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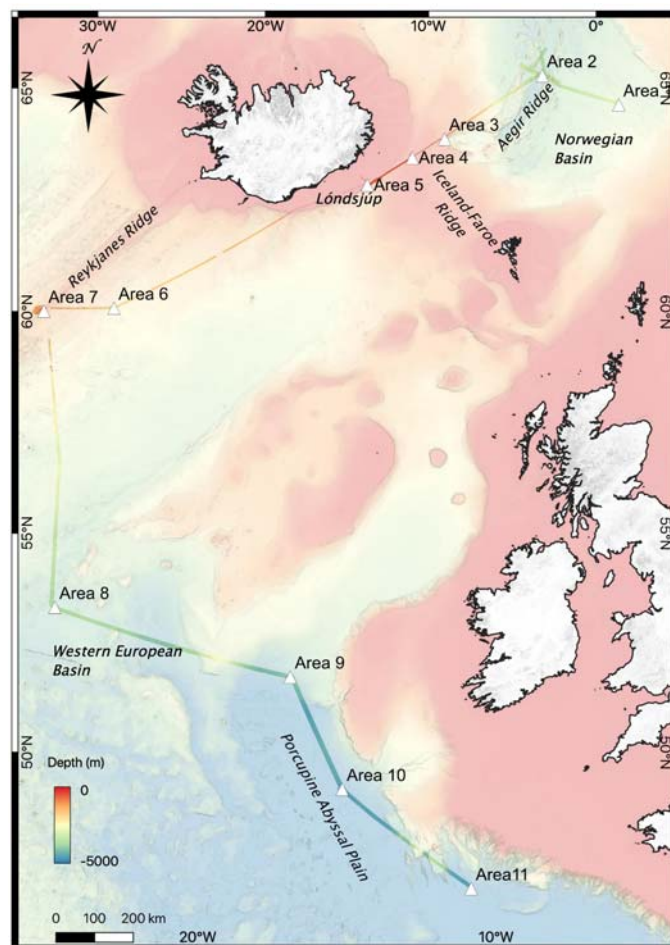
## Short Cruise Report Cruise No. SO276 (MerMet 17-06)

Emden (Germany) – Emden (Germany)

22.06.2020 – 26.07.2020

Chief Scientist: Saskia Brix

Captain: Oliver Meyer



**Figure 1.:** Total map of the surface covered by SO276 (MerMet17-6) over the faded GEBCO map. Working areas are located by a white triangle (Norwegian Basin and Aegir Ridge, Iceland-Faroe Ridge, Lónsjúp coral reef, Reykjanes Ridge, East Atlantic Abyssal plains).

## Objectives

Iceland is located on top of the Greenland-Scotland Ridge (GSR), a natural border. This extensive Ridge separates the deep Nordic Seas from the North Atlantic proper. Water transport across the ridge influences regional climate and global thermohaline circulation. The near-bottom temperatures within the region range from  $-1^{\circ}\text{C}$  to up to  $12\text{--}13^{\circ}$ .

The ultimate goal of the IceAGE project is to connect distribution results (morphological and molecular) with climate change scenarios, in order to predict possible future distributional patterns of selected benthic marine invertebrates within the highly variable environment around Iceland at the transition of the northern North Atlantic and the Nordic Seas. Key areas of investigation include better understanding of the genetic, morphological, and environmental patterns in Atlantic ecosystems and habitats, and the correlation and relationships between them. Larger issues under investigation are related to the different Atlantic water masses: the deep waters around Iceland include boreal, subarctic, and Arctic zones that hold discrete bodies of water, which allow scientists to compare the deep-sea ecosystems that are found in different locations. How much variation exists between basins in the deep sea? Is there gene flow between deep-sea basins? Do we see the same patterns in the deep sea and the continental shelf? IceAGE3 expands the sampling grit of BIOICE and the previous IceAGE expeditions building up on nearly three decades sampling (1992 – 2018) aiming at long-term observatory. Most important aim of the expedition “IceAGE3” is to collect deep stations below 3000m depth along two depth gradients. The sampling design of the previous IceAGE cruises showed gaps in the deeper areas and although we have continuous samples along four transect between 150 and 2850m depth, it is necessary to reach North as well as South of the GIS Ridge below the 3000m line known as “diversity turn over” from the literature. A second aim is to gain more and expand the knowledge on the cold-water coral reefs in the Lónsjúp and papagrunn area along the Icelandic shelf. A third aim is “vent hunting” in formerly MSM75\_Area2.

