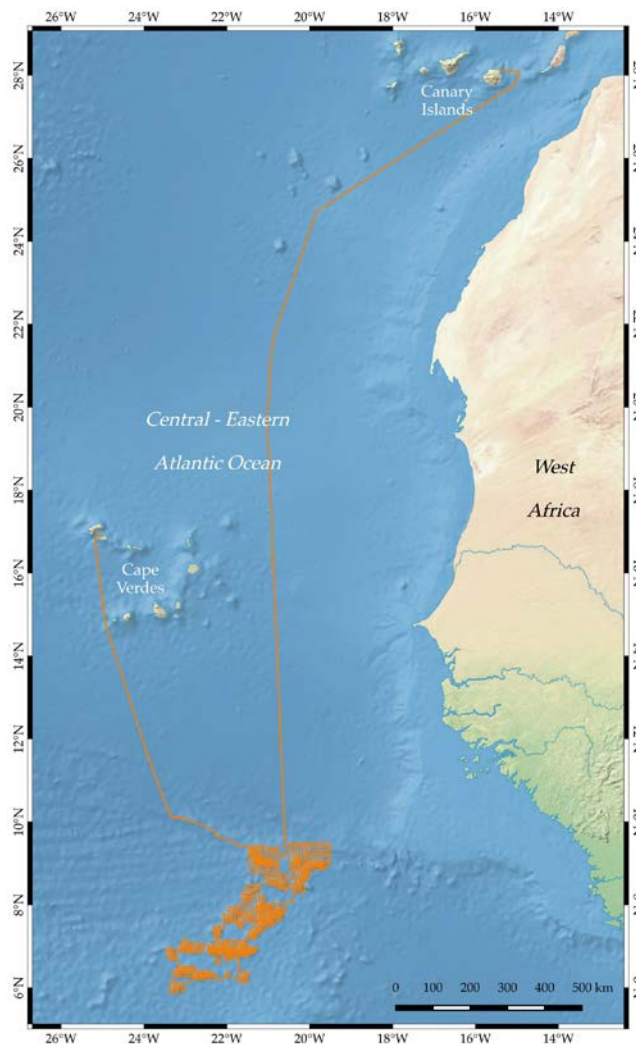


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Short Cruise Report R/V Maria S. Merian Cruise MSM70

Mindelo – Las Palmas de Gran Canaria
25th December 2017 – 1st February 2018
Chief Scientist: Froukje M. van der Zwan
Captain: Ralf Schmidt



Objectives

Main goal of the BATHYCHEM project was to gain more in-depth insights into the origins and ages of the 900 km long, intraplate volcanic province of the Bathymetrists Seamounts Chain, including the Grimaldi Seamounts and their corresponding fault zones to the North: the Cape Verde Ridge and Kane Gap.

Intraplate volcanism, in contrast to mid-ocean-ridge (MOR) oceanic crustal basalts, is formed by low degrees of mantle melting under thick lithosphere and thus has a unique and distinct major element, trace element and isotopic composition. Magmatism associated with the emplacement of this seamount province did not only directly alter the composition of the underlying lithosphere, but the magmatism may have triggered local structural changes and fluid flow causing large-scale hydrothermal activity, which would have modified the original composition of the lithosphere additionally. The formation of the Bathymetrists Seamounts may have affected the Atlantic oceanic crust ranging from 30 to >100 Ma in age (Müller et al., 2008), which was thus exposed to variable degrees of seafloor alteration during the evolution of the seafloor. With information on the structure, age and composition of the Bathymetrists Seamounts and adjacent areas, we aim to understand their origin and formation mechanism, which will allow a better constrains on how intraplate volcanism modifies the structure, morphology and composition of the oceanic lithosphere through time. Addressing this is important for our understanding of how ocean basins evolve and alter, and for determining the global composition of the oceanic lithosphere (mass budget).

The seafloor between the Sierra Leone Basin and the Gambia Basin is dominated by the Sierra Leone Rise and the SW-NE striking Bathymetrists Seamounts (Figs. 1-2). Vertical gravity gradient data (Sandwell et al., 2014) show that the northern parts of the Bathymetrists and Grimaldi Seamounts formed along several E-W striking lineaments, south of the Cape Verde Ridge and Kane Gap. The junction between Cape Verde Ridge, Bathymetrists Seamounts and Kane Gap has been formed by at least three neotectonic movements between the Oligocene and Holocene together with the formation of the Cape Verde Ridge, second order ridges and some upwelling in the Cape Verde Basin (Skolotnev et al., 2009). Apart from its complicated tectonic setting, little is known about the origin, age and nature of the Bathymetrists Seamounts and their mantle source. Few volcanic samples from the northern seamounts, have been chemically and mineralogically analyzed and dated (Kharin, 1988; Petrova et al., 2010; Skolotnev et al., 2012; Peyve and Skolotnev, 2009; Peyve, 2011) and only rare samples from the southern Bathymetrists Seamounts have been analysed (Kharin, 1988; Skolotnev et al., 2017). There are very few geochronological age determinations from this region, ranging from 36-59 Ma, but determined from partially altered rocks and without clear systematics (Kharin, 1988; Jones et al., 1991; Skolotnev et al., 2010). In contrast, transit data from Meteor expedition M116 (Visbeck, 2015) over the Bathymetrists Seamounts revealed indications of potentially younger volcanism and tectonic activity.

