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Short Cruise Report
R/V SONNE cruise SO267
Suva (Fiji) - Suva (Fiji)
11.12.2018 - 26.01.2019
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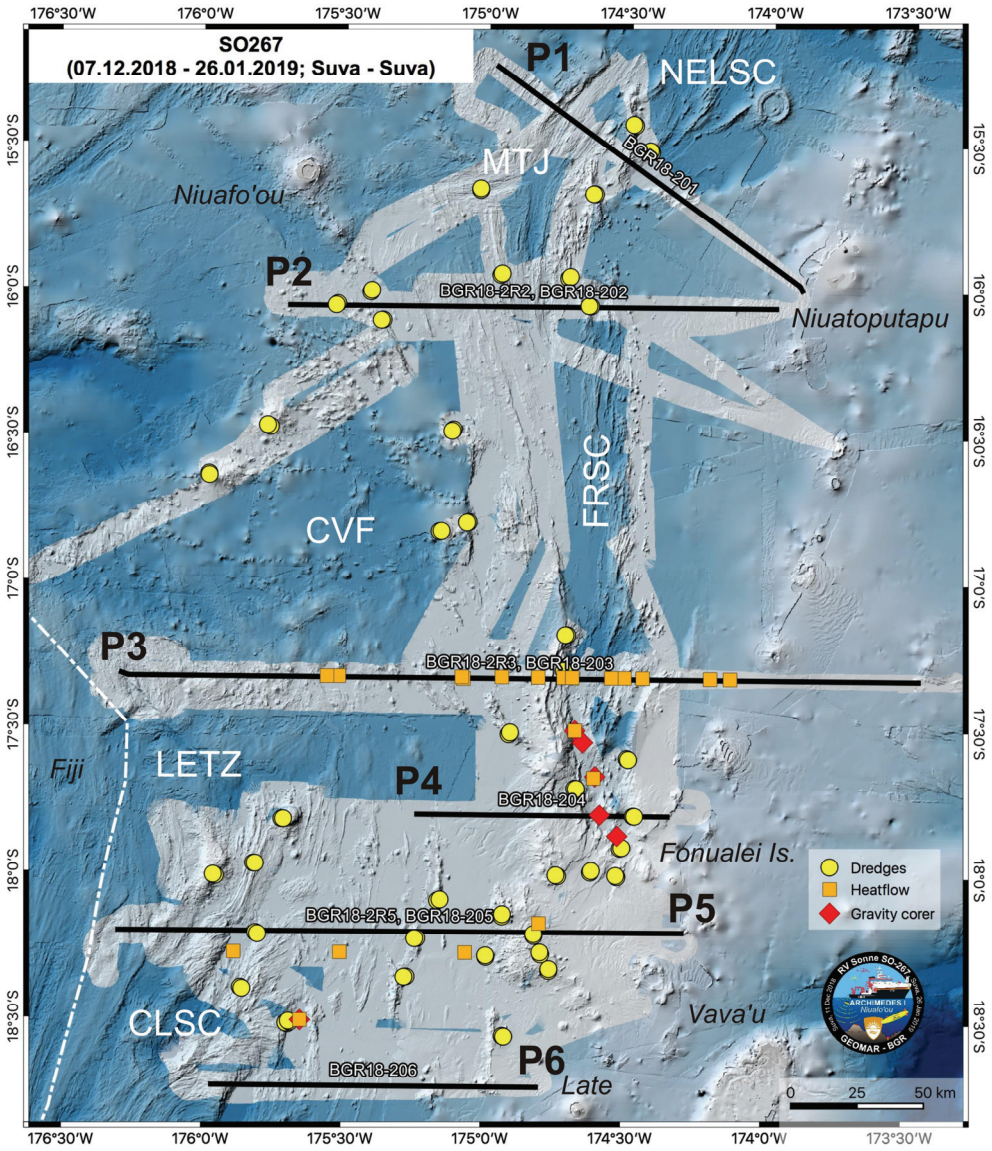
Captain: Oliver Meyer