We

- describe the sampled habitats by video surveys (ROV KIEL 6000);
- explore the biodiversity of the Nordic Seas and the North Atlantic;
- compare the biodiversity of the Nordic Seas and North Atlantic below 3000m depth;
- define biodiversity hot spots in the region and establish observatory stations;
- sample deep abyssal plains North and South of Iceland in comparable water depth
- extend the IceAGE depth transects below the 3000m line
- proof the modeled existence of cold-water coral reefs south-east of Iceland
- extend the bathymetry data of the Icelandic shelf break and Reykjanes Ridge;

## Narrative

IceAGE (Icelandic marine Animals: Genetics and Ecology) is an ongoing and international project that builds on over a decade of sampling initiated by the Benthic Invertebrates of Icelandic Waters (BIOICE) project. Our focus is on the climatic sensitive region at the northernmost part of the North Atlantic and the Nordic Seas (Greenland, Iceland and Nordic Seas reaching to the North Sea), i.e. the region around Iceland and adjacent waters. With IceAGE3, we add deep stations South and North of Iceland along two transects between 4000 and 700m depth to the IceAGE sampling grid from in total three previous expeditions (M85/1, POS456 and MSM75), connect IceAGE samples to the EU project iAtlantic and link the sampling to previous IceAGE expeditions revisiting stations at the southern and northern slope. The marine environment at all depths (bathymetric gradient) and all different marine habitats like abyssal plains, cold water coral reefs, hydrothermal active areas located on the Reykjanes Ridge) along the border between North Atlantic and Arctic waters is used as a proxy to be compared with North American and North European continental slopes and deep-sea basins in regard of the connectivity of the fauna. Our focus are four target areas: the deep sea of the Norwegian Basin along the Aegir Ridge, the Iceland-Faroe Ridge as overflow region between separating the Arctic from the Nord Atlantic Ocean, the cold-water corals reefs Lónsjúp and Papagrunn South-East of Iceland and the deep-sea Basing South of Iceland with focus on samples below 3000m water depth down to the Porcupine Abyssal plain in 4500m depth.

SO276 (MerMet17-06) is a special journey in Corona times. After everyone got through the Corona Test Camp healthy and negative, crew and scientists were able to get on board on June 21, 2020. On June 22nd, 2020 it was time to get started and FS Sonne set off northwards with the destination 65 °N and the 0 Meridian. On Thursday, June 25th we reached the first field of work faster than expected with a tailwind and beautiful summer weather. During the first two weeks, we concentrated our work on the deep waters in the Norwegian Basin and along the submarine feature "Aegir Ridge". The ROV Kiel 6000 and the first deep dive were the highlight of the week. In eight 250m long transects, the ROV flew over the ocean floor at a height of 2m and amazed not only us, but our international audience. From June 24th we had the opportunity to broadcast the dives of the ROV Kiel6000 live with increased bandwidth. With the help of the livestream from our "showroom" we could bring the international cooperation partners of the IceAGE project on board so that they can support both the determination of the observed animals and the sampling with their expertise directly during the dive.

As expected by the end of the first week, stormy conditions hit us in the beginning of the second week. On Wednesday, the weather was calm enough to have a second successful ROV dive in 3800m depth exploring the deep part of the Aegir Ridge. Thursday and early Friday we spent mapping the seafloor along the Aegir Ridge on the transit to the southern part of it. In the afternoon, we put behind us 20h of transit to our next working area, the third one, located just East of the Icelandic continental shelf. Planning for the next two ROV dives happening Saturday and Sunday, a detailed multibeam bathymetry was followed by deploying the complete set of gear (CTD, plankton net, boxcorer, multicorer and EBS) inside the valley like structure in 2100m depth of the southern end of the Aegir Ridge as well as on the shelf break in 700 m depth and its sedimented areas.

During the third week, our focus was on cold-water coral reefs south-east of Iceland. The sun lived up to its name during the two ROV dives and in addition to the

wonderful weather, the ROV Kiel 6000 also brought fantastic samples and videos to the surface. The dives on the neighbouring coral reefs Lónsjúp and Papagrúnn were planned and then carried out via DFN conference directly on board the sun in cooperation with our Icelandic colleagues from the Institute for Marine Fisheries and Research (MFRI, Reykjavik) and the EU project iAtlantic.

