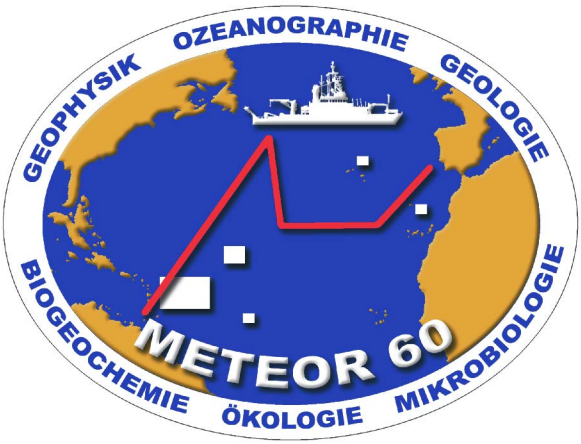
Meteor-Cruise M60/1

Short Cruise Report



OASIS

11.11.2003-6.12.2003

Principal Scientist
Dr. Bernd Christiansen, Universität Hamburg

Participants

No	Name	1st name	Institution	Task
1	Christiansen	Bernd	UHH-IHF	chief scientist
21	Beck	Tim	FAU	macrofauna
18	Bett	Brian	SOC	megafauna
19	Billett	Dave	SOC	megafauna
26	Emelianov	Mikhail	ICM	physical oceanography
17	Espino Caballero	Minerva	ULPGC	primary production, fluxes
27	Furey	Tom	NUIG	moorings
11	George	Kai-Horst	DZMB	meiofauna
16	Gutiérrez Lobato	Carlos	ULPGC	primary production, fluxes
12	Henche	Annika	DZMB	meiofauna
3	Hirch	Stefanie	UHH-IHF	zooplankton
9	Holscher	Boris	TUHH	hyperbaric experiments
20	Horton	Tammy	SOC	scavengers
23	José	Felix	IMAR	physical oceanography
14	Kiriakoulakis	Kostas	ULIV	biogeochemistry
4	Koppelmann	Rolf	UHH-IHF	zooplankton, hyperbaric experiments
5	Laakmann	Silke	UHB	benthos/lipids
10	Lübben	Andrea	URO	biogeochemistry
28	Maçedo	Luis	IMAR	physical oceanography
8	Maier	Dominique	UHH-IHF	zooplankton
2	Martin	Bettina	UHH-IHF	zooplankton
22	Mendonça	Ana	IMAR	primary production, fluxes
6	Ruseler	Silke	UHH-IHF	biochemistry
7	Simonelli	Paolo	UHH-IHF	zooplankton
25	Turnewitch	Robert	SOC	biogeochemistry
24	Ullgren	Jenny	NUIG	physical oceanography
15	Vilas Español	Juán Carlos	ULPGC	primary production, fluxes
13	Werk	Stephan	URO	biogeochemistry

Participating institutions

DZMB	Deutsches Zentrum für Marine Biodiversität, Wilhelmshaven
FAU	Friedrich-Alexander Universität Erlangen, Institut für Paläontologie, Erlangen
ICM	Institut de Ciencies del Mar, CMIMA - CSIC, Grup d'Oceanografia Fisica, Barcelona
IMAR	IMAR/DOP, Departamento de Oceanografia e Pescas, Universidade dos Açores, Horta
NUIG	National University of Ireland, Galway, Department of Oceanography, Galway
SOC	Southampton Oceanography Centre, George Deacon Division for Ocean Processes, Southampton
TUHH	Technische Universität Hamburg-Harburg, Arbeitsbereich Meerestechnik 1, Hamburg
UHB	Universität Bremen, Bremen
UHH-IHF	Universität Hamburg, Institut für Hydrobiologie und Fischereiwissenschaft, Hamburg
ULIV	University of Liverpool, Dept. of Earth Science, Oceanography Laboratories, Liverpool
ULPGC	Universidad de Las Palmas de Gran Canaria, Facultad de Ciencias del Mar, Las Palmas
URO	Universität Rostock, Institut für Aquatische Ökologie - Meersbiologie, Rostock

Research objectives and work programme

The first leg of METEOR cruise M60 aimed at physical, biogeochemical and biological sampling in the framework of the EU project OASIS (OceAnic Seamounts: an Integrated Study). OASIS is an interdisciplinary project with 9 partners from 5 European countries. The project studies the functional characteristics of seamount ecosystems. Based on two case studies, OASIS will yield an advanced mechanistic understanding of the processes characterizing seamount ecosystems, and their influence on the surrounding ocean. The scientific knowledge gained, condensed in a conceptual ecosystem model, will be applied to outline a model management plan as well as site-specific management plans for the seamounts investigated.