Objectives

SO267 (ARCHIMEDES I) conducted a series of crustal cross-sections at the outer edge of the Indo-Australian Plate, in the largely uncharted waters of the Kingdom of Tonga. The project, entitled “Arc Rifting, Metallogeny and Microplate Evolution – An Integrated Geodynamic, Magmatic and Hydrothermal Study of the Fonualei Rift System”, was designed to document the geological evolution of an emerging microplate mosaic in the NE Lau Basin, a region with some of the fastest growing crust on Earth, and establish the sequence of events that cause arc rifting and related magmatic-hydrothermal activity. Using a coordinated approach of high-resolution 2D seismics, potential field methods, mapping and sampling, we imaged the deep structure of the Fonualei Rift system (FRSC) and Niuafo’ou microplate. The goal was to address a major unsolved question concerning crustal growth in complex arc-backarc systems: at what stage in the structural and thermal evolution of the crust does arc rifting occur and seafloor spreading initiate? To understand the large-scale tectonic processes, we conducted 6 transects across the plate boundary in an area encompassing nearly 300 km x 300 km. The results represent one of the most comprehensive records of microplate formation in the oceans.

The program was carried out over 43 days, including multichannel reflection seismics (MCS) using BGR’s 4-km long streamer together with GEOMAR’s G-gun cluster, the deployment of ocean bottom seismometers (OBS) for deep refraction profiling, high-resolution magnetics with BGR’s towed magnetometer and continuous gravimeter recordings. Ocean bottom magnetotelluric sensors (OBMTs) were also deployed to measure deep crustal resistivity. The geophysical transects were complemented by dredging, heat flow measurements, and sidescan imaging and plume detection with the AUV ABYSS. This ambitious program was made possible by a close collaboration between GEOMAR and BGR scientists, bringing together diverse technologies and expertise.

The studied rift is in a unique location where all of the relevant tectonic processes of crustal growth in arc-backarc systems can be documented in their entirety. This area was chosen to address the following key questions: 1) How and where does arc rifting begin? 2) What are the styles of faulting and the role of pre-existing basement structures? 3) What is the thickness of the arc crust where rifting starts? 4) What is the nature of the magma plumbing system beneath the rift? 5) When and where do the largest hydrothermal systems develop? 6) Where are the boundaries of the emerging Niuafo´ou microplate? Our first objective was to identify the nature of the arc crust just prior to rifting and to determine how this influences rift propagation. In the south, crudely organized faulting at the termination of the FRSC was imaged in 3D by combining the seafloor mapping and sampling with the seismic sections to reveal the architecture of the rifting process. We identified the deepest and most active faults bounding the FRSC and their relationship to pre-existing basement structure, and with additional processing, we expect the seismic data will reveal the deep lithospheric structures that control the rifting. We also measured the crustal thickness in 3 refraction profiles across the FRSC, clearly defining the eastern boundary of the Niuafo’ou microplate, which is migrating east with the arc front. At the same time, a new plate boundary appears to be forming between the southern tip of the FRSC and the northernmost basins of the Eastern Lau Spreading Center (ELSC). In the north, the FRSC appears to be actively overtaking the east arm of the Mangatolu Triple Junction (MTJ) in the north, where a new triple junction is forming with the Northeast Lau Spreading Center (NELSC). These different scenarios will have consequences for mantle flow, the composition of the near-arc volcanoes, and the magmatic and hydrothermal budget of the growing Niuafo’ou microplate, which will be tested by the extensive rock sampling program.

Narrative

On Monday, December 10, 39 scientists from GEOMAR, BGR, and partner institutions joined RV SONNE in Suva, Fiji. A total of 14 containers of equipment, some already on board and some recently arrived in Suva, were unpacked and loaded, and the vessel left port in the late afternoon of Tuesday, December 11. We arrived on station and commenced operations at 19:00 on Wednesday, December 12, after a transit of 360 nm. The first operations were deployment of 50 OBSs and 16 OBMTs on our longest of 6 seismic lines across the FRSC (P3, 160 nm). Twelve (12) heat flow stations were conducted between the OBS and OBMT deployments, and on December 15, GEOMAR's two large G-gun arrays were deployed to shoot the OBSs following mammal mitigation procedures. Shooting of the line continued until Sunday evening, December 16, with continuous high-resolution towed magnetics and ship-based gravity recorded simultaneously.