Starting from the coral reefs, we did a long transit towards the second depth transect South of Iceland. This transect, we started in a hydrothermal active area in 700m on the Reykjanes Ridge. In the early Sunday morning we started "hunting for the hydrothermal vents" on the Reykjanes Ridge together with the colleagues on-line via DFN. As a result of the "IceAGE\_RR" expedition (MSM75 in 2018) we were able to start a "bubble hunt" with the multibeam and the "fish sonar" from Saturday 11<sup>th</sup> July 2020 to Sunday. Building on the precise maps of the ground topography, combined with the data from the nightly bubble hunt and the eH signals measured by GEOMAR AUV Abyss during MSM75, we started a promising ROV dive on Sunday morning. On 12<sup>th</sup> July 2020 at 11:40 am the sensation was perfect: we discovered the "IceAGE vent field". The "IceAGE vent field" is the second of its kind on the Reykjanes Ridge, which extends from Iceland from the Reykjanes Peninsula to the Charlie Gibbs Fracture Zone and at the same time forms the northern part of the Mid Atlantic Ridge (MAR). So far, South of Iceland only Steinahóll is known for hydrothermal activity.

On Monday and Tuesday we were able to do two more dives in our work area on the Reykjanes Ridge. Emerging bad weather conditions forced us to shorten the second dive considerably and to focus more on mapping trips "off axis". We also use the time before the next storm to drive a CTD Toyo over the hydrothermal field to be able to say more about the temperature jumps and drift direction of the warm water.

Just in time before the next storm hit the working area, we got all necessary samples and needed to go south escaping the bad weather conditions. However, it was not possible for us to completely avoid the weather. As a result, we had to skip our station work along the 3000 and 3500 m line and were only able to continue sampling on Thursday and Friday further South than originally planned at a depth of 3700 m.

After the Saturday transit, we were able to suspend the second of a total of three ARGO floats in working area 9 on the morning of Sunday. In the fourth week, we did reach the deep stations in the southern tip of the Iceland Basin, Western European Basin and in the fifth week we ended this transect with 4500m deep samples in the Porcupine Abyssal Plain. On Monday and Tuesday of the fifth week on board, we were able to sample a depth of 4500m in the Porcupine Abyssal Plain (PAP). After all benthic devices had been used for the last time in the PAP, all station work was ended on Wednesday evening with the third and last suspended ARGO float.

On July, 26<sup>th</sup> 2020, RV Sonne returned to Emden harbor in Germany.

## **Acknowledgements**

A special thanks go to captain Oliver Meyer and his crew for all the support during our expedition. The whole expedition would not have been possible without the full support of the German Science Foundation under grant no MerMet 17-06 and all institutions involved in the expedition planning. Special thanks go to the German Research Fleet Coordination Centre at the University of Hamburg and the shipping company Briese Research. The telepresence during the expedition was supported via the MARUM (Volker Ratmeyer) and GEOMAR (Tom Kwasnitschka).

**Teilnehmerliste**

<b>Name</b>	<b>Institution</b>
1 Brix, Saskia PhD (PI/chief scientist)	SaM
2 Abegg, Friedrich PhD (ROV pilot)	GEOMAR
3 Bodendorfer, Matthias (ROV pilot)	GEOMAR
4 Pieper, Martin (ROV pilot)	GEOMAR
5 Cuno, Patrick (ROV pilot)	GEOMAR
6 Huusmann, Hannes (ROV pilot)	GEOMAR
7 Matthiessen, Torge (ROV pilot)	GEOMAR
8 Suck, Inken (ROV pilot)	GEOMAR
9 Florian, Bischo (ROV pilot)	GEOMAR
10 Tewes, Simon (CTD)	BSH
11 Lörz, Anne-Nina PhD (Macrofauna)	CeNak
12 Stefanie Kaiser PhD (Macrofauna)	ULODZ
13 Nancy Mercado Salas PhD (Meiofauna)	CeNak
14 Le Saout, Morgane PhD (Bathymetry)	GEOMAR
15 Taylor, James PhD (Macrofauna)	SaM
16 Zankl, Solvin (Photography)	SaM
17 Stein, Tina (technician)	SaM
18 Jeskulke, Karen (technician)	SaM
19 Bruhn, Marco (technician)	SaM
20 Gatzemeier, Nicole (technician)	SaM
21 Wilsenack, Maik (technician)	SaM
22 Siegler, Viola (technician)	SaM
23 Kabus, Jana (Megafauna)	CAU
24 Paulus, Eva (Megafauna)	SaM
25 Hartmann, Vivien (Macrofauna)	SaM
26 Severin Korfhage (Meiofauna)	SaM
27 Eichsteller, Angelina (Megafauna)	SaM
28 Neuhaus, Jenny (Macrofauna)	SaM
29 Schumacher, Mia (Bathymetry)	GEOMAR
30 Kürzel, Karlotta (Macrofauna)	SaM
31 Gärtner, Lisa (Plankton)	UHANNOVER
32 Schleinkofer, Nico (Geology)	GUF
33 Lux, Thorsten (Bathymetry)	GEOMAR
34 Uhlir, Carolin (Macrofauna)	SaM