The primary goal of OASIS, to provide a holistic, integrated assessment of seamount ecology, will be achieved by addressing the following main objectives: a) To identify and describe the physical forcing mechanisms effecting seamount systems. b) To assess the origin, quality and dynamics of particulate organic material within the water column and surface sediment at seamounts. c) To describe aspects of the biodiversity and the ecology of seamount biota, to assess their dynamics and the maintenance of their production. d) Modelling the trophic ecology of seamount ecosystems. e) Application of scientific knowledge to practical conservation.

A further goal of the cruise was to test a newly developed hyperbaric laboratory which is designed to study deep-sea organisms under in situ pressure.

Study sites
The studies were performed at two seamounts in the northeast Atlantic (Fig. 1), with a focus on the Sedlo Seamount north of the Azores. This seamount has a summit depth of ca 750 m. Principally all parts of the seamount were sampled, from the base to the summit including the overlying water column. For comparison, samples were taken at a reference station outside the influence of the seamount.

Seine Seamount northeast of Madeira rises up to 170 m below the sea surface. Here, a few selected samples were taken, supplementing material from a former cruise.

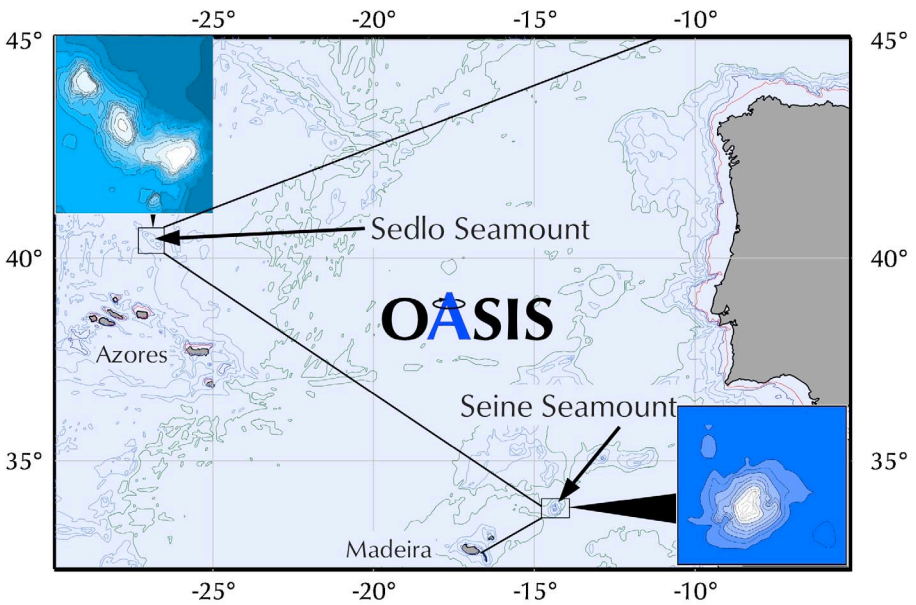


Fig. 1: METEOR cruise M60/1: cruise track and study sites

Bathymetry and hydrography
In addition to existing maps, hydrosweep and parasound were used to gain topographic information of the two study sites. Both sites have been poorly studied in this respect. The detailed measurements focussed on the bottom topography in the vicinity of the sampling stations and are a prerequisite for sampling the benthos and the near-bottom water layer. Moored current meters and ADCP as well as CTD profiles of temperature and salinity were used to measure the flow field, the structure of the benthic mixed layer (BML) and the vertical diffusivity. A total of 5 current meter moorings deployed in summer 2003 by R.V. ARCHIPELAGO were recovered.

Biogeochemistry
Organic particles in the water column were sampled by means of water bottles (CTD/rosette) and stand-alone pump systems (SAPS) which pump water through a membrane filter. Water samples from the rosette were also used to determine primary production, export rates and remineralisation rates. For primary production measurement, water samples were incubated for 24 h under ambient light conditions representing different depths. A multiple corer was used to sample sediment for the analysis of pigments, lipids, stable isotopes and thorium.