After shooting the OBSs on P3 (BGR18-2R3), BGR's 4-km streamer was deployed for the MCS (BGR18-203). After a brief interruption to repair 4 of the guns that were not firing, the MCS was completed on Tuesday, December 18. During the MCS, the sub-bottom profiler (PARASOUND) recorded sediment thickness to target additional heat flow and gravity coring. On Wednesday and Thursday the OBSs were recovered from P3 and 17 instruments were redeployed in a microseismicity network to measure earthquakes on the east and west bounding faults of the S-FRSC. Two additional refurbished OBMTs were also deployed to supplement the 16 already at the seafloor. On Friday morning, December 21, the program shifted to mapping and sampling of the southern FRSC. We also deployed the AUV ABYSS (Dive 308) to map the propagating tip of the FRSC in two areas. During the dive, heat flow stations and gravity coring were carried out in the rift valley. Sediment was recovered in the core catcher at several stations, but in other areas the substrate was mostly coarse volcaniclastics, which could not be penetrated with the 3-m corer. Christmas Eve was celebrated with a toast by the Captain and Chief Scientist and an exchange of gifts, during which a large-scale multibeam, magnetics, and gravity survey of the FRSC was completed. The AUV ABYSS spent Christmas in the water surveying the southwest arm of the FRSC rift (Dive 309). On Christmas Day we proceeded to line P4 (BGR18-204) to conduct MCS profiling across the southern extension of the FRSC and the adjacent back-arc, after which we deployed 34 OBSs on line P5 (BGR18-2R5), the second longest of the seismic profiles in our program (108 nm). We started shooting on Thursday, December 27, and the MCS profile (BGR18-205) was completed late on Friday, December 28. The OBSs were then shot in the opposite direction until late Saturday, December 29. The OBSs were recovered on December 30 and 31.

Week 4 ushered the first bad weather, with several tropical depressions passing through the working area beginning on New Year's Eve and the arrival of cyclone "Mona" on January 6. Despite weather delays, we completed all of our seismic work on the FRSC (P3, P4, and P5), and began an intensive sampling program in the complex transfer zone between the Fonualei Rift (FRSC) and the Central Lau Spreading Center (CLSC). Heat flow and gravity coring was attempted in the arc-to-backarc transition, but the coring continued to be a challenge. Three heat flow measurements were possible, and sediment was recovered from one deep (>3,000 m) basin nearest the CLSC in the west. On Thursday, January 3, we were able to launch the AUV (Dive 310) for a sidescan survey of young volcanic fissures on the inner arc high south of the FRSC, and then began a dredging program in the FRSC-CLSC Transfer Zone from continued Sunday, January 6, until Wednesday, January 9. Dredging in the deepest basins of the CLSC recovered fresh basalt but also strongly altered rocks, indicating past hydrothermal activity associated with the lowermost exposed back-arc crust. On Tuesday, January 8, we launched the AUV (Dive 311) on the first survey for hydrothermal plumes along the northeast arm of the CLSC close to Peggy Ridge. The next few days were spent exploring the western

boundary of the Niuafo'ou plate, including arc-like volcanoes adjacent to Peggy Ridge and at the northeast arm of the CLSC. At mid-week, we had our first full day of sunshine since December 28, and on Wednesday, January 9, we transited to the southernmost line in the program (P6, BGR18-206) to conduct MCS. This line was chosen to image the buried ridges and failed rifts at the northern end of the ELSC where it approaches the Niuafo'ou plate boundary. Late on Thursday, January 10, we concluded operations in the southern working area.

