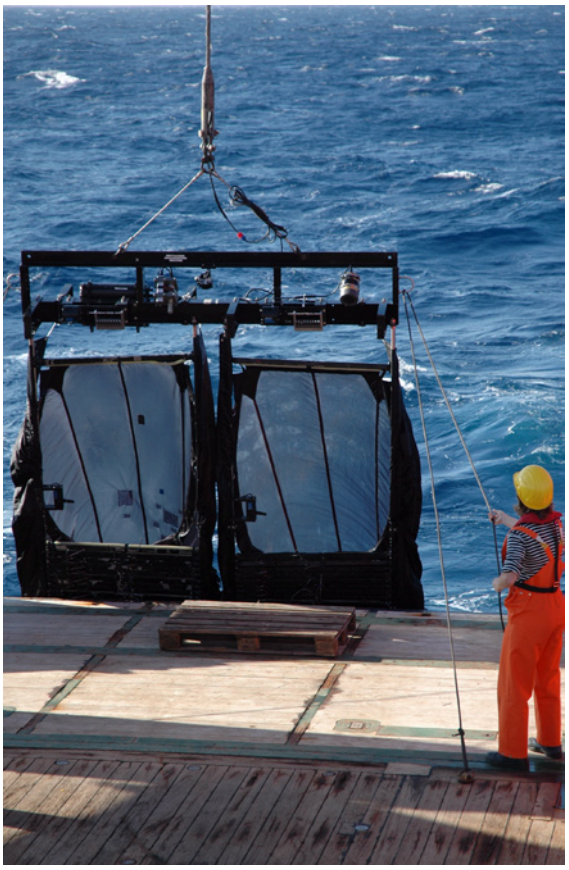

The 1m²-double-MOCNESS

Participants

No	Surname	First name	Institution	Task
1	Christiansen	Bernd	UHH-IHF	chief scientist/seafloor photography
2	Büntzow	Marco	DZMB	benthos: meiofauna
3	Ciftci	N. Bozkurt	TPAO	observer TPAO/Turkey
4	Denda	Anneke	UHH-IHF	zooplankton/trophic relationships
5	Eisenack	Thomas	–	documentation
6	Frost-Fajans	Jessica	UHH-IHF	zooplankton/gelatinous plankton
7	George	Kai-Horst	DZMB	benthos: meiofauna
8	Hanel	Reinhold	IFM-GEOMAR	fish
9	Hannides	Angelos	UCYP-OC	guest Cyprus
10	Jarms	Gerhard	UHH-ZIM	benthos: coronata
11	Kaufmann	Manfred	UMA	phytoplankton
12	Kiriakoulakis	Kostas	ULIV	biogeochemistry
13	König	Sabine	FAU	benthos: makrofauna
14	Koppelmann	Rolf	UHH-IHF	zooplankton
15	Martin	Bettina	UHH-IHF	zooplankton
16	Miske	Volker	EMAU	nekton: cephalopoda
17	Mohn	Christian	NUIG	physical oceanography
18	Mouriki	Dimitra	HCMR	benthos: meiofauna
19	Peine	Florian	URO	biogeochemistry
20	Philipps-Bussau	Kathrin	UHH-IHF	zooplankton
21	Podaras	Dimitrios	HCMR	benthos: makrofauna
22	Reichelt	Theresa	UHH-IFM	physical oceanography
23	Ruseler	Silke	UHH-IHF	zooplankton
24	Siranidou	Evdokia	HCMR	benthos: meiofauna
25	Springer	Barbara	URO	biogeochemistry
26	Tselepides	Anastasios	HCMR	benthos: meiofauna
27	Turnewitsch	Robert	SAMS	biogeochemistry
28	Warneke-Cremer	Cornelia	UHH-ZIM	nekton: cephalopoda

