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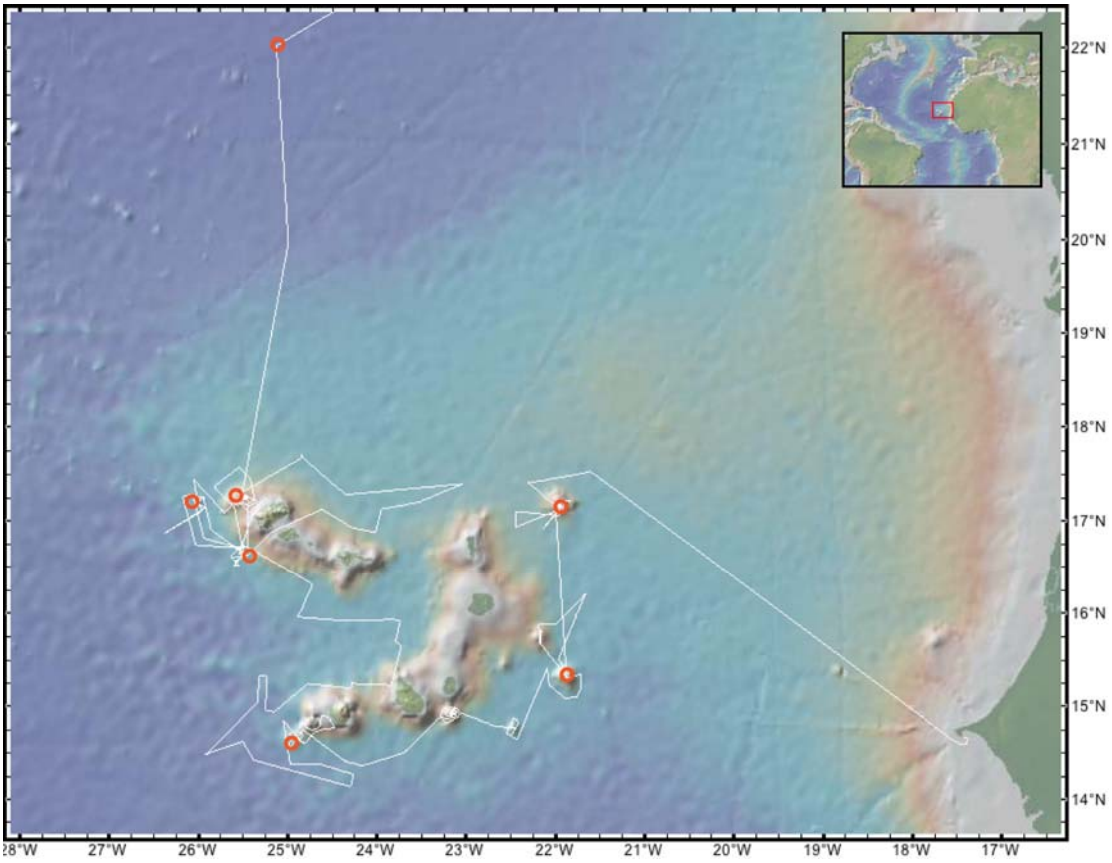
Short Cruise Report
RV METEOR Cruise M80/3

Dakar – Las Palmas
29. December 2009 – 1. February 2010
Chief Scientist: Thor H. Hansteen
Captain: Thomas Wunderlich



Ship track of RV Meteor cruise M80/3 with locations of ROV deployments marked.

Objectives

Leg M80/3 was designed to provide geological and biological sampling and oceanographic measurements on both local and regional scales in the Cape Verde Archipelago. A special focus was detailed investigations of seamounts using the ROV KIEL 6000. Complementary methods were regional dredging of geological and biological materials, and regional sediment collection using gravity coring. Rock and sediment samples will be age dated and analysed by petrological, geochemical and volcanological methods in order to reach these overarching goals:

- Reconstruction of the origin and temporal and spatial evolution of magmas during formation of the archipelago.
- Description of composition, size and dynamics of the mantle source region of Cape Verde magmatism.
- Characterisation of young submarine volcanism at Cape Verde, probably representing the birth of the next seamount in this archipelago.
- Determination of the regional dispersion and age distribution of marine ashes from large explosive eruptions on the Cape Verde Islands, in order to obtain the magnitude, source and recurrency intervals of such catastrophic events.