The second part of SO-267 explored the northern boundary of the Niuafo'ou microplate, beginning with OBS deployments on line P2 (BGR18-2R2, BGR18-202) across the thinning arc crust at the northern termination of the FRSC. In transit to P2 we launched the AUV (Dive 312), which followed the vessel for 100 km along the axis of the FRSC to better establish the spacing of hydrothermal vents. The dive continued while we deployed 20 of the 30 OBSs planned for P2. Operations were interrupted on Saturday, January 12, when the vessel received notice from the Rescue Coordination Centre in NZ of a distress signal 90 nm SE, and we were dispatched to investigate. After ~13 hrs attending to a disabled fishing vessel, we returned to P2 to recover the AUV and resume the deployment of the OBSs. The MCS survey was completed on Monday, January 14, and we moved to line P1 (BGR18-201), which crosses the southern tip of the Northeast Lau Spreading Centre (NELSC) and the actively spreading north arm of the Mangatolu Triple Junction (MTJ). Shooting of P1 continued until Tuesday afternoon, January 15, when we started the first dredging in the northern study area, focusing on the Central Volcanic Field (CVF) of the Niuafo'ou microplate. On Wednesday, January 16, we redeployed the air guns to shoot the OBSs on line P2. Recovery of the OBSs commenced on Thursday and lasted until Friday, January 18. During the recovery of the OBSs we deployed the AUV (Dive 313) on a plume mapping mission along the northern arm of the MTJ, thus completing an important part of the inventory of hydrothermal activity in the NE Lau Basin. We continued sampling volcanic rocks in the transfer zone between the propagating NELSC, the N-FRSC and the MTJ on Friday night until Saturday, January 19. During the dredging we deployed the AUV (Dive 314) on a sidescan survey over the location of newly discovered hydrothermal sites along the northern MTJ spreading center. Early in the morning of Sunday, 20 January, we transited back to line P3 to begin the long process of recovering the OBMTs that had been deployed there 5 weeks earlier. Recovery continued through Monday, January 21, and a final AUV Dive (315) to map plumes in the S-FRSC was completed during the OBMT recovery. On January 22 and 23 we returned to the northern working area to complete our final dredging and mapping program for the cruise, and on Thursday, January 24, we departed the working area for Suva. The vessel arrived in Suva on January 26 at 8 am, and we docked at 08:00 to commence unloading equipment bound for Germany, Hawaii, and Korea.

Over 7 weeks, the entire scientific crew of 39 participated around-the-clock in the seismic experiments, including mobilization and demobilization the OBSs and OBMTs, deployment of the instruments, monitoring and maintenance of the operating equipment, mammal watching, and data acquisition and analysis. 110 stations were completed, with an average of 10 hrs each, including 146 OBS and OBMT deployments. The seismic program included 9 seismic profiles (1,065 km of MCS and 673 km of refraction seismics), with more than 25,000 shot points. The seismic program was complemented by 8 AUV dives with 910 km travelled, 41 dredges, and 21 heat flow and 6 gravity corer stations. The work was supported by more than 46,600 km^2 of high-resolution multibeam, backscatter, and sub-bottom profiling, and more than 4,200 km of towed magnetics, making it one of the most comprehensive studies of its kind.

The team of geologists and geophysicists from GEOMAR, BGR, and partner institutions, preparing to board RV SONNE in Suva on Monday, December 10, 2018. After 7 weeks at sea, the scientists disembarked on Sunday, January 27, 2019.

Acknowledgements

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17.	Demir, Uemit	Streamer	BGR
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33.	Martins, Sofia, Dr.	Gravity Coring	GEOMAR
34.	Lange, Sabine	Gravity Coring	GEOMAR
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36.	Diller, Nikolaj	AUV	GEOMAR
37.	Kurbjuhn, Torge	AUV	GEOMAR
38.	Parianos, John	Sediment Sampler, Observer	Nautilus
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Stationsliste