Participating institutions

DZMB	Forschungsinstitut und Naturmuseum Senckenberg (Abt. DZMB), Wilhelmshaven/Germany
EMAU	Ernst-Moritz-Arndt-Universität Greifswald, Greifswald/Germany
FAU	Friedrich-Alexander-Universität Erlangen, Institut für Paläontologie, Erlangen/Germany
HCMR	Hellenistic Centre for Marine Research, Dept. of Deep-Sea Ecology, Institute of Oceanography, Heraklion, Crete/Greece
IFM-GEOMAR	Leibniz-Institut für Meereswissenschaften, Kiel, Germany
NUIG	National University of Ireland, Galway, Department of Oceanography, Galway/Ireland
SAMS	Scottish Association for Marine Science, Oban, Scotland/UK
TPAO	Turkish Petroleum Company, Ankara, Turkey
UCYP-OC	University of Cyprus, Oceanography Centre, Nicosia/Cyprus
UHH-IFM	Universität Hamburg, Institut für Meereskunde, Hamburg/Germany
UHH-IHF	Universität Hamburg, Institut für Hydrobiologie und Fischereiwissenschaft, Hamburg/Germany
UHH-ZIM	Universität Hamburg. Zoologisches Institut und Museum, Hamburg/Germany
ULIV	University of Liverpool, Dept. of Earth Science, Liverpool/UK
UMA	University of Madeira,Department of Biology and Centre of Macaronesian Studies, Funchal, Madeira Island/Portugal
URO	Universität Rostock, Institut für Aquatische Ökologie - Meersbiologie, Rostock/Germany

Research objectives and work programme

Leg METEOR M71/1 focused on physical, biogeochemical and biological sampling at the Anaximander Mountains. There are only very few seamount-like structures in the eastern Mediterranean. They are fairly isolated from the world ocean and are located in a region with exceptionally high temperatures of 14 °C in the deep-water layers.

The primary goal of the studies at one peak of the Anaximander Mountains was to assess if a seamount ecosystem in an oligotrophic region with a warm deep-water layer is comparable with similar topographic features in the NE-Atlantic, which have been studied within the EU funded project OASIS. In particular, the study is supposed to clarify if these systems in different oceanographic regimes have similar impacts on the current field and on the particle flux, and if they are similar with regard to their productivity, the distribution of their food webs and their sphere of interference, i.e. the extention of the space which is effected by seamount processes.

A further goal of the cruise was to extend a time series of zooplankton distribution and composition in eastern Mediterranean basins, which in particular monitores the effect of the EMT (Eastern Mediterranean Transient) on the plankton communities.

The scientific programme included the following main tasks:

1. To identify and describe the physical forcing mechanisms effecting the Anaximander Mountains and their surrounding. These are key requirements for an understanding of the biogeochemical and biological processes, and they are essential for the design of an effective biogeochemical and biological sampling strategy. Tasks include measurement and modelling of the 3D flow field and of the vertical diffusivity of the near-bottom water layer.

2. To assess the origin, the quality and the dynamics of organic particulate material within the water column and the surface sediments of the seamount. The organisms below the euphotic zone depend, with a few exceptions, on (particulate) organic material that has been produced in the surface ocean. During its descent to the seafloor this material is altered in many ways, for example by ingestion and egestion by pelagic animals, by microbial degradation or aggregate formation. Within the benthic mixed layer, sedimentation and resuspension will strongly influence the availability of this material. All these processes will affect the nutritional value of the organic matter for organisms living at or close to the seafloor. This task studies the quality of organic particles, their sources, and exchange processes between sediment and water column.

3: To describe aspects of the biodiversity and the ecology of the Anaximander Mountains communities, to assess their dynamics and the maintenance of their production. Seamounts frequently accommodate enhanced densities of organisms, often including commercially valuable species. Several hypotheses exist regarding how these stocks are maintained, e.g. by trapping of particles in Taylor columns, by enhanced primary production due to upwelling, or by trapping of the vertically migrating deep scattering layer fauna. This objective addresses the major faunistic groups (zooplankton, micronecton, benthos and fish) at the Anaximander Mountains, their composition, distribution and their trophic interactions, with special emphasis on the bottom mixed layer fauna and on the deep scattering layer.