## Institutes

Through the high support from land and the telepresence, all institutions are listed who have been active in the realisation of the telepresence or having been involved actively in the ROV dive planning during the telepresence on board. On land support is marked in grey letters.

**SaM – Senckenberg am Meer**  
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26382 Wilhelmshaven / Germany

**GEOMAR - Helmholtz-Zentrum für  
Ozeanforschung Kiel**

**BSH - Bundesamts für Seeschifffahrt  
und -Hydrographie**

MARUM Zentrum für marine  
Umweltwissenschaften  
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28359 Bremen / Germany

**CeNak Centrum für Naturkunde/  
UHH Universität Hamburg**  
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**GUF Goethe University  
Frankfurt**  
Geozentrum / Campus Riedberg  
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**UHANNOVER University Hannover**  
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**CAU Christian Albrechts  
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Sciences  
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**MFRI Marine Research and  
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**NHM Náttúrufræðistofnun  
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of Natural History )**  
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IS-210 Garðabær / Ísland

**Uiceland**  
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and The Nature Center  
Institute of Earth Sciences  
Sturlugata 7  
101 Reykjavik / Iceland

**BAS British Antarctic Survey**  
High Cross,  
Madingley Road, Cambridge /England

**ULodz University of Lodz**  
Department of Polar Biology and  
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Banacha 12/19  
Lodz 90-237 / Poland

UA University of Alabama  
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**UDansk University of Gdańsk**  
Division of Geophysics  
Institute of Oceanography  
al. Marszałka Piłsudskiego 46  
81-378 Gdynia  
Poland