Two hypotheses have been proposed for the origin and formation of the Bathymetrists and Grimaldi Seamounts: (a) the rising of a deep mantle plume, possibly by bending or a detached offshoot of the Sierra Leone plume (Schilling et al., 1994; Peyve and Skolotnev, 2009), where the spatial positioning of the two seamount chains was determined by local plate tectonics (e.g., Peyve, 2011; Skolotnev et al., 2017), or (b) decompression melting of asthenosphere mafic rocks due to extension along the Cape Verde Ridge and Kane Gap transform faults (Jones et al., 1991; Skolotnev et al., 2012), each having their own effect on the oceanic lithosphere.

To study the Bathymetrists Seamounts we planned an extensive mapping program to generate high-resolution bathymetric maps and a dredge program to sample these seafloor structures. Bathymetric maps will help to understand the tectonic interplay at the junction of the Cape Verde Ridge FZ, Kane Gap FZ with the northern part of the Bathymetrists Seamounts and the Grimaldi Seamounts and to answer questions regarding seafloor characteristics and possibly identify areas with younger (Holocene) volcanism. Morphological and tectonic studies on bathymetric data will improve the knowledge of emplacement of intraplate volcanoes and their effects on the surrounding plate, especially in this complicated tectonic environment. Furthermore, the role of local transform faults intersecting the seamount province will be studied.

This will be followed by petrology, mineralogy, major and trace element and isotope (Sr-Nd-Pb-Hf-O) geochemistry together with $^{40}\text{Ar}/^{39}\text{Ar}$ dating of preserved multi-phase K-rich minerals (to avoid alteration) aiming at deciphering the age and origin of this sparsely studied volcanic province, and to distinguish between the different formation hypothesis for the Bathymetrists and Grimaldi Seamounts, i.e. if they were formed from a deep plume source or shallower asthenosphere melting. With that we can study how is large-scale intraplate volcanism affects the geochemical budget of oceanic lithosphere of different ages.

Narrative

On the 24th of December three of the thirteen scientific participants boarded MARIA S. MERIAN for the MSM70 cruise in the harbour of Mindelo, Cape Verdes. The other participants were planned to join as well, but were stranded in Lisbon due to cancelled flights due to a sandstorm above the Cape Verdes. An extra flight on the 26th of December finally brought the remaining participants, together with a large part of the crew to Sao Vicente and we could leave port with only a small delay compared to the scheduled program at 20:00 the same day, sailing southwards in the direction of the Bathymetrists Seamounts.

The next morning, when we left the EEZ of the Cape Verdes, we started recording hydro-acoustic data during our transit to collect data in the framework of the EU-Project AtlantOS. The petrologists prepared the laboratories and the dredge equipment until we arrived in our first working area in the morning of the 27th of December, where we started our scientific work with an XSV profile to obtain the sound velocity of the water column for the bathymetric measurements. This was followed on this and the next day by hydro-acoustic mapping of the Cape Verde Ridge. The mapping was interrupted for four dredge hauls along the Ridge, that we could plan on the almost instantly available bathymetric models of the mapped area and from which one returned ~100 Ma old basalts.

The work on the Bathymetrists Seamounts themselves started midday of the 29th with the northwestern-most *Annan Seamount*. This seamount was mapped with the multibeam system together with the first (of many) unnamed seamount in the area. These unnamed seamounts we labeled throughout the expedition with working names BSM (Bathymetrists SeaMount) and succeeding Roman Nr. (e.g. BSM I). After the mapping three dredge positions were selected based on the bathymetric model of the seamount. These dredge hauls were performed the next day and brought back volcanoclastic and phosphorite-crust samples. Sampling of *Annan Seamount* was directly followed on the 30th and 31th by the mapping and sampling of the west part of *Carter Seamount*, where manganese crusts were recovered. On the last day of 2017 and the first day of 2018 we had a longer mapping program, finishing the seafloor mapping of *Carter Seamount* and the first of the Grimaldi Seamounts: *Hirondelle Seamount*, located in the northeastern part of our area. After three dredge hauls the next day at *Hirondelle Seamount*, bringing up volcanoclastic material, we mapped and sampled on the 3rd of January the Kane Gap (including BSM II), which borders the Bathymetrists Seamounts to the North. Here we recovered a full dredge with manganese nodules. The 4th till the 6th of January we finalized the work at the northeast corner by hydro acoustic mapping and six dredge hauls at the remaining Grimaldi Seamounts: *Prince Albert*, BSM III and *Princesse Alice*, and their neighbour *Whitney Seamount*. We recovered basalts and volcanoclastics, all strongly coated by manganese crusts.