The integration of results from these task will lead to an advanced understanding of the functioning of this special seamount ecosystem in comparison with the seamounts studied in the NE-Atlantic, and it will increase the knowledge of these topographic features in their particular hydrographic setting.

Study sites

The studies were performed in the Rhodes Basins and in the area of the Anaximander Mountains. These mountains are located south of Antalya and comprise 3 elevations which rise more than 1000 m above the surrounding sea floor. Water depth at the base is between 2000 and 3000 m; the minimum summit depth is ca 700 m (Fig. 1). The Anaximander Mountains feature areas with steep slopes as well as gently-sloping regions.

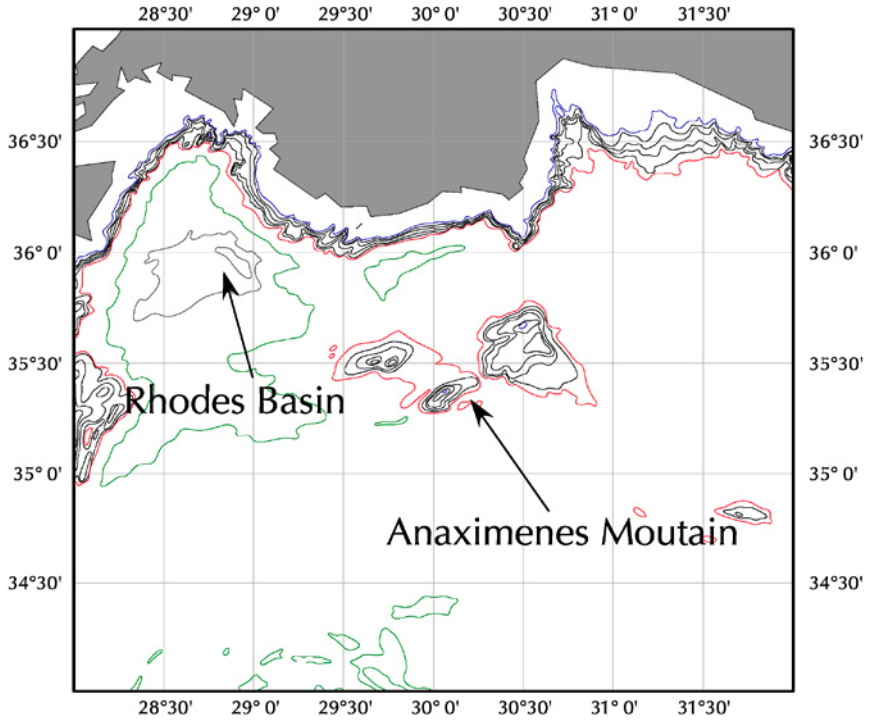

Figure 1: METEOR 71/1 study sites

Bathymetry and hydrography

The shipboard multibeam echosounder was used to complement the existing bathymetric maps of the area, with a focus on the bottom topography at the sampling stations and along the transects of towed instruments.

CTD profiles of temperature and salinity were used, in combination with the hull-mounted ADCP, to characterize the water masses and the current field. We plan to use satellite images to identify the exact location of the eddies in the vicinity of the Anaximander Mountains.

Biogeochemistry

Organic particles in the water column were sampled by means of water bottles (CTD-rosette) and stand-alone pumping systems (SAPS), which pump large volumes of water through a membrane filter. Part of the study aimed at the effect of tide cycles on the sedimentation and resuspension of organic material, and focused on two locations at the northern slope of the Anaximenes Mountain. Further

samples were taken in connection with the biological studies. For the characterization of the particles, SPM, POC, PN, Pigments and ^{234}Thorium will be measured. ^{234}Thorium will also be used to assess residence times and export fluxes of particles.

Sediment for the analysis of pigments, lipids, stable isotopes ($\delta^{13}C/\delta^{15}N$), ^{234}Th, and ^{210}PB was sampled with a multicorer. ^{210}PB will be used to assess bioturbation rates at a time scale of 100 years.