Further aims of to be addressed within the framework of interdisciplinary cooperation are:

- Description of the interactions between geosphere, hydrosphere and biosphere at the comparatively isolated Senghor Seamount.
- Determination of regional biodiversity of deep water corals and other sessile organisms.

An important aspect of the cruise was close cooperation between different disciplines and seamount working groups through the coordination between cruises M79/3 and M80/3, thus facilitating an efficient use of allotted ship time.

Narrative

The final preparations for cruise M80/3 were carried out onboard the RV METEOR in the harbour of Dakar (Senegal). Ten scientists boarded the ship on December 25th and began with the mobilisation of the remotely operated vehicle (ROV) KIEL 6000. A reception and ship's tour were held for the German embassador in Senegal and other members of the embassy on December 27th. On December 28th the remaining scientists boarded the ship and started preparations in the laboraties during the next day.

The RV METEOR disembarked from Dakar in the evening of December 29th and began her transit to the first working area at Senghor seamount in the northeast of the Cape Verde Archipelago. The scientists used the transit time to finish lab preparations and the set-up of equipment. Scientific work began on December 31th with the recovery of two gravity cores to the northeast and northwest of Senghor seamount.

During the following hydroacoustic mapping in the night to January 1st, the ship´s crew arranged an appropriate New Year celebration. Year 2010 began with another three gravity cores and two dredge hauls at Senghor Seamount followed by PARASOUND mapping to reveal the nature of its summit plateau.

The ROV KIEL 6000 was deployed for the first time during the cruise on January 2nd to explore an area of Senghor's southwestern flank. The deployment, including coordination, operation and recovery worked well; the dive was successful but had to be shortened for technical reasons. As the local weather conditions were rapidly getting worse, it was decided to spend no more time at Senghor Seamount but to proceed to Cabo Verde Seamount 200 km further south. The next day the ROV dove for 9 hours within a collapse scar and crater-like depression to investigate the interior of this presumably old seamount. The dive was very successful and the recovery of even large samples at any place exceeded the expections. During the following 1 1/2 days Cabo Verde Seamount was further sampled by three dredge hauls, three gravity cores were recovered in its vicinity, and bathymetric data were completed, before the RV METEOR headed for Maio Seamount.

The work at Maio Seamount began on January 5th with detailed hydroacoustic mapping of this hitherto unmapped and unsampled edifice. Right after mapping a detailed digital map could be produced and three dredge localities were selected. The dredge hauls yielded many corals but no rocks, suggesting that Maio Seamount is an relatively old edifice. Similar work was carried out at the nearby Maio Ridge to the west, a subsided island for which bathymetric data and samples were lacking until now. After successful mapping and three dredge hauls the RV METEOR headed further west on January 7th. Three gravity cores were taken south of Santiago and Fogo islands, and Cadamosto Seamount southwest of the Fogo-Brava platform was mapped.

The next two ROV dives were carried out at Cadamosto Seamount on January 8th and 9th. Because of favourable weather conditions with the RV METEOR operating on the lee side of Fogo and Brava the sea was relatively calm. The very successful dives lasted for eleven hours each and yielded a number of rock and coral samples from the summit region of Cadamosto. The ROV explored a number of apparently young lava flows, three steep crater rims, the bottom of one of these craters, and a recent volcanic vent. The work at Cadamosto was finished by two dredge hauls at two volcanic cones on its northeastern flank that yielded some fresh volcanic rocks. During the next four days a total of twelve gravity cores were recovered around Brava and progressively farther north towards the central area of the archipelago. PARASOUND profiles in the southern parts of the archipelago revealed young faults with vertical displacements of up to 80m, showing the importance of Recent vertical tectonics for the regional geological evolution.

On January 14th the RV METEOR reached the Charles Darwin volcano field southwest of Santo Antão. The first ROV dive to about 3400 m depth revealed some technical problems, which were fixed during the following day. The work programme was accoringly changed in order to recover two gravity cores west of the volcano

field followed by multibeam mapping. During the next five days, four successful ROV dives were carried out at the volcano field at depths up to 3800 m, yielding a large number of samples and spectacular imagery of volcanic structures and colonisation of deep seamounts by corals and sponges. The work was supplemented by six dredge hauls, multibeam mapping and some PARASOUND profiles in this area. On January 16th Nola Seamount northwest of Santo Antão featuring two shallow plateaus was mapped in detail, and in the evening the "Bergfest" (mid-cruise celebration) was solemnised during hydroacoustic mapping.