During a short transit on the 7th of January to the central Bathymetrists Seamounts, we crossed a deeper transform fault indicated from gravity data. Therefore we recorded here in addition to multibeam data, a parasound profile. In the evening we reached the Central Seamounts, where we started with studying the two middle seamounts *Murchison* and *Cindy Seamounts*. Also here, the seamounts were mapped followed by four dredge tracks. While we could recover some relatively fresh basalts from *Murchison Seamount*, *Cindy Seamount* was more challenging to obtain samples from and only Mn-crusts could be recovered. As *Cindy Seamount* represents also the most central part of our working area, we performed here a sound-velocity profile up to 3,700 m depth, to obtain the sound-velocity over the full water column, required for accurate multibeam modeling. On the 8th in the evening we continued with the eastern group of the central seamounts, consisting of *Reedjones*, BSM IV and V, *Snodgrass* and *Rebmann Seamounts*. In four days we mapped these Seamounts and performed nine dredge-tows, which successfully recovered basalts, volcanoclastics and Mn-crusts.

In the morning of 12th of January we began our work in the southern study area of the Bathymetrists seamounts. This area consists of one very large composite-Seamount: *Webb & Gilg Seamount* and multiple smaller solitaire seamounts. Due to the large size of *Webb & Gilg Seamount* (~140x50 km) it took us three days to map and sample the central and eastern part of the seamount. Six dredge hauls recovered volcanoclastic breccias and carbonates. For planning purposes, we afterwards first continued south to the solitaire seamounts BSM VIII, *Arroyo Seamount*, BSM X, BSM XI, BSM XII and BSM XIII-XV. On the 15th till the 20th of January we mapped and sampled these seamounts, which took a day for each of those. At both BSM VIII and

Arroyo Seamount we dredged three times; from BSM VIII we collected basalt and volcanoclastics, from *Arroyo Seamount* we recovered in addition also carbonates. One dredge haul at BSM X returned volcanoclastics, while we found basalt at BSM XI. BSM XII was dredged two times returning basalt and volcanoclastic material. At the seamount group BSM XIII-XV we performed one dredged and collected volcanoclastics. The southern group was finished in the morning of the 21st of January with the mapping of the western end of *Webb & Gilg Seamount*. After finishing the southern seamounts, we worked our way back northwards along the western side of the central Bathymetrists Seamounts. *Marchant Seamount* was mapped and basalts and volcanoclastics were sampled by two dredge hauls in the afternoon and night of the 21st of January. *Carron Seamount* we mapped on the 22nd followed by four dredge hauls. Nevertheless, we could only recover Mn-crusts, similar as at Cindy seamounts, which is just North of it. *Sorensen Seamount* and BSM XVI were mapped on the 23rd and *Flanagan Seamount* and BSM XVII the day after. At both Sorensen and BSM XVI seamounts dredging recovered volcanoclastics, while basalts were collected at *Flanagan Seamount*. The 25th of January we worked on the last unmapped Bathymetrists Seamount group – *McGowan Seamount* and BSM XVIII. After mapping we performed three dredge hauls, recovering volcanoclastics, basalts and Mn-crusts. To obtain a good sampling coverage, we finished the dredge program on the 26th of January with three more dredges at *Carter* and *Annan Seamounts*, were recovery of volcanic samples in the beginning of the cruise was poor. This time we could recover volcanoclastics, basalts and carbonates with the last successful dredges. We finished our overall working program on the 27th of January with mapping of the Kane Gap transform fault north of the Bathymetrists Seamounts. At 16:00 left the working area and started the four days transit towards the port of Las Palmas de Gran Canaria.