Biology

Water samples from the CTD/rosette will be analysed for phytoplankton composition and pigment content. Acoustic methods (echo sounder, ADCP - acoustic Doppler current profiler) were used to monitor the deep scattering layer in order to get a qualitative picture of the daily vertical migrations of zooplankton and micronekton, and to identify the interaction between scattering layer and benthic mixed layer. Samples with multiple opening and closing nets of the MOCNESS type (1 m^2 for macrozooplankton and 10 m^2 for micronekton) will yield detailed information of the faunal composition of the deep scattering layer community and of the zooplankton and micronekton in the water column and close to the bottom. Generally, the whole water column was covered with stratified, oblique tows, with sampling intervals increasing with depth, from 50 m in the top 100 m to a maximum spacing of 500 m at depths greater than 1000 m at Rhodes Deep. In the near-bottom water layer down to ca 20 m above bottom, the net was towed horizontally. To investigate diel vertical migrations day and night hauls with the 1m^2-Double-MOCNESS were made. Part of the MOCNESS samples will be used for biochemical studies of trophic interactions. These include measurements of stable isotope ratios ($\delta^{15}N$ und $\delta^{13}C$) and lipid biomarkers for the identification of trophic levels and trophic pathways, respectively. Pelagic catches were also made with a 6*3 m dip net, and for demersal fishes a longline mooring was used.

The benthic studies included megafauna, macrofauna and meiofauna. Optical methods were employed to get quantitative information of the abundance and distribution of epibenthic megafauna and larger benthopelagic organisms. The DOS (DOS=Deep-sea Observation System of the IHF Hamburg), an altimeter-controlled camera sled with downward looking still camera and video camera was used for photographic transects of the seafloor. Megafauna and macrofauna specimens for taxonomic analyses and for the determination of biochemical parameters like lipids and stable isotopes were sampled by epibenthic sledge, trawl, dredge and boxcorer. Meiofauna was sampled by a multicorer.

Cruise narratives

R.V. METEOR left the port of Heraklion on December 11th, 2006. The weather was calm and sunny, and all groups were busy to assemble their equipment and to set up the laboratories. The first sampling station in the Rhodes Basin was reached on December 12th at 02:00h. We started station work with a 1m^2-double MOCNESS haul covering the water column to a depth of 3900 m, followed by a CTD/rosette/SAPS cast and a second MOCNESS haul, which reached 4400 m. A series of successful multiple corer and boxcorer hauls yielded material for the benthic workgroups.

Work in the Rhodes Basin was finished in the evening of December 13th, and METEOR sailed to the second study area at the Anaximenes Mountain, where she arrived on December 14th. We started with a benthic sampling programme on top of the Anaximenes Mountain, employing box corer and multiple corer, before the first tide cycle station was sampled with the CTD/rosette. After a

combined hydrographic and bathymetric survey with ADCP and multibeam echosounder, the same station was sampled again. Station work continued with 1m²-double MOCNESS hauls, CTD/rosette casts, including SAPS (stand-alone pumping systems), and several multiple corer hauls, all of them successful (see Figure 2 for an overview of sampling locations in the Anaximenes Mountain region).

On December 15th, the DOS (deep-sea observation system) was lowered to the summit of Anaximenes Mountain for the first time. The distance to the seafloor was kept at approximately 3 m and was monitored by an altimeter. The system was equipped with a Benthos standard camera with a capacity of 800 frames. The frame interval was set at 8 sec. The DOS transect covered a depth range from approximately 800 to 900 m. A 1m²-double MOCNESS haul and CTD/rosette casts with SAPS followed.

On morning of December 16th, the 10m²-MOCNESS was successfully deployed above the summit of Anaximenes Mountain. A second haul on 20 December failed due to a defect in the electronics system.