On the evening of January 19th RV METEOR headed towards Sodade Seamount west of Santo Antão, that was discovered some days earlier through hydroacoustic surveys. After carrying out a more detailed mapping, the seamount was successfully sampled by four dredge hauls and explored by a long ROV dive during the following day. Two gravity cores were recovered west of Santo Antão on January 21st, and the volcanic area around Sodade Seamount was mapped before the ship went to Nola Seamount. In spite of transient winch problems, two dredge hauls at Nola were recovered in the night of January 22nd, followed by completion of the local bathymetric mapping. The next day began with a ROV dive at Nola, which was interrupted soon after deployment by a complete power failure of the ROV. Whilst the vehicle was drifting upward by its own buoyancy, the skilled ROV team assisted by the ship's WTD team managed to repair the high-voltage power supply. The dive could be continued and yielded excellent imagery and samples from a part of Nola Seamount. On the evening two successful dredge hauls were carried out, before the RV METEOR headed for the next gravity-core station.

Between January 23rd and 25th, seven gravity cores were recovered north of the northern Cape Verde chain and close to Santo Antão. Because of successful and time-efficient coring, time was available for two more ROV dives at the Charles Darwin volcano field and at Nola Seamount on January 25th and 26th, respectively. The night between both dives was used for three dredge hauls at Nola Seamount. On the morning of January 26th the RV METEOR began her transit to Las Palmas de Gran Canaria, briefly interrupted on 28th in order to carry out a deep-sea diving test of the ROV to about 5200 m water depth.

The RV METEOR called at the port of Las Palmas on the morning of February 1st, having successfully completed cruise M80/3.

Acknowledgements

We express our gratefulness to Captain Wunderlich and his crew for their professionality and the very pleasant working atmosphere during the cruise, which contributed to the success of the expedition. No research equipment was lost during the cruise undoubtedly due to their skillful control of the research vessel, cranes, winches and other systems.

Furthermore we acknowledge the professional patronage of the German Ministry of Foreign Affairs and the Leitstelle (control station) METEOR. We respectfully

appreciate the support of the government of the Repubic of Cape Verde for providing permission to work in their territorial waters. The METEOR expedition 80/3 was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Council) and the Bundesministerium für Bildung, Wissenschaft, Forschung und Technologie (BMBF, Federal Ministry of Education and Research).

Cruise Participants

Name	Discipline	Institution
Hansteen, Thor H.	Chief scientist	IFM-GEOMAR
Abegg, Friedrich	ROV team leader	IFM-GEOMAR
Barker, Abigail	Geochemistry, petrology	U. Uppsala
Foster, Andy	ROV team	Schilling
Freundt, Armin	Volcanology, petrology	IFM-GEOMAR
Gothieu, Matthias	Petrology	U. Bremen
Hildner, Elliot	Petrology	U. Bremen
Hinz, Claus	ROV team	IFM-GEOMAR
Huusmann, Hannes	ROV team	IFM-GEOMAR
Irion, Ines	Gravity coring	U. Kiel
Klügel, Andreas	Volcanology, petrology	U. Bremen
Kurtenbach, Björn	Media	NDR (Freelance)
Kutterolf, Steffen	Volcanology, petrology	IFM-GEOMAR
Kwasnitschka, Tom	Volcanology, sedimentology	IFM-GEOMAR
López Correa, Matthias	Geobiology	U. Erlangen
Meier, Arne	ROV team	IFM-GEOMAR
Petersen, Asmus	Core-technician	IFM-GEOMAR
Pieper, Martin	ROV team	IFM-GEOMAR
Queisser, Wolfgang	ROV pilot	IFM-GEOMAR
Raddatz, Jacek	Geobiology	IFM-GEOMAR
Raeke, Andreas	Meteorology	DWD
Ramalho, Ricardo	Regional geology, volcanology	U. Bristol
Schindlbeck, Julie	Gravity coring	U. Kiel
Schmidt, Alexander	Bathymetry	U. Kiel
Schumann, Kai	Bathymetry	IFM-GEOMAR
Strehlow, Karen	Gravity coring	U. Kiel
Suck, Inken	ROV team	IFM-GEOMAR
Wanke, Maren	Gravity coring	U. Kiel

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U. Kiel	Institut für Geowissenschaften, Universität Kiel, Kiel, Germany
U. Uppsala	University of Uppsala, Sweden
U. Erlangen	Geozentrum Nordbayern, Erlangen, Germany
Schilling	Schilling Robotics LTD, Aberdeen, United Kingdom
NDR	Norddeutscher Rundfunk, Keil, Germany
U. Bristol	University of Bristol, Department of Earth Sciences, United Kingdom
DWD	Deutscher Wetterdienst, Offenbach, Germany