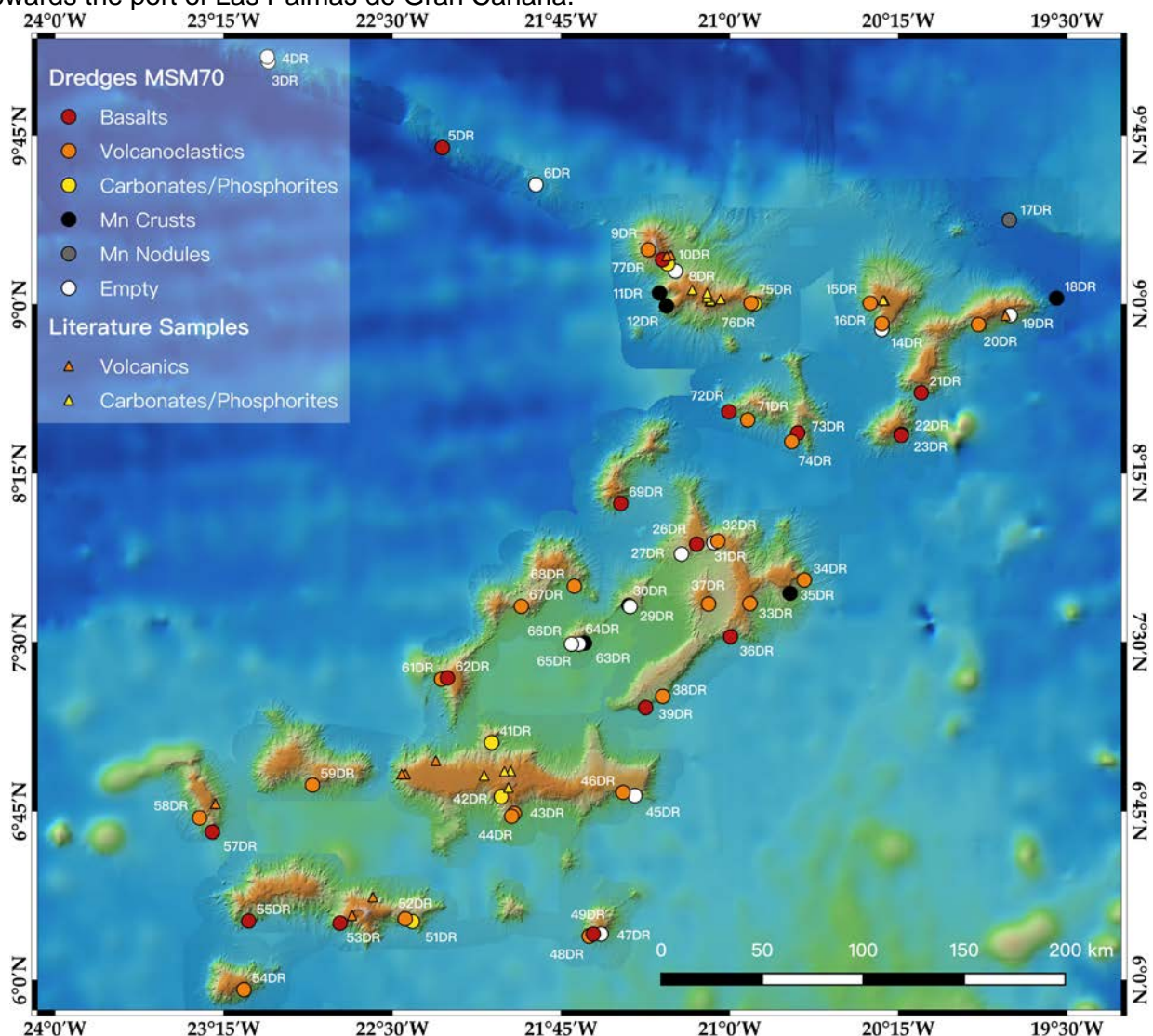


Figure 1 – Map of the Bathymetrists and Grimaldi Seamounts with the 65 dredge stations and the main lithologies that were dredged.

Acknowledgements

We like to thank Captain Ralf Schmidt and the professional crew of the Maria S. Merian for their enthusiastic support during the MSM70 expedition that enabled us to successfully complete our working program in a good atmosphere on board.

The ship time of R/V Maria S. Merian was provided by the Deutsche Forschungsgemeinschaft DFG. We gratefully acknowledge the support.

Teilnehmerliste

Name	Task	Institute
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4. Richard Jason Antonio	Alteration/Petrology	GeoB
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10. Dr. Morgane Le Saut	Bathymetry	GEOMAR
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Stationlist

Total: 78 stations

Station abbreviations: DR = Chainbag dredge (Kettensack Dredge); MB = Multibeam survey; XSV = Expandable Sound Velocimeter; PS = Parasound; SVP = Sound Velocity Profiler

