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Cruise Report SONNE 157

FOUNDATION 3

Magmatic and Hydrothermal Processes at a Spreading Axis influenced by a Hotspot: the Pacific – Antarctic Ridge and Off-Axis Seamounts near 37°S

Magmatische und Hydrothermale Prozesse einer Spreizungsachse im Einflussbereich eines Hotspots: der Pazifisch – Antarktische Rücken und die Off-Axis Seamounts bei 37°S

Valparaiso, Chile – Easter Island, Chile
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TABLE OF CONTENTS

List of Figures **Page**

List of Tables **Page**

List of Appendices **No. of Pages**

List of Plates

1. SUMMARY

Cruise SO 157 of the FS *SONNE* visited the Pacific–Antarctic Ridge (PAR) adjacent to its intersection with the Foundation Seamount Chain from 36.5–41.5°S. The cruise followed earlier visits to the Foundation Seamounts by the FS *SONNE* (1995) and the NO *L'ATALANTE* (1997), which had discovered silica-rich lavas and indications of widespread hydrothermal activity along this part of the PAR crest and pin-pointed the present-day position of the Foundation mantle plume as ~35 km west of the PAR crest near 37°25'S. Major objectives the SO 157 cruise were to establish the nature of plume–ridge interactions, to define the extent and genesis of silica-rich (>55 wt.% SiO_2) lavas outcropping along the ridge crest, and to investigate the relationship between the silica-rich lavas and widespread hydrothermal activity. A total of 66 stations were completed, comprising 50 dredge stations, 10 TV-grab stations, and 6 OFOS stations. Sea conditions were often marginal and difficult, and shortly after a severe Beaufort 11–12 storm the ship suffered a broken driveshaft bearing. This resulted in the immediate termination of the work program, ~5 days earlier than planned.

The newly installed SIMRAD EM120 system was used to create the first high resolution bathymetric map of the PAR crest. In the northern part of the working area (as far south as 39°48'S), this revealed the presence of numerous narrow 5–15 km-long axial domes that rise 50–100 m above intervening saddles on the PAR crest. Further south, the ridge crest slowly deepens and short ridge segments are separated by a series of left-stepping overlapping spreading centres. A large isolated seamount was identified in the well-developed overlap basin between the major 36.5–41.5°S and 41.5–46.5°S PAR segments.

Recovered lavas (230) ranged from MORB-like aphyric basalt to silica-rich aphyric andesite/dacite. Other lithologies, including plagioclase basalt and sparsely phyric olivine +/- pyroxene bearing rocks, were relatively few. In the absence of phenocrysts, silica-rich lavas were identified by secondary criteria such as the presence of high viscosity flow indicators (elongate and deformed vesicles), supercooling, and conchoidal fractures. Silica-rich lavas predominate in the northern part of the working area. Dacitic lavas outcrop near the top of the axial domes, whereas andesitic lavas are at lower elevations and rarer MORB-like lavas can occur at any depth. In contrast, MORB-like lavas predominate to the south of 39°48'S on the progressively deepening PAR crest. Thick glass crusts characterize many of the very fresh PAR lavas, making them ideal for geochemical analysis. Traces of pyrite–marcasite were commonly observed as thin films coating vesicle surfaces, and pyrrhotite sometimes occurs as magmatic sulfide within the lava. More rarely, thin dustings of Mn oxides coat the weathered older lavas.

A key result of SO 157 is the recognition of silica-rich lavas as far south as the axial dome near 39°48'S. Combined with the results from the earlier FS *SONNE* and NO *L'ATALANTE* cruises, silica-rich lavas have now been recovered from the PAR crest over a distance of 290 km. Unfortunately, the relative proportion of silica-rich to MORB-like lava in the key area from 38.5–39.5°S remains to be established.

Active hydrothermal vents, together with abundant vent fauna and fossil sulfide deposits, were located during the OFOS and TV-grab surveys. Widespread diffuse venting (near-bottom water temperature anomalies up to 0.25°C) was associated with the young silica-rich lavas on the 37°40'S axial dome. Two partly talus-covered sulfide outcrops (~30 m in diameter) and free-standing sulfide spires were observed; the outcrops comprise sulfide rubble with halos of metalliferous sediment and Fe-hydroxide staining. Localized areas of dark dusty hydrothermal sediment, interpreted as recent plume fallout, coincided with weak temperature anomalies.