Biology
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. Targeted catches within and outside the deep scattering layer with multiple opening and closing nets of the MOCNESS type (1 m^2 for macrozooplankton and 10 m^2 for micronekton) yield detailed information of the faunal composition of the deep scattering layer community and specimens for biochemical studies of trophic interactions.

The benthic studies focus on the megafauna (those specimens which can be identified with optical methods). The British WASP system (WASP=wide angle seafloor photography), an altimeter-controlled camera sled with downward looking still camera and video camera was used for photographic and video transects. Megafauna was sampled with an epibenthic sledge, and additionally macrofauna and meiofauna samples were taken using box corer and multiple corer.

A pilot study of hyperbaric experiments on metazoan plankton was performed using the pressurized experimental chamber "APROACH" (Adaptive Pressurized Ocean Analysis Chamber). Deep-sea plankton was sampled and transferred to the experimental chamber under *in situ* pressure and temperature conditions by means of a temperature-isolated, pressurized sampling chamber, which was attached to a MOCNESS cod end bucket. APROACH offers various possibilities for the observation and manipulation of organisms and allows the application of different probes, e.g. to measure oxygen concentrations. During METEOR cruise M 60/1, the principal possibility of sampling and maintaining deep-sea organisms under in situ pressure was studied and evaluated.

The samples taken during METEOR cruise M60/1 will be analysed in the course of the EU funded research project OASIS. The final report for this project is due in January 2006.

Cruise narratives

After the last provisions were loaded, METEOR sailed from Kiel at noon on 11 November. We enjoyed the passage of Kiel Canal with cold, but sunny weather. The weather stayed calm in the North Sea, and all groups were busy to assemble their equipment and to set up the laboratories. At the western entrance of the English Channel a gale hit us with wind force 8 Bft and waves up to 8 m high which slowed our speed considerably. But the wind and the sea calmed down soon, and we could continue the preparations for the station work.

On 16 November a first series of test stations with the CTD was run which revealed some problems with the electrical connections. These could be fixed, and on 18 November METEOR arrived at our first study site, Sedlo Seamount. First, two CTD stations were run, and then a combined hydrographic/bathymetric survey was performed at the southeastern summit of the seamount which is the main area of interest for our studies. Parallel tracks were used for swath bathymetry with hydrosweep, and a grid of 5*3 CTD stations, each going to 1500 m depth, was used to sample hydrographic data and water for the analysis of particulate organic matter (Fig. 2). During the survey, four moorings carrying current meters which had been deployed on a cruise with the Portuguese research vessel ARCHIPELAGO in summer 2003, were successfully recovered. A baited amphipod trap was deployed on the summit of Sedlo Seamount on 21 November.