After the MOCNESS, a longline baited with fish and squid was deployed and recovered after 8 h of bottom time. Although part of the longline was messed up and had to be cut free, some hooks held fish, mainly sharks (*Galeus melastomus* and *Etmopterus cf. spinax*) and 2 conger eels (Conger conger). A second deployment of the longline on December 17th again revealed sharks, but also two morids (*Mora moro*).

After a series of MOCNESS hauls and CTD casts and a second DOS transect covering water depths between 835 and 1160 m (see Figure 3 for examples of seafloor images), a further benthic sampling programme with several multiple and box corers and two beamtrawl hauls was performed from December 17th to 19th, complimented by CTD/rosette casts at the tide cycle stations. The first of the two beamtrawls was towed on the plain north of Anaximenes Mountain at a water depth of around 2000 m. The catch was very poor and contained a few crustaceans and molluscs. During the second haul on the summit at a depth of ca 800 m the net was severely damaged.

From the morning of December 19th until December 22nd, the next pelagic sampling series was carried out with 1m²-double MOCNESS hauls and CTD/rosette casts (some of them with SAPS), including also three DOS transects at the Anaximenes Mountain covering depths between 790 and 1740 m. A last benthic programme started with two beamtrawl tows on December 22nd, one in the area between Anaximenes Mountain and Anaxagoras Mountain, the other one on the Anaximenes summit. Both hauls were successful, but the catches were again poor and contained, apart from garbage and wood debris, some crustaceans, bivalves, a few sharks and macrourid fishes. Two more multiple corer hauls followed, then a CTD/rosette cast, and finally two box corer hauls.

Because bad weather was forecasted for the next day, the station work had to be finished in the evening of December 22nd, and METEOR left the study site at 18:15 h to sail to Heraklion. After two weeks of mostly calm sea, the way back was slightly more uncomfortable due to strong winds up to force 9, but METEOR arrived in Heraklion in due time in the evening of December 23rd.