Station	Station Area	Gear	Latitude (°N)/ Longitude (°W)	Date/ Time (UTC) Start/End	Depth (m)	Comments
MSM70_1	Cape Verde Ridge	XSV	10°12.35'/023°22.96' To 10°11.49'/023°22.96'	28.12.2017 07:25 07:32	4827	Sound velocity profile till 2000 m depth
MSM70_2		MB		28.12.2017 08:05 29.12.2017 14:23		Multibeam survey of a single profile along the Cape Verde Ridge in eastern direction
MSM70_3	Guinea Fracture Zone	DR	10°04.44'/23°03.19' To 10°04.73'/23°02.92'	28.12.2017 11:33 14:45	4442- 4333	Empty (sediments in traps)
MSM70_4	Guinea Fracture Zone	DR	10°05.78'/23°03.51' To 10°06.05'/23°03.18'	28.12.2017 15:11 18:24	4348- 4215	Empty (sediments in traps)
MSM70_5	Guines Fracture Zone	DR	09°41.60'/022°16.74' To 09°41.94'/022°16.58'	29.12.2017 01:17 04:29	3880- 3546	17 samples taken fine and coarse grained Basalt; volcanic Breccia and biogenic sedimentary rock
MSM70_6	Guinea Fracture Zone	DR	09°31.68'/021°51.79' To 09°32.03'/021°51.55'	29.12.2017 08:34 11:40	3942- 3653	Empty (sediments in traps)
MSM70_7		MB		29.12.2017 14:37 01.01.2018 04:39		Multibeam survey of Seamounts Annan, Carter, Lombardi
MSM70_8	Annan Seamount; Carter Seamount	DR	09°08.79'/021°14.60' To 09°08.94'/021°14.35'	30.12.2017 13:07 15:28	2745- 2468	Empty (sediments in traps)
MSM70_9	Annan Seamount	DR	09°14.53'/021°21.73' To 09°14.54'/021°21.71'	30.12.2017 16:28 18:31	1221- 1205	6 samples taken Breccia, Mn crust, one piece of aphyric basalt
MSM70_10	Annan Seamount	DR	09°10.61'/021°16.67' To 09°10.90'/021°16.44'	30.12.2017 19:35 22:09	2619- 2297	7 samples taken + reserve Breccia, Mn crust, sedimentary rock, 1 piece of basalt
MSM70_11	Carter Seamount; Western Branch	DR	09°02.84'/021°18.83' To 09°03.22'/021°18.61'	31.12.2017 07:20 10:25	3379- 2963	4 samples taken Breccia, Phosphorites
MSM70_12	Carter Seamount; Southwestern Branch	DR	08°59.38'/021°16.93' To 08°59.76'/021°16.80'	31.12.2017 11:16 14:14	2751- 2449	6 samples taken Mn crust with light-coloured soft sediments (mudstones)
MSM70_13		MB		01.01.2018 11:26 06.01.2018 07:51		Multibeam survey of Grimaldi Seamounts (Hirondelle, Prince Albert, Princesse Alice), Whitney Seamounts and E of Kane Gap
MSM70_14	Hirondelle Seamount	DR	08°53.13'/020°19.45' To 08°53.53'/020°19.38'	02.01.2018 00:38 03:30	3389- 2999	Empty (sediment in traps)
MSM70_15	Hirondelle Seamount	DR	09°00.10'/020°22.54' To 09°00.49'/020°22.45'	02.01.2018 04:15 06:38	2508 2098	9 samples taken Large manganese crusts, amygdaloidal basalt, breccia, limestone
MSM70_16	Hirondelle Seamount	DR	08°54.68'/020°19.39' To 08°55.07'/020°19.37'	02.01.2018 07:34 10:09	2930 2592	5 samples taken Breccia
MSM70_17	Guinea Fracture Zone	DR	09°22.16'/019°45.55' To 09°22.77'/019°45.19'	03.01.2018 12:32 16:24	4464- 4329	6 samples taken Mn crust and Manganese nodules
MSM70_18	Single cone east of Prince Albert	DR	09°01.43'/019°32.83' To 09°01.85'/019°32.75'	04.01.2018 11:38 15:11	4432- 4023	5 samples taken + reserve Manganese crust, breccia
MSM70_19	Prince Albert Seamount	DR	08°56.88'/019°45.19' To 08°57.29'/019°45.08'	04.01.2018 16:42 19:21	2560- 2125	Empty (sediment in traps)
MSM70_20	Prince Albert Seamount	DR	08°54.43'/019°53.65' To 08°54.82'/019°53.55'	04.01.2018 21:57 05.01.2018 00:20	2474- 2078	16 samples taken + reserve Volcanoclastic breccia, encrusted sedimentary rock