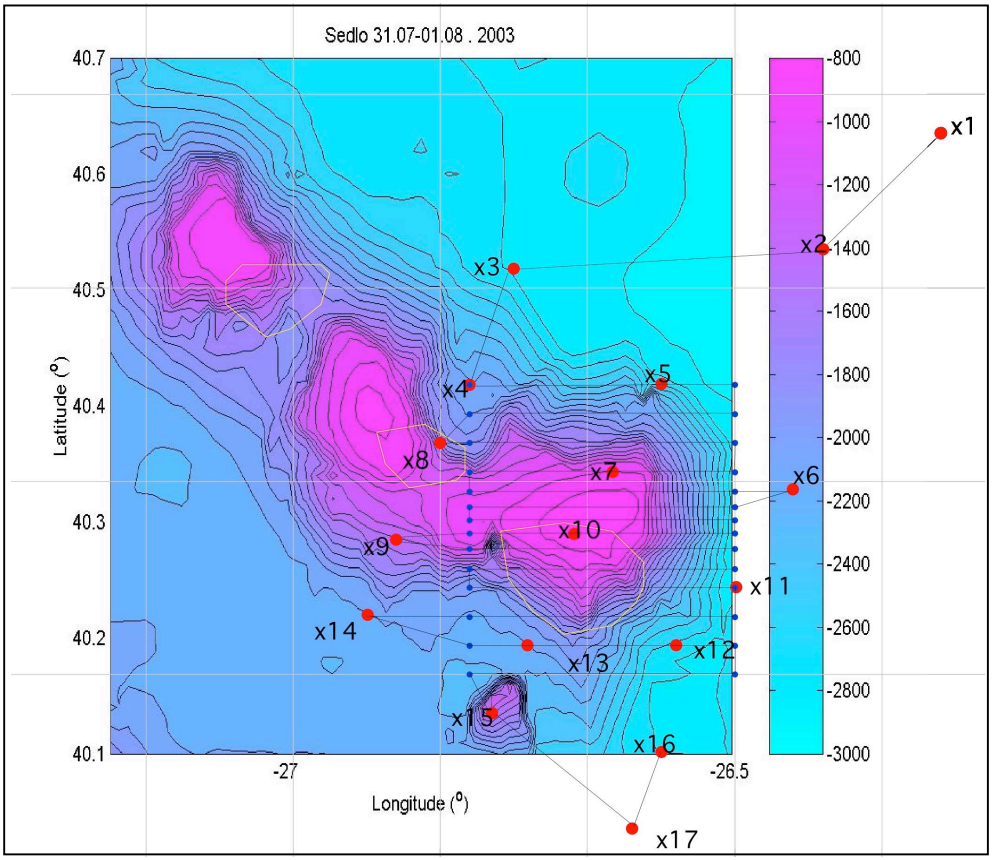


Fig. 2: METEOR cruise M60/1: Bathymetric track and hydrography stations

The bathymetric survey which was sometimes impaired by high swell, was finished on 21 November in the evening, and a first haul with the 1m^2-double-MOCNESS was conducted, yielding stratified samples from 1000 m water depth to the surface. Station work continued with further MOCNESS hauls and CTD-rosette casts, including SAPS (stand-alone pump

systems), for the analysis of primary production, nutrients, dissolved and particulate organic matter. On 22 November the WASP (wide angle seabed photography) was lowered to the summit of Sedlo Seamount for the first time. The distance to the seafloor was kept at approximately 3 m and was monitored by an acoustic telemetry system. The system produced still images and one hour of digital video film. Surprisingly, the summit plateau showed bare rock in many places, with only a few patches of sediment in between, sometimes with bolders and gravel, all this pointing to strong currents sweeping over the top of the seamount. After the WASP, two multiple corer hauls were conducted, which both failed.

Two further WASP hauls on 23 November at ca 1000 m water depths similarly showed bare rock in most places.

On 23 November in the morning the amphipod trap was released and recovered. The catch was surprisingly small, with only a few amphipods, but several fishes. A fifth current meter mooring was successfully recovered after the amphipod trap.

Further CTD casts, MOCNESS tows with both the $10m^2$ and the $1m^2$ double system, and WASP transects were performed at different locations and depths in the area of Sedlo Seamount until 30 November. Benthic sampling during this time included multiple corer, box corer, amphipod trap, rock dredge and epibenthic sledge. The epibenthic sledge haul at the base of the seamount failed because both nets were damaged. The rock dredge, towed at the flank of the seamount, caught a few sessile organisms like crinoids and corals.

Station work at Sedlo Seamount was finished on 30 November, and METEOR sailed to our second study site, Seine Seamount, where we arrived on 2 December in the afternoon. Strong wind and high swell did not allow for using towed gear, so we started with several CTD/rosette casts. On the following day, the weather and sea conditions improved considerably, and one 10 m^2-MOCNESS haul (down to 1000 m) and two hauls with the $1m^2$-double-MOCNESS (down to 4170 m) could be performed.

The remaining time at Seine Seamount was mainly used for benthic sampling, including WASP transects, multiple corer and box corer. The WASP videos showed that the summit plateau was covered with sediment. At the edges, some patches with flat rock could be seen. An epibenthic sledge haul on the summit plateau of the seamount, at a water depth of 170-180 m, caught large numbers of megafaunal organisms, like sea urchins, sea stars, crustaceans, worms, but also benthopelagic fish like snipe fish, which are typical for seamounts.

METEOR left Seine Seamount on 5 December in the afternoon and sailed to Funchal, Madeira, where we arrived the next day in the morning.