List of stations

Station	Date	Locality	START Lat °N	START Long °W	START Depth	END Lat °N	END Long °W	END Depth
1383 SL	31.12.09	NE of Senghor Smt	17°32.00'	21°36.01'	3384			
1384 SL	31.12.09	NW of Senghor Smt	17°24.99'	22°18.06'	3356			
1385 SP	31.12.09	NW of Senghor Smt	17°25.19'	22°18.43'	3357			
1386 MB	31.12.09	Senghor Smt	17°6.34'	22°0.56'	2132	17°4.50'	22°5.20'	3133
001 SL	01.01.10	Senghor Smt	17°3.82'	21°58.08'	2995			
002 SL	01.01.10	Senghor Smt	17°12.21'	21°52.92'	1888			
003 SL	01.01.10	SW Senghor Smt	16°56.00'	22°8.00'	3394			
004 DR	01.01.10	Senghor Smt E flank	17°13.18'	21°53.52'	1270	17°13.13'	21°53.43'	1302
005 DR	01.01.10	Senghor Smt E flank	17°12.98'	21°50.39'	1962	17°13.01'	21°50.45'	1928
006 PS	02.01.10	Senghor Smt plateau	17°13.26'	21°58.19'	441			
007 ROV	02.01.10	Senghor Smt SW flank	17°6.71'	22°0.46'	1908	17°7.22'	21°59.78'	1635
008 DR	02.01.10	Senghor Smt SW flank	17°07.20'	21°59.76'	1630	17°07.24'	21°59.85'	1640
009 MB	02.01.10	Transit	17°7.24'	21°59.69'	1571	15°18.63'	21°52.63'	1671
010 ROV	03.01.10	Cabo Verde Smt	15°18.27'	21°52.51'	1052	15°19.49'	21°52.61'	746
011 MB	03.01.10	Transit	15°19.52'	21°52.64'	772	15°53.13'	22°0.39'	3425
012 SL	04.01.10	E of Boa Vista	16°13.00'	21°40.01'	3794			
013 SL	04.01.10	NW of Cabo Verde Smt	15°31.00'	21°58.00'	3699			
014 DR	04.01.10	Cabo Verde Smt NE flank	15°21.18'	21°51.04'	1304	15°21.24'	21°51.16'	1186
015 DR	04.01.10	Cabo Verde Smt crater	15°18.61'	21°52.42'	1025	15°18.71'	21°52.64'	842
016 DR	04.01.10	Cabo Verde Smt crater	15°18.44'	21°52.42'	1030	15°18.53'	21°52.68'	798
017 MB	05.01.10	Transit	15°21.18'	21°43.41'	3566	15°24.81'	22°5.68'	3826
018 SL	05.01.10	W of Cabo Verde Smt	15°25.03'	22°5.61'	3823			
019 MB	05.01.10	Maio Smt	15°24.94'	22°5.57'	3830	14°42.41'	22°29.13'	3874
020 DR	05.01.10	Maio Smt summit	14°46.44'	22°27.23'	2069	14°46.55'	22°27.46'	2029
021 DR	05.01.10	Maio Smt summit	14°45.96'	22°26.98'	1971	14°46.07'	22°27.17'	1800
022 DR	06.01.10	Maio Smt summit	14°46.78'	22°27.03'	2165	14°46.88'	22°27.23'	2075
023 SL	06.01.10	W of Maio Smt	14°47.72'	22°40.15'	3879			
024 MB	06.01.10	Maio Ridge	14°56.34'	23°4.19'	2032	14°57.28'	23°7.79'	328
025 DR	06.01.10	Maio Ridge scar	14°59.99'	23°7.72'	1402	15°0.05'	23°7.76'	1205
026 DR	06.01.10	Maio Ridge scar	14°59.65'	23°8.19'	1153	14°59.75'	23°8.29'	886
027 DR	06.01.10	Maio Ridge scar	14°58.60'	23°7.60'	1208	14°58.78'	23°7.82'	1107
028 MB	07.01.10	Maio Ridge	14°58.60'	23°7.86'	704	14°53.45'	23°17.62'	3039
029 SL	07.01.10	S of Santiago	14°32.35'	23°40.40'	3963			
030 SL	07.01.10	SE of Fogo	14°23.00'	24°7.00'	4154			
031 SL	07.01.10	S of Fogo	14°25.36'	24°21.25'	4197			
032 MB	08.01.10	Cadamosto Smt	14°45.53'	24°49.55'	2996	14°40.04'	24°54.49'	1778
033 ROV	08.01.10	Cadamosto Smt summit	14°38.98'	24°54.92'	1559	14°39.72'	24°55.08'	1572
034 MB	08.01.10	S of Fogo-Brava platform	14°42.57'	24°59.25'	3657	14°40.36'	24°54.56'	1815
035 ROV	09.01.10	Cadamosto Smt summit	14°39.09'	24°54.75'	1571	14°40.12'	24°54.64'	1758