MSM70_21	Princess Alice Seamount	DR	08°36.48'/020°08.90' To 08°36.92'/020°08.85'	05.01.2018 19:22 23:23	3401-3409	6 samples taken Phyric basalt, breccia, Mn crust Dredge stuck at 08°36.91'/020°08.85' ; vessel moved backwards; Dredging aborted
MSM70_22	Whitney Seamount	DR	08°25.17'/020°14.21' To 08°25.58'/020°14.13'	06.01.2018 10:18 12:59	2804-2364	Empty (sediment in traps)
MSM70_23	Whitney Seamount	DR	08°25.17'/020°14.21' To 08°25.58'/020°14.22'	06.01.2018 13:17 16:27	2775-2844	6 samples taken Phyric basalt, breccia, Mn crust, coral Dredge stuck at 08°25.11'/020°14.22' ; vessel moved backwards; Dredging aborted
MSM70_24		PS	08°17.36'/020°24.32' To 08°03.44'/020°24.48'	06.01.2018 19:07 20:55		Parasound profile from Whitney Seamount southwards
MSM70_25		MB		07.01.2018 00:11 12.01.2018 06:58		Multibeam survey of the central area of the Bathymetrists Seamounts including Murchinson, Snodgrass, Reedjones, Rebmann and Cindy Seamounts
MSM70_26	Murchison Seamount	DR	07°55.91'/021°08.80' To 07°56.33'/021°08.80'	07.01.2018 14:45 17:01	2029-1688	6 samples taken Phyric basalt, sedimentary rock
MSM70_27	Murchison Seamount	DR	07°53.32'/021°12.86' To 07°53.64'/021°12.86'	07.01.2018 17:48 20:00	2749-2555	Empty (sediment in traps)
MSM70_28		SVP		08.01.2018 10:34 12:18		Sound velocity profile till 3700 m depth
MSM70_29	Cindy Seamount	DR	07°39.64'/021°26.96' To 07°40.02'/021°26.88'	08.01.2018 14:15 16:03	3041-2623	2 samples taken + reserve Mn crust
MSM70_30	Cindy Seamount	DR	07°39.28'/021°26.60' To 07°39.70'/021°26.52'	08.01.2018 16:44 19:31	3095-2684	Empty (sediment in traps)
MSM70_31	Murchison Seamount	DR	07°56.35'/021°04.25' To 07°56.69'/021°04.19'	09.01.2018 05:31 07:26	1890-1689	Empty (sediment in traps)
MSM70_32	Murchison Seamount	DR	07°56.74'/021°03.18' To 07°57.15'/021°03.11'	09.01.2018 07:44 09:45	1808-1577	7 samples taken Aphyric basalt, breccia, Mn crust with breccia
MSM70_33	BSM VI	DR	07°40.14'/020°54.51' To 07°40.44'/020°54.64'	09.01.2018 21:35 10.01.2018 00:02	1997-1640	9 samples taken Phosphorites, Mn-crust
MSM70_34	Snodgrass Seamount	DR	07°46.36'/020°40.07' To 07°46.80'/020°40.11'	10.01.2018 08:28 11:26	3083-2630	3 samples taken Mn encrusted breccia, breccia
MSM70_35	Snodgrass Seamount	DR	07°42.83'/020°43.86' To 07°43.27'/020°43.89'	10.01.2018 12:22 15:04	2704-2317	2 samples taken Mn crust
MSM70_36	BSM VI	DR	07°31.28'/020°59.73' To 07°31.72'/020°59.77'	11.01.2018 02:11 05:14	3211-2682	5 samples taken + reserve Aphyric basalt, breccia, Mn crust
MSM70_37	Reedjones Seamount	DR	07°40.01'/021°05.60' To 07°40.37'/021°05.63'	11.01.2018 07:01 09:14	2152-1849	2 samples taken + reserve Basalt, breccia
MSM70_38	Rebmann Seamount	DR	07°15.38'/021°17.84' To 07°15.79'/021°17.88'	11.01.2018 14:37 17:26	3401-2957	7 samples taken Phyric basalt, breccia
MSM70_39	Rebmann Seamount	DR	07°12.53'/021°22.43' To 07°12.91'/021°22.46'	11.01.2018 18:23 21:37	3556-3444	1 sample taken Phyric basalt Dredge stuck at 07°12.63'/021°22.43'; vessel moved backwards; Dredging aborted
MSM70_40		MB		12.01.2018 07:02 14.01.2018 01:01		Multibeam survey of the central and eastern part of the largest volcanic structure: Webb & Gilg Seamount and BSM VII and VIII (Schönberg)
MSM70_41	Northern Part of Gilg Seamount	DR	07°03.09'/022°03.55' To 07°03.44'/022°03.51'	12.01.2018 17:59 20:06	2168-1762	6 samples taken Sedimentary rock, Mn crust