METEOR cruise M60/1: List of stations

Station	Date	Time	Latitude		Longitude		Water depth	Gear
No		UTC					m	
675	16.11.03	10:38	45° 43.7	N	15° 45.0	W	4711	CTD
676	16.11.03	13:46	45° 30.2	N	16° 18.6	W	4071	CTD
677	16.11.03	15:34	46° 23.5	N	16° 34.3	W	3581	CTD
678	18.11.03	15:52	40° 38.0	N	26° 16.0	W	2895	CTD
679	18.11.03	18:55	40° 32.0	N	26° 24.0	W	2887	CTD
680	18.11.03	21:40	40° 31.0	N	26° 45.0	W	2741	CTD
681	18.11.03	23:52	40° 24.9	N	26° 48.1	W	2164	CTD
682	19.11.03	3:16	40° 25.0	N	26° 35.0	W	26°53	CTD
683	19.11.03	7:45	40° 22.0	N	26° 50.0	W	1423	CTD
684	19.11.03	10:54	40° 22.1	N	26° 36.8	W	1298	CMM recovery
685	19.11.03	15:33	40° 20.5	N	26° 38.3	W	891	CTD
686	19.11.03	21:03	40° 19.6	N	26° 25.9	W	2873	CTD
687	19.11.03	4:10	40° 17.2	N	26° 41.2	W	757	CTD
688	20.11.03	6:25	40° 17.3	N	26° 53.1	W	1395	CTD
689	20.11.03	8:50	40° 15.1	N	26° 49.8	W	1465	CMM recovery
690	20.11.03	12:04	40° 15.7	N	26° 35.3	W	1535	CMM recovery
691	20.11.03	13:54	40° 13.1	N	26° 33.9	W		CMM recovery
692	20.11.03	21:28	40° 14.4	N	26° 29.0	W	2818	CTD
693	21.11.03	1:56	40° 13.0	N	26° 55.0	W	2150	CTD
694	21.11.03	4:30	40° 11.5	N	26° 44.0	W	2176	CTD
695	21.11.03	7:30	40° 11.6	N	26° 34.0	W	26°00	CTD
696	21.11.03	9:09	40° 11.4	N	26° 34.0	W	26°82	A-Trap deployment
697	21.11.03	12:52	40° 8.0	N	26° 46.5	W	2379	CTD
698	21.11.03	16:00	40° 2.0	N	26° 37.0	W	26°18	CTD
699	21.11.03	18:24	40° 5.9	N	26° 35.0	W	2707	CTD
700	21.11.03	22:16	40° 15.5	N	26° 34.0	W	2000	D-MOC
701	22.11.03	4:30	40° 15.3	N	26° 37.0	W	1222	3 CTD
702	22.11.03	12:30	40° 15.2	N	26° 33.1	W	2040	D-MOC
703	22.11.03	18:30	40° 17.9	N	26° 39.1	W	725	WASP
704	22.11.03	20:40	40° 19.1	N	26° 38.0	W	763	WASP
705	22.11.03	23:34	40° 19.0	N	26° 40.0	W	773	MUC
706	23.11.03	3:38	40° 18.5	N	26° 48.0	W	935	WASP
707	23.11.03	6:00	40° 19.9	N	26° 51.0	W	973	WASP
708	23.11.03	9:56	40° 11.0	N	26° 33.9	W	26°93	A-Trap recovery
709	23.11.03	12:51	40° 17.1	N	26° 42.3	W		CMM recovery
710	23.11.03	14:45	40° 12.9	N	26° 43.2	W	837	D-MOC
711	23.11.03	20:00	40° 21.1	N	26° 36.0	W	1003	WASP
712	23.11.03	23:46	40° 12.8	N	26° 26°.0	W	1750	D-MOC
713	24.11.03	4:10	40° 19.0	N	26° 40.0	W	774	3 CTD
714	24.11.03	10:26°	40° 19.0	N	26° 39.9	W	772	A-Trap deployment
715	24.11.03	11:32	40° 13.1	N	26° 42.9	W	1660	D-MOC
716	24.11.03	15:45	40° 12.9	N	26° 35.9	W	2352	WASP
717	24.11.03	19:25	40° 11.0	N	26° 33.1	W	2719	GKG
718	24.11.03	23:25	40° 11.1	N	26° 33.1	W	2718	MUC
719	25.11.03	3:44	40° 19.9	N	26° 50.6	W	1123	RD
720	25.11.03	6:43	40° 20.0	N	26° 51.0	W	1110	RD
721	25.11.03	9:41	40° 19.1	N	26° 39.3	W	775	A-Trap recovery
722	25.11.03	12:54	40° 22.2	N	26° 44.4	W	1240	D-MOC