036 DR	09.01.10	NE of Cadamosto Smt	14°40.01'	24°52.39'	2525	14°40.14'	24°52.56'	2403
037 DR	10.01.10	NE of Cadamosto Smt	14°41.73'	24°53.73'	2456	14°41.82'	24°53.86'	2457
038 SL	10.01.10	W of Brava	14°51.40'	25°3.10'	4110			
039 SL	10.01.10	S of Brava	14°23.31'	24°58.32'	4312			
040 SL	10.01.10	SSW of Brava	14°23.60'	24°39.02'	4245			
041 MB	10.01.10	Transit	14°23.61'	24°38.94'	4239	14°26.00'	25°23.02'	4416
042 SL	11.01.10	SW of Brava	14°26.00'	25°23.00'	4414			
043 SL	11.01.10	SW of Brava	14°38.00'	25°30.10'	4428			
044 SL	11.01.10	SW of Brava	14°30.15'	25°54.20'	4541			
045 MB	11.01.10	W of Brava	14°30.18'	25°54.15'	4536	14°57.03'	25°9.29'	4209
046 SL	12.01.10	W of Brava	14°57.00'	25°9.00'	4193			
047 SL	12.01.10	N of Brava	15°15.10'	24°46.50'	4033			
048 SL	12.01.10	NW of Fogo	15°15.13'	24°16.95'	3388			
049 MB	12.01.10	transit	15°15.13'	24°16.95'	3387	15°56.50'	23°50.48'	3722
050 SL	13.01.10	SE of Sao Nicolau	15°56.38'	23°50.76'	3723			
051 SL	13.01.10	S of Sao Nicolau	15°55.65'	24°21.52'	3879			
052 SL	13.01.10	SW of Sao Nicolau	15°58.21'	24°53.32'	4014			
053 SL	13.01.10	SW of Sao Nicolau	15°58.21'	24°53.30'	4016			
054 MB	14.01.10	transit	15°58.52'	24°53.26'	4011	16°43.84'	25°30.79'	3391
055 ROV	14.01.10	Darwin field	16°43.87'	25°30.69'	3383	16°43.87'	25°30.69'	3384
056 SL	14.01.10	SW of Santo Antao	16°43.97'	25°49.43'	4138			
057 SL	14.01.10	SW of Santo Antao	16°44.92'	26°1.92'	4225			
058 MB	14.01.10	Darwin field	16°45.06'	26°1.93'	4224	16°42.49'	25°29.84'	3427
059 ROV	15.01.10	Darwin field, Volcano B	16°42.51'	25°29.85'	3412	16°43.30'	25°29.23'	3199
060 DR	15.01.10	Darwin field, Volcano A	16°43.69'	25°30.10'	3309	16°43.93'	25°30.21'	3176
061 DR	16.01.10	Darwin field, Volcano F	16°38.65'	25°32.69'	3613	16°38.82'	25°32.75'	3504
062 MB	16.01.10	W of Santo Antao	16°42.71'	25°31.29'	3468	16°44.22'	25°30.84'	3359
063 ROV	17.01.10	Darwin field, Volcano A	16°44.39'	25°31.01'	3379	16°44.98'	25°30.05'	2906
064 DR	17.01.10	Darwin field, Volcano E	16°39.73'	25°30.85'	3753	16°39.91'	25°30.94'	3609
065 DR	18.01.10	Darwin field, Volcano G	16°37.86'	25°27.33'	3476	16°38.04'	25°27.43'	3341
066 MB	18.01.10	Darwin field	16°37.83'	25°27.51'	3520	16°36.51'	25°38.35'	3984
067 ROV	18.01.10	Darwin field, Volcano C	16°41.43'	25°34.86'	3597	16°42.84'	25°35.00'	2969
068 DR	18.01.10	Darwin field, Volcano D	16°41.32'	25°29.56'	3144	16°41.53'	25°29.77'	2985
069 DR	19.01.10	Darwin field, Volcano H	16°33.88'	25°33.40'	4155	16°34.02'	25°33.46'	4179
070 MB	19.01.10	Darwin field	16°34.15'	25°33.43'	3882	16°35.51'	25°31.61'	3933
071 ROV	19.01.10	Darwin field, Volcano E	16°39.67'	25°30.82'	3754	16°39.84'	25°30.39'	3491
072 MB	19.01.10	Sodade Smt	16°39.91'	25°30.52'	3566	17°10.09'	25°59.23'	3526
073 DR	20.01.10	Sodade Smt W summit	17°11.81'	26°0.77'	3268	17°11.98'	26°0.87'	3162
074 DR	20.01.10	Sodade Smt NE cone	17°15.14'	25°57.62'	3263	17°15.32'	25°57.77'	3208
075 DR	20.01.10	Sodade Smt E summit	17°12.18'	25°59.58'	2742	17°12.35'	25°59.69'	2717
076 ROV	20.01.10	Sodade Smt W summit	17°11.87'	26°2.18'	3699	17°12.47'	26°0.79'	2898