## Stationlist

cruise	station	gear	time_start	Lat	Long	depth	Valid
SO276	1	CTD	22:28	65° 01.254' N	000° 03.593' E	2770,16	
SO276	3	PLA	06:53	65° 01.244' N	000° 03.529' E		
SO276	4	ROV	10:36	65° 01.023' N	000° 01.821' E	2768	
SO276	5	EBS	19:08	65° 03.168' N	000° 01.744' E	2800,2	
SO276	6	BC	23:49	65° 02.718' N	000° 01.080' W	2801,7	
SO276	7	BC	02:22	65° 00.876' N	000° 02.513' E	2761,6	
SO276	8	BC	04:39	64° 58.904' N	000° 06.289' E	2747	
SO276	9	MUC	06:56	64° 58.171' N	000° 03.810' E	2739	
SO276	10	MUC	09:17	65° 00.137' N	000° 00.188' E	2766	
SO276	11	MUC	11:33	65° 02.074' N	000° 00.608' W	2800	
SO276	13	CTD	00:01	65° 42.676' N	002° 57.153' W	3343	
SO276	15	PLA	04:37	65° 44.349' N	002° 53.908' W	3380,2	
SO276	16	EBS	04:42	65° 43.552' N	002° 58.158' W	3363	
SO276	17	BC	09:21	65° 43.555' N	002° 58.155' W	3382	no
SO276	18	BC	11:45	65° 43.547' N	002° 58.155' W	3362	no
SO276	19	MUC	14:20	65° 44.208' N	002° 56.499' W	3377,3	
SO276	20	MUC	17:15	65° 42.369' N	003° 02.575' W	3287	
SO276	21	MUC	20:11	65° 43.176' N	002° 58.539' W	3319,3	
SO276	23	CTD	04:00	65° 55.471' N	003° 33.628' W	3692	
SO276	24	PLA	09:09	65° 55.475' N	003° 33.622' W	3690,2	
SO276	25	BC	08:13	65° 55.872' N	003° 32.558' W	3697	
SO276	26	EBS	10:49	65° 56.122' N	003° 31.727' W	3702	
SO276	29	CTD	08:08	66° 10.152' N	004° 21.613' W	3423	
SO276	30	EBS	11:29	66° 09.596' N	004° 20.937' W	3467	
SO276	31	BC	16:48	66° 09.597' N	004° 20.918' W	3462	
SO276	32	MUC	19:30	66° 09.593' N	004° 20.944' W	3466	
SO276	33	MUC	22:32	66° 08.618' N	004° 22.188' W	3474,5	no
SO276	34	CTD	02:10	66° 03.183' N	003° 59.896' W	3675	
SO276	35	PLA	06:40	66° 03.180' N	003° 59.910' W	3678,2	
SO276	36	MUC	05:23	66° 03.185' N	003° 59.915' W	3679	
SO276	37	ROV	10:12	66° 03.170' N	003° 59.914' W	3673,9	
SO276	38	PLA	22:02	66° 03.730' N	004° 01.964' W	3418,5	
SO276	39	EBS	21:29	66° 02.682' N	004° 00.570' W	3678	
SO276	41	CTD	16:01	65° 16.296' N	007° 56.559' W	1413	
SO276	43	CTD	02:50	64° 52.862' N	009° 37.831' W	716	
SO276	45	PLA	14:14	64° 45.077' N	009° 28.903' W	2311	
SO276	46	PLA	14:44	64° 45.077' N	009° 45.077' W	2309,6	
SO276	47	EBS	14:01	64° 48.515' N	009° 31.816' W	2289	
SO276	48	BC	17:45	64° 48.515' N	009° 31.806' W	2289	
SO276	49	BC	19:30	64° 48.497' N	009° 31.782' W	2288	
SO276	50	BC	21:19	64° 48.502' N	009° 31.783' W	2290	
SO276	51	MUC	22:57	64° 48.487' N	009° 31.778' W	2289	
SO276	52	MUC	00:57	64° 49.465' N	009° 32.870' W	2216	