Station No.		Date	Gear	Time	Latitude	Longitude	Water Depth	Remarks/Recovery
SONNE	GEOMAR BGR	2018 / 2019		[UTC]			[m]	
SO267_1-1		12.12.	Cage	5:32	-17,44422	-176,20798	2872	Releaser Test
SO267_1-2		12.12.	Cage	7:58	-17,44420	-176,20797		Releaser Test
SO267_2-1	50 OBS 16 MT	12.12.	OBS OBMT	13:57	-17,33000	-176,22568	2269	OBS/OBMT Deployment (P3)
SO267_3-1		12.12.	Cage	14:49	-17,32943	-176,13098	1929	Releaser Test
SO267_4-1		13.12.	Cage	0:13	-17,32990	-175,13553	2067	Releaser Test
SO267_5-1	05 HF	13.12.	Heat Flow	3:31	-17,33592	-175,07523	2360	No penetration
SO267_6-1	06 HF	13.12.	Heat Flow	7:38	-17,32972	-174,93885	2363	No penetration
SO267_7-1	07 HF	13.12.	Heat Flow	11:09	-17,32968	-174,81007	1725	Temp, Gradient, HP
SO267_8-1	08 HF	13.12.	Heat Flow	14:44	-17,32973	-174,72015	2348	No penetration
SO267_9-1	09 HF	13.12.	Heat Flow	17:15	-17,32957	-174,68925	2794	Temp, Gradient, HP
SO267_10-2	10 HF	14.12.	Heat Flow	3:23	-17,32967	-174,50410	2518	Temp
SO267_11-1	11 HF	14.12.	Heat Flow	6:42	-17,32985	-174,43982	2210	No penetration
SO267_12-1	12 HF	14.12.	Heat Flow	11:28	-17,32972	-174,12985	1463	Temp
SO267_13-1	BGR18-2R3	14.12.	AG/ Magnetometer	18:30	-17,33197	-173,32623	1208	Refraction Seismics (P3)
SO267_14-1	BGR18-203	16.12.	Streamer/AG/ Magnetometer	12:00	-17,37220	-176,27460	2289	Reflection Seismics (P3)
SO267_15-1	43 OBS	18.12.	OBS	18:19	-17,33693	-173,53183	1317	OBS Recovery (P3)
SO267_16-1	11 OBS 2 MT	19.12.	OBS OBMT	3:43	-17,32903	-174,16863		OBS/OBMT Re-deployment (P3)
SO267_17-1	17-1 HF	20.12.	Heat Flow	1:19	-17,33033	-175,08108	2367	No penetration
SO267_17-2	17-2 HF	20.12.	Heat Flow	1:45	-17,33033	-175,08108	2368	Temp
SO267_18-1	18 HF	20.12.	Heat Flow	9:59	-17,33005	-175,51708	2329	Temp, Gradient, HP
SO267_19-1	19 HF	20.12.	Heat Flow	12:59	-17,33028	-175,55910	2325	Temp
SO267_20-1	2 OBS	20.12.	OBS	22:02	-17,32723	-176,05665		OBS Recovery (P3) (continued)
SO267_21-1	BGR18-207	21.12.	Magnetometer	1:03	-17,32515	-176,23683	2305	Transit and mapping
SO267_22-1	22DR	21.12.	Dredge	16:13	-17,18520	-174,71028	1803	1/4 Full
SO267_23-1	23DR	21.12.	Dredge	20:00	-17,30785	-174,71372	2626	1/5 Full
SO267_24-1	AUV308	22.12.	AUV	4:00	-17,93453	-174,66748	1199	AUV (1)
SO267_25-2	25 HF	22.12.	Heat Flow	7:35	-17,67013	-174,61013	2954	Temp
SO267_26-1	Nautilus	22.12.	Jumper	10:07	-17,54248	-174,70730	1415	Not recovered
SO267_27-1	27 HF	22.12.	Heat Flow	11:39	-17,50988	-174,67820	2689	Temp
SO267_28-1	28GC	22.12.	3m Corer	14:09	-17,50995	-174,67827	2781	Empty