Similar diffuse venting was recorded at deep fissures cutting the 37°48'S axial dome, which consists of older partly sediment-covered lavas buried by younger sediment-free flows. White hydrothermal fluid was observed near a small sulfide outcrop at one fissure, and the fissures are surrounded by a vesicomyid clam bed with abundant vent fauna. A partly buried and disrupted fossil sulfide outcrop (30 m across) occurs north of the clam field, and includes two large sulfide spires up to 3 m high. Talus from this outcrop is strongly altered, and stained with bright red Fe-hydroxides, yellow jarosite, and bright green atacamite. Recovered sulfide blocks consisted of coalesced pyrite chimneys, massive recrystallised sphalerite and chalcopyrite, and included sulfide-pseudomorphed clams and large worm tubes up to 1.5 cm in diameter.

The faunal communities around the active hydrothermal vents are the first reported from high latitudes on southern hemisphere spreading ridges. They are dominated by *Bathymodiolus* and *Neolepas*, and mobile animals include bythograeid crabs, *Munidopsis*, and zoarcid fish. Unlike *B. thermophilus* found near sulfide-rich vent fluids elsewhere, the gills of recovered *Bathymodiolus* specimens were only moderately hypertrophic and H_2S was not released when the shells were opened. Polychaete worms and snails were collected from the vent sites, and dense beds of dead vesicomyid clams were seen in the peripheral zone. Filter-feeders at the active vents and in the peripheral zone were hexactinellid sponges and sessile crinoids, whereas the more distal zones were dominated by large assemblages of serpulid tubes, actinians, coryphaenid fish and swimming crinoids. The abundance of swimming crinoids at the PAR is possibly unique, and they were a useful indicator of nearby hydrothermal venting.

2. ACKNOWLEDGEMENTS

We thank Captain Henning Papenhagen, his officers and the crew onboard FS *SONNE* for their expert help and advice. The inevitable “wear and tear” problems with the dredges, TV-grab and OFOS were quickly and efficiently repaired, and had no significant effects on our program. Sea and weather conditions were extremely difficult and marginal for much of this winter cruise, as storms travelling north across open ocean from the Antarctic front passed through the working area. A severe Beaufort 11 storm was probably responsible for damage to a driveshaft bearing on the FS *SONNE*, resulting in the immediate termination of the work program ~5 days earlier than planned. This serious breakage was handled calmly and professionally by the Captain, officers and crew. The ship reached Easter Island (~750 miles) at the originally scheduled time without further difficulties or damage to the motors, despite more inclement weather and limited (~30 %) propulsive power.

Thanks are also due to the shipping agents in Valparaiso (I. Mahn; SAAM Ltda) and on Easter Island (J. Edmunds & B. Rapahango; Rapa Ltda) for their assistance with our logistic and travel arrangements. We particularly appreciated the efforts of the Easter Island agents when our arrival time was uncertain, bad weather required us to disembark at the far end of the island (20 km from Hanga Roa), and during check-in at the airport.

The newly installed SIMRAD EM120 system on the FS *SONNE* quickly proved its value, as high quality detailed bathymetric maps of the entire ridge crest and its offsets (~25 km wide swath) were generated after only 2 traverses. All agencies and personnel concerned with the purchase and installation of this system are to be commended.

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3. PARTICIPANTS

FOUNDATION 3 is a multidisciplinary international project led by the University of Kiel (Institute of Geosciences) and the Technical University of Freiberg (Institute of Mineralogy). Other participating research groups are Natural Resources Canada, IFREMER, the Senckenberg Research Institute (University of Frankfurt), the University of Hamburg (Zoological Institute), and the University of Toronto (Dept. of Geology). The 19 scientists in the Shipboard Scientific Party have diverse interests spanning the fields of petrology, mineralogy, geochemistry, economic geology, biology and tectonics. Full contact details for the shipboard scientists are listed in Appendix 1.

Shipboard Scientific Party:

Stoffers, Prof. Dr. Peter	Chief Scientist, PI	IfG-Kiel	Petrology
Ackermand, Dr. Dietrich		IfG-Kiel	Mineralogy
Borowski, Dr. Christian		Uni Hamburg	Biology
Dankert, Susanne		IfM-Freiberg	Economic Geology
Fretzdorff, Dr. Susanne		IfG-Kiel	Petrology/Geochemistry
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Jonasson, Dr. Ian		NR Canada	Economic Geology
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Monecke, Thomas		IfM-Freiberg	Economic Geology
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Weiershäuser, Lars		Uni Toronto	Economic Geology
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Ship's Crew:

Papenhagen, Henning	Captain		
Meyer, Oliver	1st Officer	Guzmann, Werner	Chief Engin.
Baschek, Walter	1st Officer	Rex, Andreas	2nd Engineer
Köthe, Wolfgang	Radio Officer	Klinder, Klaus Dieter	2nd Engineer
Leppin, Jörg	Electronic Engineer	Bekaan, Steffen	Electrician
Hoffman, Hilmar	Chief Electr. Engineer	Fromme, Lothar	Motorman
Wintersteller, Paul	Systems Manager	Kunze, Christian	Motorman
Angermann, Rudolf	Systems Manager	von Arronet, Johann	Motorman
Naeve, Ingo	Doctor	Teichert, Klaus	Motorman
Hermann, Klaus	Chief Cook	Rosemeyer, Rainer	Fitter
Ernst, Arnold	2nd Cook	Horzilla, Ernst	Chief Steward
Lohmüller, Karl-Heinz	Boatsman	Götze, Rainer	2nd Steward
Kraft, Jürgen	A.B.	Hoppe, Jan	2nd Steward
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4. INTRODUCTION

The fast to superfast spreading centres of the SE Pacific form a complex and dynamic tectonic environment that features two active microplates, Easter and Juan Fernandez, and two major mantle plumes, Foundation and Easter (Fig. 4.1). Furthermore, the area also features fossil microplates (e.g., Selkirk- Tebbens and Cande, 1997), abandoned spreading ridge segments (e.g., Galapagos Rise- Eakins et al., 1997), and the distance of both major mantle plumes from the spreading axis has varied with time. Remarkably little was known about the spreading centres south of 36°S until the early 1990s, when the region from 35–56°S was surveyed in detail (Lonsdale, 1994). This survey revealed that the northern part of the Pacific–Antarctic Ridge (PAR) from 36.5–41.5°S was anomalously shallow and at near-constant elevation.

Shortly afterwards, the nearby Foundation Seamounts were visited for the first time by the FS *SONNE* (cruise SO 100; 1995) and subsequently by the NO *L'ATALANTE* (1997). Both of those cruises were primarily concerned with the structure, geochemistry, and origin of the Foundation Seamounts. Key findings were that the Foundation Seamounts reflect the progressive drift of the Pacific Plate over an active mantle plume, that intervals of plume–ridge interaction have occurred in the past (together with microplate development and ridge jumps), and that the Foundation plume is presently located ~35 km to the west of the PAR crest near 37°25'S (Devey et al., 1996; Hekinian et al., 1997; 1999; O'Connor et al., 1998; Maia et al., 2000; 2001; O'Connor et al., 2001).

4.1. Cruise Objectives

Both the FS *SONNE* and NO *L'ATALANTE* cruises briefly visited the PAR adjacent to the Foundation Seamounts in 1995 and 1997 respectively. A major surprise was the recovery of silica-rich lavas (up to 64 wt.% SiO_2) from the PAR crest, in addition to N- and T-MORB (Hekinian et al., 1997; 1999). Among other spreading systems, similar silica-rich (>55 wt.% SiO_2) magmas have been erupted only at the northern East Pacific Rise (10.5°N- Thompson et al., 1989), the 095° propagator of the Galapagos Spreading Centre (Clague et al., 1981), and on Iceland. Widespread evidence of hydrothermal activity along the PAR was also observed.

Based on these results, the present cruise (SO 157) was planned to sample and survey the PAR crest adjacent to the Foundation Seamounts in detail. The prime objectives of the SO 157 cruise were:

- to establish the nature of present day plume–ridge interaction and mantle dynamics beneath the high-standing PAR segment (36.5–41.5°S),

Fig. 4.1: Tectonic setting, bathymetry and working stations on the Pacific–Antarctic Ridge.
Left: SO 157 working area and major tectonic features of the SE Pacific. Satellite-derived bathymetry is from Sandwell and Smith (1997), EM = Easter Microplate, JFM = Juan Fernandez Microplate.
Right: SO 157 working area in detail. The bathymetry is combined high resolution SIMRAD EM120 data collected during both this FS *SONNE* SO 157 cruise and the earlier NO *L'ATALANTE* 1997 cruise (Maia et al., 2000) and the Sandwell and Smith (1997) database. SO 157 stations are shown as black circles, with major topographic features referred to in the text in white. The orange circle is the 10 cm contour of the Foundation plume geoid anomaly (Maia et al., 2000). A black arrow depicts the area from which silica-rich lavas have now been recovered (SO 157, NO *L'ATALANTE* in 1997, and SO 100).

- to determine the extent and genesis of the highly differentiated silicic magmas erupted along this segment,
- to explore the relationship between the silica-rich magmas, widespread hydrothermal activity and sulfide mineralization.

Neither the extent nor mechanism of plume–ridge interaction at the PAR could be determined from the limited number of various N- and T-MORBs (and silicic lavas) recovered by the earlier FS *SONNE* and NO *L'ATALANTE* cruises (7 dredges). However, the high-standing region of the PAR crest extends for ~500 km to the south of the inferred plume position, suggesting plume–ridge interaction over long distances. Nevertheless, geochemical anomalies generated by such interactions are usually far more complicated than simple bathymetric anomalies, as plume material may be irregularly distributed rather than flowing as a simple sheet or cylinder. One objective of SO 157 was to correlate the bathymetric anomaly with the presence of plume-derived material, with the latter quantified by major, trace element and isotopic analyses. Plume–ridge interactions in the Pacific provide a far better test of these issues because spreading rates are significantly higher than those in the Atlantic or Indian Oceans.