SO276	53	MUC	02:48	64° 50.799' N	009° 36.221' W	2034	
SO276	54	ROV	06:53	64° 50.818' N	009° 36.219' W	2030,8	
SO276	55	EBS	17:35	64° 53.509' N	009° 38.047' W	681,1	
SO276	56	BC	19:24	64° 53.511' N	009° 38.049' W	680	
SO276	57	BC	20:11	64° 53.517' N	009° 38.045' W	680	no
SO276	58	BC	20:48	64° 53.517' N	009° 38.044' W	680,6	
SO276	59	MUC	21:26	64° 53.537' N	009° 38.017' W	679	
SO276	60	MUC	22:08	64° 53.513' N	009° 38.015' W	679	
SO276	61	EBS	23:05	64° 52.979' N	009° 39.289' W	686	
SO276	62	CTD	00:35	64° 53.019' N	009° 39.247' W	685	
SO276	64	ROV	07:22	64° 52.180' N	009° 37.471' W	1411	
SO276	66	ROV	10:00	64° 03.199' N	014° 15.597' W	241	
SO276	67	CTD	19:56	63° 51.240' N	013° 44.880' W	658	
SO276	68	PLA	22:42	63° 51.244' N	013° 44.877' W	654,7	
SO276	69	PLA	23:23	63° 51.241' N	013° 44.874' W	665,26	
SO276	71	CTD	05:43	64° 26.997' N	013° 37.497' W	414	
SO276	72	PLA	08:17	64° 26.004' N	011° 37.498' W	424	
SO276	73	EBS	07:10	64° 26.194' N	011° 37.738' W	415	
SO276	74	BC	08:28	64° 26.189' N	011° 37.458' W	415	
SO276	75	MUC	09:07	64° 26.192' N	011° 37.448' W	417	
SO276	77	CTD	10:37	64° 32.966' W	011° 35.371' W	439	
SO276	78	PLA	13:18	64° 32.071' N	011° 35.386' W	438,4	no
SO276	79	EBS	11:55	64° 33.101' N	011° 35.497' W	433	
SO276	80	BC	13:05	64° 33.098' N	011° 35.494' W	435	
SO276	81	MUC	13:35	64° 33.098' N	011° 35.489' W	444	
SO276	83	CTD	15:13	64° 27.330' N	011° 23.233' W	411	
SO276	84	PLA	17:49	64° 27.334' N	011° 23.278' W	410,9	
SO276	85	EBS	16:30	64° 27.508' N	011° 23.274' W	413	
SO276	86	BC	17:38	64° 27.516' N	011° 23.277' W	412	no
SO276	87	MUC	18:09	64° 27.514' N	011° 23.276' W	265	no
SO276	89	PLA	22:00	64° 20.077' N	011° 27.146' W	387,5	
SO276	90	EBS	20:40	64° 20.262' N	011° 27.170' W	385	no
SO276	92	ROV	07:38	63° 51.249' N	013° 44.932' W	666,6	
SO276	94	HG	04:51	63° 51.883' N	013° 46.523' W	380	
SO276	95	HG	05:40	63° 51.973' N	013° 46.464' W	374	
SO276	96	HG	06:20	63° 52.144' N	013° 46.266' W	365	
SO276	97	ROV	09:14	63° 52.957' N	013° 58.659' W	300	
SO276	99	CTD	13:38	60° 32.316' N	026° 02.649' W	2175	
SO276	103	ROV	08:20	60° 14.082' N	029° 08.485' W	659	
SO276	106	ROV	06:36	60° 13.925' N	029° 08.927' W	660	
SO276	108	CTD	06:57	60° 14.031' N	029° 08.456' W	665	
SO276	109	PLA	09:53	60° 14.024' N	029° 08.499' W	659	
SO276	110	PLA	10:30	60° 10.030' N	029° 08.499' W	658	
SO276	111	PLA	12:14	60° 14.027' N	029° 08.426' W	645	
SO276	111	PLA	12:14	60° 14.027' N	029° 08.426' W	645	
SO276	112	ROV	15:01	60° 14.027' N	029° 08.585' W	656	



SO276	114	CTD	07:31	53° 28.668' N	026° 34.918' W	3663	
SO276	116	ROV	15:15	53° 48.422' N	026° 55.758' W	3667	
SO276	117	EBS	21:43	53° 29.235' N	026° 33.666' W	3704	
SO276	118	BC	02:35	53° 29.244' N	026° 33.669' W	3664	
SO276	119	BC	05:05	53° 29.234' N	026° 33.682' W	3665	
SO276	120	BC	07:45	53° 29.264' N	026° 33.739' W	3666	
SO276	121	MUC	10:14	53° 29.256' N	026° 33.741' W	3668	
SO276	122	MUC	13:17	53° 28.095' N	026° 30.233' W	3662	
SO276	123	MUC	15:58	53° 26.964' N	026° 26.783' W	3654	
SO276	124	EBS	18:27	53° 27.098' N	026° 27.619' W	3656	
SO276	125	CTD	03:49	52° 21.910' N	017° 06.281' W	3945	
SO276	126	PLA	06:14	52° 21.913' N	017° 06.275' W	3941	
SO276	127	PLA	06:57	52° 21.911' N	017° 06.272' W	3942	
SO276	129	CTD	21:12	49° 50.234' N	015° 13.876' W	4569	
SO276	131	PLA	04:58	49° 47.921' N	015° 18.434' W	4600	
SO276	132	PLA	05:33	49° 47.926' N	015° 18.436' W	4601	
SO276	133	ROV	09:12	49° 48.031' N	015° 13.004' W	4621,1	
SO276	134	EBS	19:17	49° 48.451' N	015° 13.856' W	4573	
SO276	135	EBS	00:47	49° 48.355' N	015° 14.521' W	4577	
SO276	136	MUC	06:45	49° 48.348' N	015° 14.538' W	4577	
SO276	137	MUC	09:55	49° 47.827' N	015° 14.553' W	4576	
SO276	138	BC	12:55	49° 47.352' N	015° 14.553' W	4570	
SO276	139	BC	15:45	49° 47.246' N	015° 14.550' W	4568	
SO276	140	CTD	16:48	45° 58.576' N	009° 56.429' W	4677	