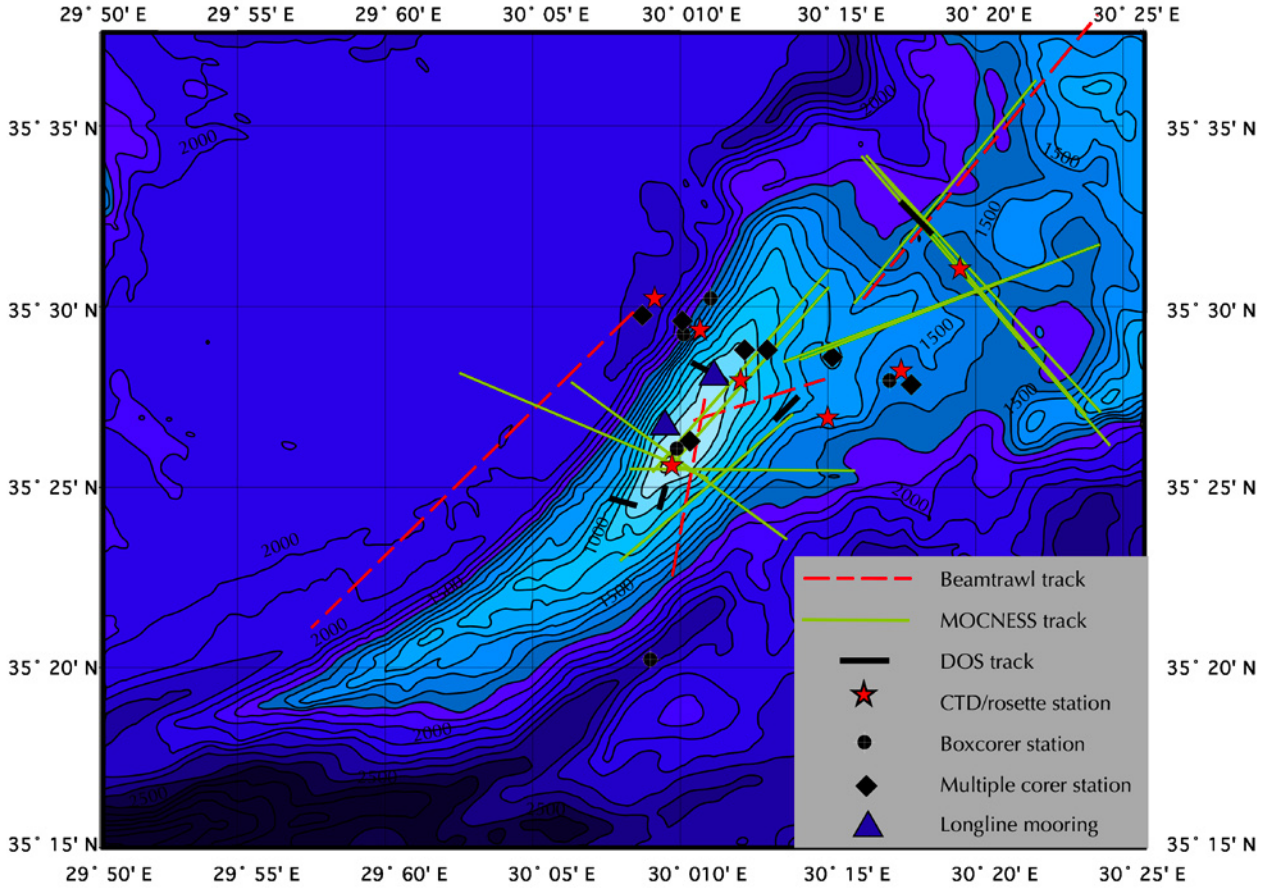

Figure 2: Sampling locations in the Anaximenes Mountain region.

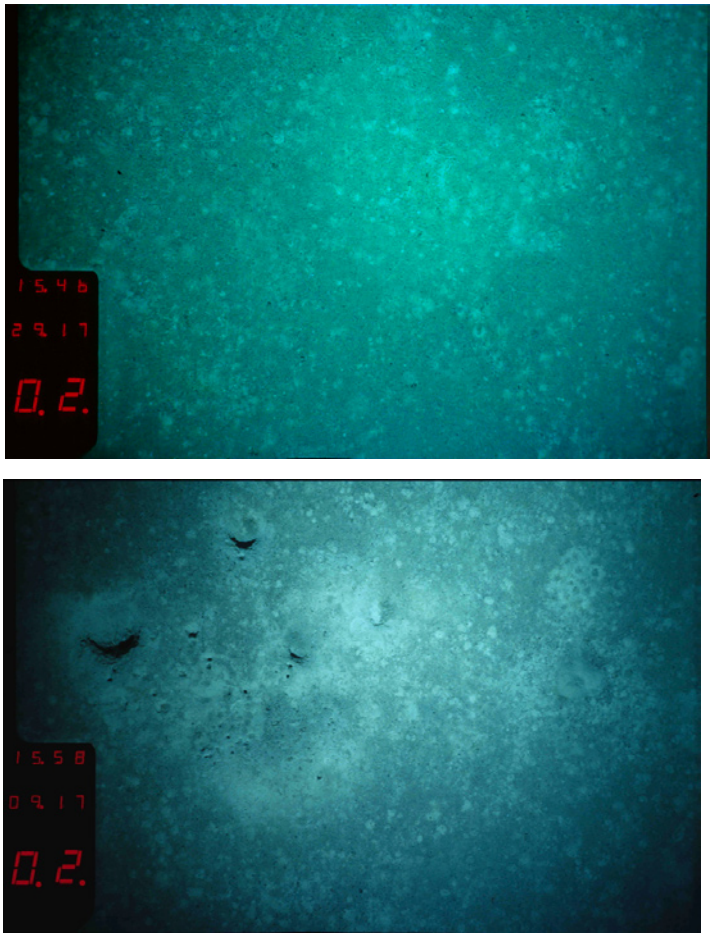

Figure 3: Examples of seafloor images from the Anaximenes Mountain (DOS haul 2). Water depth approximately 1000 m. No larger megafauna visible.