MSM70_42	Gilg Seamount	DR	06°48.69'/022°01.00' To 06°48.99'/022°00.89'	12.01.2018 22:28 13.01.2018 00:31	2162- 1856	5 samples taken Carbonate rich sedimentary rocks
MSM70_43	Gilg Seamount	DR	06°44.19'/021°57.47' To 06°44.60'/021°57.47'	13.01.2018 09:53 12:34	2986- 2575	2 samples taken Volcanoclastic breccia
MSM70_44	Gilg Seamount	DR	06°43.45'/021°58.15' To 06°43.86'/021°58.16'	13.01.2018 13:02 15:38	3033- 2495	6 samples taken + reserve Aphyric basalt, Volcanoclastic breccia, sedimentary rock, Mn crust
MSM70_45	Webb Seamount	DR	06°49.05'/021°25.27' To 06°49.26'/021°25.31'	14.01.2018 11:51 15:43	3073- 2927	Empty (sediment in traps)
MSM70_46	Between Webb Seamount and Gilg Seamount	DR	06°49.81'/021°28.42' To 06°50.22'/021°28.49'	14.01.2018 16:13 18:56	2969- 2617	13 samples taken Phyric and aphyric basalt, volcanoclastic breccia, sedimentary rock, Mn crust, coral
MSM70_47	BSM VII	DR	06°12.07'/021°34.28' To 06°12.48'/021°34.31'	15.01.2018 15:08 17:47	2928- 2531	Empty (sediment in traps)
MSM70_48	BSM VII	DR	06°11.51'/021°37.49' To 06°11.92'/021°37.49'	15.01.2018 18:17 21:01	3301- 2874	8 samples taken Amygdaloidal basalt, encrusted breccia, sedimentary rock
MSM70_49	BSM VII	DR	06°12.08'/021°36.40' To 06°12.50'/021°36.40'	15.01.2018 21:32 16.01.2018 00:14	2960- 2594	6 samples taken Amygdaloidal basalt, Mn crust
MSM70_50		MB		16.01.2018 00:23 17.01.2018 06:01		Multibeam survey of SW Bathymetrists Seamounts: Arroyo Seamount, BSM IX, BSM X (Behm), BSM XI (Zwan)
MSM70_51	Arroyo Seamount eastern edge	DR	06°15.43'/022°24.64' To 06°15.84'/022°24.65'	16.01.2018 13:56 16:46	3162- 2758	1 sample taken Sedimentary rock; sediment traps also sampled
MSM70_52	Arroyo Seamount eastern edge	DR	06°16.27'/022°26.56' To 06°16.68'/022°26.56'	16.01.2018 17:18 20:21	3087- 2985	2 samples taken Encrusted volcanoclastic breccia, Mn crust Dredge stuck at 06°16.48'/022°26.56', vessel moved backwards; dredging aborted
MSM70_53	Arroyo Seamount	DR	06°15.15'/022°43.93' To 06°15.56'/022°43.93'	17.01.2018 06:23 09:29	2851- 2785	4 samples taken Aphyric basalt, Mn crust Dredge stuck at 06°15.56'/022°43.93', vessel moved backwards; dredging aborted
MSM70_54	BSM X	DR	05°57.29'/023°09.66' To 05°57.68'/023°09.52'	17.01.2018 18:49 21:15	2632- 2204	6 samples taken Aphyric Basalt, Mn crust, volcanoclastic breccia, corals
MSM70_55	BSM XI	DR	06°15.97'/023°08.41' To 06°15.46'/023°08.28'	18.01.2018 08:22 11:15	3248- 2750	8 samples taken + reserve Aphyric Basalts, Mn-crust, altered basalt rims
MSM70_56		MB		19.01.2018 03:00 21.01.2018 08:22		Multibeam survey of SW Bathymetrists Seamounts: BSM XII (Cigogne), BSM XIII-XV (Maria S. Merian) and western Webb & Gilg Seamount
MSM70_57	BSM XII	DR	06°39.29'/023°18.12' To 06°39.71'/023°17.96'	19.01.2018 03:10 06:21	3200- 2717	39 samples taken + reserve Aphyric Basalt, Mn-crust, Manganese boulder
MSM70_58	BSM XII	DR	06°43.03'/023°21.49' To 06°43.46'/023°21.34'	19.01.2018 07:28 10:29	3145- 2742	5 samples taken Mn-crust, volcanoclastic Breccia
MSM70_59	BSM XII	DR	06°51.76'/022°51.32' To 06°52.20'/022°51.25'	19.01.2018 21:17 23:54	2749- 2353	3 samples taken Phyric Basalt, altered Scoria, Mn-crust
MSM70_60		MB		21.01.2018 08:24 24.01.2018 15:02		Multibeam survey of western central Bathymetrists Seamounts: Marchant, BSM XVI, Carron, Sorensen, BSM XVII and Flanagan Seamount
MSM70_61	Marchant Seamount	DR	07°19.94'/022°16.91' To 07°20.37'/022°16.91'	21.01.2018 16:38 19:24	2974- 2472	5 samples taken Phyric Basalt, encrusted Breccia, volcanoclastic Breccia