SO267_29-1	29GC	22.12.	3m Corer	17:13	-17,55008	-174,65020	2654	Core Catcher Sample
SO267_30-1	30GC	22.12.	3m Corer	20:09	-17,66503	-174,60503	2955	Core Catcher Sample
SO267_31-1	31GC	22.12.	3m Corer	23:13	-17,79705	-174,58722	2218	Core Catcher Sample
SO267_32-1	32GC	23.12.	3m Corer	1:43	-17,86905	-174,52425	2032	Empty
SO267_33-1	33DR	23.12.	Dredge	5:29	-18,00938	-174,52385	1214	1/2 Full
SO267_34-1	34DR	23.12.	Dredge	8:22	-17,90932	-174,51338	1061	1/4 Full
SO267_35-1	35DR	23.12.	Dredge	11:16	-17,80033	-174,46843	1708	3 rocks
SO267_36-1	36DR	23.12.	Dredge	14:54	-17,60507	-174,49293	2332	1/6 Full
SO267_37-1	37DR	23.12.	Dredge	19:35	-17,70623	-174,67748	1951	Few rocks
SO267_38-1	AUV309	23.12.	AUV	23:47	-17,75272	-174,75583	1972	AUV (2)
SO267_39-1	BGR18-208	24.12.	Magnetometer	0:09	-17,75703	-174,76325	1994	Transit and Mapping
SO267_40-1	BGR18-204	25.12.	Streamer/AG/ Magnetometer	2:35	-17,72720	-174,28667	1297	Reflection Seismics (P4)
SO267_41-1	Multibeam	26.12.	EM122	1:32	-17,85020	-175,18060	2436	Transit and Mapping
SO267_42-1	34 OBS	26.12.	OBS	12:17	-18,20013	-176,15148	1876	OBS Deployment (P5)
SO267_43-1	BGR18-205	27.12.	Streamer/AG/ Magnetometer	1:28	-18,22083	-174,43502	1000	Reflection Seismics (P5)
SO267_44-1	BGR18-2R5	28.12.	AG	12:21	-18,34987	-176,34352	2427	Refraction Seismics (P5)
SO267_45-1	34 OBS	29.12.	OBS	16:57	-18,20180	-174,43833	1015	OBS Recovery (P5)
SO267_46-2	BGR18-209	30.12.	Magnetometer	23:04	-18,22193	-176,15457	1959	Transit and Mapping
SO267_47-1	47DR	01.01.	Dredge	1:41	-17,99443	-174,61777	1560	2 rocks
SO267_48-1	48DR	01.01.	Dredge	5:28	-18,00840	-174,73422	1056	Full
SO267_49-1	49DR	01.01.	Dredge	9:33	-18,21205	-174,81558	1350	1 rock
SO267_50-1	50DR	01.01.	Dredge	13:21	-18,14767	-174,93045	1720	1/4 Full
SO267_51-1	Multibeam	01.01.	EM122	15:57	-18,13972	-174,92968	1322	Transit and Mapping
SO267_52-1	52 HF	02.01.	Heat-Flow	0:45	-18,16948	-174,79908	1354	No penetration
SO267_53-1	53 HF	02.01.	Heat-Flow	6:21	-18,27182	-175,06080	2219	No penetration
SO267_54-1	54 HF	02.01.	Heat-Flow	13:20	-18,27350	-175,50763	2471	No penetration
SO267_55-1	AUV310	02.01.	AUV	22:07	-18,18232	-174,81477	1352	AUV (3)
SO267_56-1	56DR	03.01.	Dredge	0:57	-18,09653	-175,16155	2162	Few rocks
SO267_57-1	57DR	03.01.	Dredge	4:43	-18,22312	-175,23385	1787	2/3 Full
SO267_58-1	58DR	03.01.	Dredge	8:27	-18,35537	-175,27018	2100	1/4 Full
SO267_59-1	59DR	03.01.	Dredge	14:18	-18,55467	-174,92717	1403	Few rocks