METEOR cruise M71/1: List of stations

Station No	Date	Time	Depth	Latitude			Longitude			Gear
Nr.	[UTC]	[UTC]	[m]	[°]	[']		[°]	[']		
880	13/12/10	2:03	3167	35	47.99	N	29	12.60	E	MOC-D
881	13/12/10	11:38	4429	35	55.05	N	28	48.00	E	CTD/SAPS
882	13/12/10	18:12	4446	35	53.43	N	28	43.91	E	MOC-D
883	14/12/10	5:34	4431	35	54.99	N	28	48.02	E	MUC
884	14/12/10	8:28	4427	35	54.98	N	28	48.01	E	MUC
885	14/12/10	10:55	4429	35	55.00	N	28	48.00	E	MUC
886	14/12/10	13:44	4430	35	55.00	N	28	47.99	E	BC
887	14/12/10	16:17	4430	35	55.00	N	28	48.00	E	BC
888	15/12/10	2:04	1257	35	28.62	N	30	15.14	E	BC
889	15/12/10	3:10	1258	35	28.61	N	30	15.14	E	BC
890	15/12/10	4:18	1259	35	28.61	N	30	15.14	E	BC
891-1	15/12/10	5:26	1259	35	28.61	N	30	15.14	E	MUC
891-2	15/12/10	6:30	1261	35	28.61	N	30	15.13	E	MUC
891-3	15/12/10	7:35	1254	35	28.61	N	30	15.15	E	MUC
892	15/12/10	10:00	1767	35	29.47	N	30	10.10	E	CTD
893	15/12/10	16:25	1771	35	29.50	N	30	10.11	E	CTD
894	15/12/10	19:28	1914	35	23.55	N	30	13.62	E	MOC-D
895	15/12/10	23:49	702	35	25.78	N	30	9.91	E	CTD/SAPS
896	16/12/10	4:46	1124	35	22.96	N	30	7.96	E	MOC-D
897	16/12/10	9:00	904	35	28.80	N	30	12.29	E	MUC
898	16/12/10	9:57	914	35	28.77	N	30	12.95	E	MUC
899	16/12/10	10:49	904	35	28.80	N	30	12.26	E	MUC
900	16/12/10	11:39	917	35	28.80	N	30	12.30	E	MUC
901	16/12/10	13:12	797	35	25.05	N	30	9.51	E	DOS
902	16/12/10	16:46	685	35	25.65	N	30	9.73	E	MOC-D
903	16/12/10	21:05	678	35	25.60	N	30	9.58	E	CTD/SAPS
904	17/12/10	2:04	686	35	25.68	N	30	9.77	E	MOC-10
905	17/12/10	5:00	790	35	27.99	N	30	11.29	E	LL deployment
906	17/12/10	7:30	1169	35	25.51	N	30	8.28	E	MOC-D
907	17/12/10	11:53	2105	35	30.23	N	30	8.96	E	CTD/RO
908	17/12/10	14:33	788	35	27.97	N	30	10.98	E	LL recovery
909	17/12/10	18:04	2125	35	30.23	N	30	8.98	E	CTD
910	17/12/10	20:00	708	35	25.28	N	30	9.14	E	MOC-D
911	18/12/10	1:43	678	35	25.60	N	30	9.59	E	CTD/SAPS
912	18/12/10	5:32	800	35	26.90	N	30	10.01	E	LL deployment
913	18/12/10	7:32	1044	35	25.24	N	30	10.95	E	MOC-D
914	18/12/10	12:30	805	35	26.65	N	30	10.06	E	LL recovery
915	18/12/10	15:12	844	35	24.49	N	30	8.53	E	DOS
916	18/12/10	18:50	1930	35	30.15	N	30	9.03	E	MUC
917	18/12/10	20:00	1965	35	30.23	N	30	8.97	E	MUC
918	18/12/10	21:20	1943	35	30.23	N	30	8.95	E	MUC
919	18/12/10	22:54	2043	35	20.23	N	30	8.98	E	BC
920	19/12/10	0:57	1551	35	29.49	N	30	10.10	E	CTD
921	19/12/10	3:00	2119	35	30.23	N	30	10.98	E	BC
922	19/12/10	4:26	2117	35	30.23	N	30	10.98	E	BC
923	19/12/10	7:03	1766	35	29.49	N	30	10.10	E	CTD