MSM70_62	Marchant Seamount	DR	07°20.42'/022°15.31' To 07°20.85'/022°15.26'	21.01.2018 19:58 22:46	2297- 2177	11 samples taken + reserve Phyric Basalt, volcanoclastic Breccia, coral, sedimentary rock Dredge stuck at 2293m, 07°20.52'/022°20.52', vessel moved backwards
MSM70_63	Carron Seamount	DR	07°29.58'/021°38.77' To 07°30.00'/021°38.67'	22.01.2018 11:23 14:36	2962- 2962	1 sample taken Mn crust Dredge stuck at 3069 m, 07°30.00'/021°38.69', vessel moved backwards to start point
MSM70_64	Carron Seamount	DR	07°29.58'/021°38.77' To 07°30.00'/021°38.69'	22.01.2018 14:54 18:15	2985- 2568	1 sample taken Mn crust Dredge stuck at 2902 m, 07°30.00'/021°38.69', vessel moved backwards
MSM70_65	Carron Seamount	DR	07°29.65'/021°40.20' To 07°30.08'/021°40.20'	22.01.2018 18:39 21:56	2475- 2688	Empty Dredge stuck at 2641m, 07°29.36'/021°40.20', vessel moved backwards
MSM70_66	Carron Seamount	DR	07°29.31'/021°42.24' To 07°29.70'/021°42.17'	22.01.2018 22:34 23.01.2018 00:46	2741- 2489	Empty
MSM70_67	BSM XVI	DR	07°39.38'/021°55.61' To 07°39.78'/021°55.58'	23.01.2018 02:21 04:55	2502- 2164	10 samples taken Phyric Basalt, Breccia, Mn crust, Phosphorites
MSM70_68	Sorensen Seamount	DR	07°44.72'/021°41.44' To 07°45.15'/021°41.44'	23.01.2018 15:10 17:51	3144- 2667	10 samples taken + reserve Breccia, Mn crust
MSM79_69	BSM XVII	DR	08°06.91'/021°29.06' To 08°07.01'/021°29.05'	24.01.2018 00:24 03:37	3185- 3105	6 samples taken + reserve Vesicular, aphyric, Basalt, volcanoclastic Breccia
MSM70_70		MB		24.01.2018 15:06 26.01.2018 03:03		Multibeam survey of BSM XVIII, BSM XIX and McGowan Seamount
MSM70_71	BSM XVIII	DR	08°29.03'/020°55.16' To 08°29.39'/020°55.22'	24.01.2018 21:00 25.01.2018 00:00	3583- 3222	3 samples taken Volcanoclastic Breccia, Mn crust
MSM70_72	BSM XVIII	DR	08°31.19'/021°00.25' To 08°31.60'/021°00.20'	25.01.2018 00:48 03:54	3640- 3196	1 sample taken Vesicular volcanic rock
MSM70_73	McGowan Seamount	DR	08°25.55'/020°41.81' To 08°25.96'/020°41.88'	25.01.2018 06:52 09:51	2742- 2504	8 samples taken + reserve Dense Basalt, Phosphorites, Mn crust, biogenic material Dredge stuck at 2396m, 08°25.96'/020°41.88', vessel moved backwards
MSM70_74	Mc Gowen Seamount	DR	08°23.22'/020°43.41' To 08°23.64'/020°43.49'	25.01.2018 10:29 13:17	3372- 2954	1 samples taken Volcanoclastic Breccia
MSM70_75	Carter Seamount	DR	08°59.95'/020°53.36' To 09°00.36'/020°53.40'	26.01.2018 03:08 05:41	2668- 2271	4 samples taken Volcanoclastic Breccia, Phosphorites
MSM70_76	Carter Seamount	DR	09°00.11'/020°54.28' To 09°00.53'/020°54.28'	26.01.2018 06:02 08:32	2307- 2185	20 samples taken Basalt, volcanoclastic Breccia
MSM70_77	Annan Seamount	DR	09°11.69'/021°17.88' To 09°12.10'/021°17.95'	26.01.2018 11:00 13:47	1897- 1468	8 samples taken Dense Basalt, vesicular Basalt, encrusted Breccia, Mn crust
MSM70_78		MB		26.01.2017 14:09 27.01.2018 17:01		Bathymetric survey of BSM XX and XXI, the flanks of Hirondele, Carter and Annan and Kane Gap