SO267_60-1	60DR	03.01.	Dredge	20:58	-18,28533	-174,98735	2204	1/4 Full
SO267_61-1	BGR18-210	03.01.	Magnetometer	23:34	-18,27385	-174,98825	2222	Transit and Mapping
SO267_62-1	62 HF	04.01.	Heat-Flow	9:32	-18,27330	-175,88628	3169	Temp
SO267_63-1	63 HF	04.01.	Heat-Flow	14:43	-18,50730	-175,64843	2934	No penetration
SO267_64-1	64GC	04.01.	3 m Corer	17:11	-18,50733	-175,64822	2939	40 cm Sample
SO267_65-1	65DR	05.01.	Dredge	3:50	-18,39767	-175,86410	2495	1/5 Full
SO267_66-1	66DR	05.01.	Dredge	8:48	-18,20707	-175,80843	3079	1/4 Full
SO267_67-1	BGR18-211, 212	05.01.	Magnetometer	12:37	-18,21220	-175,80037	2697	Transit and Mapping
SO267_68-1	68DR	05.01.	Dredge	14:57	-17,96993	-175,81742	1817	Few rocks
SO267_69-1	69DR	05.01.	Dredge	19:27	-17,81747	-175,71725	1006	1/5 Full
SO267_70-1	70DR	07.01.	Dredge	2:19	-18,27582	-174,79153	944	1/8 Full
SO267_71-1	71DR	07.01.	Dredge	5:57	-18,33232	-174,76292	994	1/4 Full
SO267_72-1	AUV311	07.01.	AUV	22:31	-17,81047	-175,69627	915	AUV (4)
SO267_73-1	73DR	08.01.	Dredge	8:24	-18,01392	-175,95288	1697	Few rocks
SO267_74-1	BGR18-213	08.01.	Magnetometer	20:45	-18,08568	-175,99168	2230	Transit and Mapping
SO267_75-1	BGR18-206	09.01.	Streamer/AG/ Magnetometer	2:42	-18,62805	-176,07513	2955	Reflection Seismics (P6)
SO267_76-1	BGR18-214-218	10.01.	Magnetometer	1:26	-18,59588	-174,80712	1768	Transit and Mapping
SO267_77-1	77DR	10.01.	Dredge	7:49	-18,52110	-175,69325	2651	Few rocks
SO267_78-1	78DR	10.01.	Dredge	11:02	-18,51495	-175,68462	2939	1/6 Full
SO267_79-1	AUV312	11.01.	AUV	9:58	-16,83770	-174,53660		AUV (5)
SO267_80-1	30 OBS	11.01.	OBS	20:00	-16,06002	-174,03582	1393	OBS Deployment (P2)
SO267_81-1	BGR18-202, 201	13.01.	Streamer/AG/ Magnetometer	2:28	-15,98710	-175,59315	2160	Reflection Seismics (P1 and P2)
SO267_82-1	BGR18-219	15.01.	Magnetometer	5:48	-15,38325	-175,07592	2065	Transit and Mapping
SO267_83-1	83DR	15.01.	Dredge	12:15	-16,01217	-175,41298		Few rocks
SO267_84-1	84DR	15.01.	Dredge	16:17	-16,10863	-175,36803	2194	Few rocks
SO267_85-1	85DR	15.01.	Dredge	19:56	-16,05378	-175,52958	2020	Few rocks
SO267_86-1	BGR18-2R2	15.01.	AG/ Magnetometer	23:34	-16,06020	-175,66983	2021	Refraction Seismics (P2)
SO267_87-1	30 OBS	16.01.	OBS	22:06	-16,06675	-173,98368	1202	OBS Recovery (P2)
SO267_88-1	AUV313	17.01.	AUV	10:45	-15,90085	-174,85125		AUV (6)
SO267_89-1	BGR18-220	17.01.	Magnetometer	22:36	-16,05615	-175,53553		Transit and Mapping
SO267_90-1	90DR	18.01.	Dredge	8:17	-15,43683	-174,48755	1865	1/2 Full
SO267_91-1	91DR	18.01.	Dredge	11:48	-15,52812	-174,43060	2507	Full
SO267_92-1	92DR	18.01.	Dredge	16:09	-15,67443	-174,62468	1259	Full
SO267_93-1	AUV314	18.01.	AUV	20:00	-15,38378	-174,68138	2077	AUV (7)
SO267_94-1	94DR	18.01.	Dredge	23:17	-15,66277	-175,02888	2375	1/5 Full
SO267_95-1	95DR	19.01.	Dredge	4:05	-15,95160	-174,95560	2083	Few rocks
SO267_96-1	96DR	19.01.	Dredge	8:30	-16,05795	-174,63822	2500	1/4 Full
SO267_97-1	97DR	19.01.	Dredge	12:42	-15,96253	-174,71613	1487	Full
SO267_98-1	BGR18-221	19.01.	Magnetometer	19:00	-15,43377	-174,61390	2041	Transit and Mapping
SO267_99-1	16 OBS 18 MT	20.01.	OBS OBMT	5:44	-17,28367	-175,03880	2363	OBS/OBMT Recovery (P3)
SO267_100-1	AUV315	20.01.	AUV	23:44	-17,33562	-174,58705	2965	AUV (8)
SO267_101-1	HF 101	21.01.	Heat Flow	16:59	-17,32978	-174,20050	1535	No penetration
SO267_102-1	HF 102	21.01.	Heat Flow	21:19	-17,32988	-174,55100	3034	No Penetration
SO267_103-1	103DR	22.01.	Dredge	2:07	-17,52402	-174,91272	1818	1/2 Full
SO267_104-1	BGR18-222	22.01.	Magnetometer	5:06	-17,51437	-174,90572	1569	Transit and Mapping
SO267_105-1	105DR	22.01.	Dredge	23:15	-16,80063	-175,06272	1612	Empty
SO267_106-1	106DR	23.01.	Dredge	2:32	-16,83240	-175,16480	2002	2 rocks
SO267_107-1	107DR	23.01.	Dredge	8:51	-16,48265	-175,11810	2122	Few rocks
SO267_108-1	108DR	23.01.	Dredge	19:37	-16,47523	-175,76577	1112	1/3 Full
SO267_109-1	109DR	24.01.	Dredge	0:13	-16,63822	-175,98035	1402	Few rocks
SO267_110-1	BGR18-223	24.01.	Magnetometer	3:28	-16,63807	-175,9813	131	Transit

EM122 and PARASOUND were operated on all transits. AG= Airguns, HP= heat pulse