List of stations, continued

Station No	Date	Time	Depth	Latitude			Longitude			Gear
Nr.	[UTC]	[UTC]	[m]	[°]	[']		[°]	[']		
924	19/12/10	9:11	2040	35	29.86	N	30	8.42	E	BT
925	19/12/10	15:36	766	35	27.45	N	30	10.83	E	BT
926	19/12/10	18:40	1766	35	29.51	N	30	10.08	E	BC
927	19/12/10	19:55	1770	35	29.31	N	30	10.09	E	BC
928	19/12/10	21:50	1776	35	29.50	N	30	10.07	E	MUC
929	19/12/10	23:03	1786	35	29.50	N	30	10.10	E	MUC
930	20/12/10	0:41	662	35	26.05	N	30	9.87	E	MUC
931	20/12/10	1:21	680	35	26.04	N	30	9.90	E	MUC
932	20/12/10	2:09	679	35	26.06	N	30	9.88	E	BC
933	20/12/10	2:52	680	35	26.06	N	30	9.88	E	BC
934	20/12/10	7:30	1578	35	34.17	N	30	16.13	E	MOC-D
935	20/12/10	13:52	2115	35	30.25	N	30	8.92	E	CTD
936	20/12/10	16:42	1556	35	32.00	N	30	18.53	E	DOS
937	20/12/10	20:30	2125	35	30.28	N	30	8.94	E	CTD
938	20/12/10	23:11	1799	35	34.06	N	30	16.43	E	MOC-D
939	21/12/10	4:27	1648	35	31.08	N	30	19.47	E	CTD/SAPS
940	21/12/10	9:22	1824	35	34.19	N	30	16.29	E	MOC-D
941	21/12/10	15:00	1279	35	27.52	N	30	14.00	E	DOS
942	21/12/10	18:40	1496	35	30.94	N	30	21.71	E	MOC-10
943	21/12/10	19:50	1595	35	31.72	N	30	24.21	E	MOC-D
944	22/12/10	1:13	1650	35	31.10	N	30	19.50	E	CTD/SAPS
945	22/12/10	6:00	1604	35	31.68	N	30	24.06	E	MOC-D
946	22/12/10	13:36	1772	35	29.50	N	30	10.12	E	CTD
947	22/12/10	15:40	796	35	27.99	N	30	11.48	E	DOS
948	22/12/10	19:05	1382	35	26.99	N	30	14.99	E	CTD
949	22/12/10	20:00	840	35	27.99	N	30	12.04	E	CTD
950	22/12/10	21:00	1753	35	29.50	N	30	10.09	E	CTD
951	22/12/10	23:41	1415	35	30.04	N	30	16.03	E	MOC-D
952	23/12/10	5:20	1440	35	30.21	N	30	16.20	E	BT
953	23/12/10	10:53	756	35	26.85	N	30	10.45	E	BT
954	23/12/10	13:54	1544	35	27.99	N	30	17.30	E	MUC
955	23/12/10	14:57	1541	35	28.00	N	30	17.31	E	MUC
956	23/12/10	15:50	1543	35	28.00	N	30	17.30	E	CTD
957	23/12/10	16:24	1544	35	27.99	N	30	17.31	E	BC
958	23/12/10	17:23	1541	35	27.99	N	30	17.29	E	BC

CTD	Seabird CTD with 24 bottle rosette
SAPS	stand alone pumping system
LL	longline
MOC-D	1m^2-double-MOCNESS
DOS	camera sled (seafloor photography)
MUC	multiple corer
BC	giant box corer
MOC-10	10m^2-MOCNESS
BT	beamtrawl