List of stations, continued

723	25.11.03	18:00	40°	20.1	N	26°	50.2	W	1134	3 CTD
724	26°.11.03	1:13	40°	20.0	N	26°	45.5	W	1033	D-MOC
725	26°.11.03	6:10	40°	15.9	N	26°	53.9	W	1676	WASP
726°	26°.11.03	11:53	40°	23.8	N	26°	48.2	W	2029	D-MOC
727	26°.11.03	21:13	40°	20.0	N	26°	50.7	W	1123	A-Trap deployment
728	26°.11.03	22:35	40°	18.3	N	26°	42.1	W	786	2 GKG
729	27.11.03	2:52	40°	22.4	N	26°	34.4	W	1746	3 CTD
730	27.11.03	11:45	40°	15.9	N	26°	31.5	W	26°87	MOC 10
731	27.11.03	17:06	40°	19.5	N	26°	50.7	W	1179	A-Trap recovery
732	27.11.03	18:41	40°	15.1	N	26°	49.9	W	1888	MOC 10
733	27.11.03	23:34	40°	11.0	N	26°	33.0	W	2714	WASP
734	28.11.03	5:18	40°	14.8	N	26°	28.1	W	2720	EBS
735	28.11.03	13:22	39°	50.1	N	26°	17.9	W	2872	A-Trap deployment
736	28.11.03	13:47	39°	50.4	N	26°	17.9	W	2872	3 CTD
737	29.11.03	0:00	39°	50.5	N	26°	18.2	W	2877	D-MOC
738	29.11.03	6:47	39°	50.0	N	26°	17.9	W	2876	CTD
739	29.11.03	7:30	39°	50.0	N	26°	17.2	W	2835	A-Trap recovery
740	29.11.03	9:34	39°	50.4	N	26°	16.7	W	2890	D-MOC
741	29.11.03	19:05	39°	50.0	N	26°	18.0	W	2815	WASP
742	30.11.03	23:09	39°	49.9	N	26°	18.0	W	2871	MUC
743	02.12.03	15:50	33°	48.0	N	14°	40.1	W	4008	CTD
744	02.12.03	17:42	33°	30.5	N	14°	31.5	W	3395	CTD
745	02.12.03	22:09	33°	52.0	N	14°	30.1	W	3489	CTD
746	03.12.03	2:18	33°	52.0	N	14°	14.0	W		CTD
747	03.12.03	5:24	33°	42.0	N	14°	13.8	W	3382	CTD
748	03.12.03	8:38	33°	46.0	N	14°	22.0	W	178	CTD
749	03.12.03	10:09	33°	42.1	N	14°	30.1	W	2388	MOC 10
750	03.12.03	15:36	33°	44.1	N	14°	20.5	W	607	D-MOC
751	03.12.03	21:44	33°	27.7	N	14°	23.9	W	4272	D-MOC
752	04.12.03	8:08	33°	46.0	N	14°	22.0	W	178	WASP
753	04.12.03	9:40	33°	49.0	N	14°	22.1	W	215	WASP
754	04.12.03	10:50	33°	49.1	N	14°	21.9	W	209	MUC
755	04.12.03	11:55	33°	48.0	N	14°	22.0	W	207	MUC
756	04.12.03	12:52	33°	46.1	N	14°	22.0	W	178	2 MUC
757	04.12.03	16:45	33°	49.0	N	14°	22.0	W	206	A-Trap deployment
758	04.12.03	17:33	33°	45.5	N	14°	21.3	W	186	EBS
759	04.12.03	20:42	33°	46.0	N	14°	21.9	W	177	GKG
760	04.12.03	22:00	33°	46.2	N	14°	23.0	W	180	GKG
761	05.12.03	0:30	33°	42.9	N	14°	18.3	W	1700	WASP + Fisch z.W.
762	05.12.03	3:55	33°	36.3	N	14°	11.7	W	4412	MUC
763	05.12.03	8:35	33°	48.4	N	14°	21.9	W	204	A-Trap recovery
764	05.12.03	10:39	33°	40.5	N	14°	31.3	W	3270	CTD
765	05.12.03	16:53	33°	49.0	N	14°	21.9	W	222	GKG

CTD	Seabird CTD with 24 bottle rosette
CMM	current meter mooring
A-Trap	amphipod trap
D-MOC	$1m^2$-double-MOCNESS
WASP	camera sled (wide angle seafloor photography)
MUC	multiple corer
GKG	giant box corer
MOC 10	$10m^2$-MOCNESS
RD	rock dredge
EBS	epibenthic sledge