077 DR	20.01.10	Sodade Smt SE cone	17°8.92'	25°55.74'	3415	17°9.07'	25°55.84'	3350
078 SL	21.01.10	W of Santo Antao	16°52.43'	26°22.75'	4319			
079 MB	21.01.10	Sodade Smt	17°8.21'	25°58.02'	3753	17°15.65'	26°1.20'	3736
080 SL	21.01.10	NW of Santo Antao	17°26.92'	26°3.04'	3928			
081 DR	21.01.10	Nola Smt SW cone	17°5.43'	25°42.39'	2689	17°5.59'	25°42.62'	2383
082 DR	21.01.10	Nola Smt W summit area	17°10.58'	25°37.11'	667	17°10.70'	25°37.23'	550
083 MB	22.01.10	Nola Smt N flank	17°10.70'	25°37.23'	535	17°14.01'	25°22.78'	1791
084 ROV	22.01.10	Nola Smt E summit flank	17°14.03'	25°23.02'	1705	17°14.45'	25°23.84'	1293
085 DR	22.01.10	Nola Smt E summit flank	17°16.16'	25°26.48'	767	17°16.29'	25°26.61'	604
086 DR	23.01.10	Nola Smt E summit cone	17°17.71'	25°32.83'	1286	17°17.84'	25°32.94'	1227
087 SL	23.01.10	NE of Santo Antao	17°41.50'	24°50.29'	3591			
088 SL	23.01.10	NE of Santo Antao	17°24.81'	24°30.55'	3534			
089 SL	23.01.10	N of Sao Vicente	17°17.38'	24°20.46'	3530			
090 MB	23.01.10	transit	17°17.44'	24°20.46'	3531	17°24.40'	23°2.53'	3391
091 SL	24.01.10	N of Sal	17°24.32'	23°2.42'	3394			
092 SL	24.01.10	NW of Sal	17°12.35'	23°33.20'	3436			
093 SL	24.01.10	N of Sao Nicolau	17°8.00'	23°57.07'	3474			
094 MB	24.01.10	transit	17°7.98'	23°56.95'	3471	16°53.62'	25°10.32'	869
095 SL	25.01.10	S of Santo Antao	16°53.27'	25°11.14'	537			
096 ROV	25.01.10	Darwin field, Volcano G	16°37.62'	25°27.09'	3658	16°38.02'	25°27.44'	3330
097 DR	26.01.10	Nola Smt E summit cone	17°11.24'	25°26.91'	1403	17°11.44'	25°27.02'	1318
098 DR	26.01.10	Nola Smt W summit cone	17°11.69'	25°31.65'	1222	17°11.90'	25°31.75'	1080
099 DR	26.01.10	Nola Smt W summit flank	17°14.90'	25°33.47'	827	17°15.06'	25°33.57'	802
100 ROV	26.01.10	Nola Smt main saddle	17°13.72'	25°31.54'	1161	17°13.71'	25°32.26'	860
101 MB	26.01.10	transit	17°14.62'	25°31.36'	1086	21°53.64'	25°7.10'	5117
102 ROV	28.01.10	Deep-sea diving test	22°1.72'	25°7.66'	5144	22°1.62'	25°7.65'	5146