One consequence of plume–ridge interactions is the presence of an additional plume-derived magma flux at the spreading ridge, which may enhance the development of a long-term robust magma chamber beneath the ridge crest. Such magma chambers permit the processing and differentiation of primitive basaltic melts into more evolved andesitic and dacitic magmas. Elsewhere, highly differentiated lavas are erupted only at central volcanoes where the magma flux is highest (e.g., Iceland). A cruise objective was to examine whether the silica-rich PAR lavas were restricted to the centre of ridge sub-segments (analogous to Iceland central volcanoes). Furthermore, the generation of silica-rich magmas requires strong cooling of magma chambers within the crust, most probably by hydrothermal circulation. In this case, hydrothermal fields were expected to be spatially associated with the silica-rich lavas. However, other models are possible (e.g., crustal melting). The occurrence of silica-rich lavas along the PAR also raises the question of how continental crust has developed, as Archean tonalites of similar geochemistry are a major component of the oldest continental crust.

Most large sulfide ore bodies are associated with silica-rich lavas. To date, active examples of oceanic hydrothermal systems associated with silica-rich lavas are known from backarc basins (e.g., Manus Basin, Lau Basin), whereas the PAR represents the first and only known occurrence at a spreading centre. Cruise SO 157 was designed in part to establish the spatial and temporal relationships between hydrothermal activity and the silica-rich lavas, to reveal whether the Pb isotope composition of the sulfides reflects the Pb isotope composition of the plume component, and to contrast the geochemistry of sulfides formed in this environment with that of sulfide deposits found in both backarc and

normal mid-ocean ridge settings (e.g., backarc sulfides are commonly enriched in Zn, Pb and Ag).

Four sub-programs were devised to meet these objectives:

- PAR northern axial domes, 37°20'S to 37°40'S. Recent lava flows and several hydrothermal fields were observed by the NO *L'ATALANTE* on several small axial domes throughout this area, and samples obtained during SO 100 included silica-rich lavas. This was also the southernmost known occurrence of hydrothermal vent fauna. Planned station work included OFOS and TV-grab sampling of the mineralization and fauna, together with close-spaced dredging to determine the relative proportion of silica-rich lavas and their extent.
- PAR central axial dome at 37°48'S. This is the largest axial dome on the PAR, features very recent volcanism, and both active and inactive hydrothermal fields were noted by the NO *L'ATALANTE* cruise (they did not sample). Planned station work included OFOS and TV-grab sampling of the mineralization, together with close-spaced dredging to recover lavas at regular intervals across the dome and its surrounds.
- Off-axis seamount at 37°42'S. This seamount is 25 km west of the PAR, represents one of the youngest Foundation Seamounts, and sulfide chimneys were observed in the crater during the NO *L'ATALANTE* cruise (they did not sample the sulfides or rocks). Planned station work included OFOS and TV-grabs to sample the mineralization, and dredging to obtain some of the youngest Foundation lavas (i.e., the plume end-member).
- PAR crest, 36.5–41.5°S. Dredging of the PAR crest at regularly spaced intervals (~10 km) was a major aim of the petrology program in order to determine the full extent of the silica-rich lavas and the region of plume–ridge interaction. The final dredges at both ends were to be on the next major ridge segments, in order to guarantee acquiring MORB with no plume component. A high resolution bathymetric survey of the PAR crest was to be generated during the station transits.

4.2. Cruise Narrative

The Shipboard Scientific Party boarded the FS *SONNE* in Valparaiso (Chile) at 09:00 on 15 June. The containers were taken onboard later in the morning, and unpacked during the afternoon. After bunkering and provisioning were complete, the FS *SONNE* left its berth in Valparaiso at 12:30 on 16 June. The ship had just come out of dry-dock, and thus ~1 hour was spent calibrating the ship's compass in the harbour. The transit to the PAR began at 16:00, and an introductory meeting of the Shipboard Scientific Party was held in the Conference Room later that afternoon.

During the 7 day transit to the PAR, the cruise objectives and the results of previous expeditions to the PAR and Foundation Seamounts by the FS *SONNE* and NO

L'ATALANTE were outlined in a series of afternoon talks given by Karsten Haase, Roger Hekinian, Sven Petersen, Michael Türkay and Christian Borowski. The labs and sampling equipment were prepared. Sea conditions were not particularly good, with heavy swells and waves ranging between 2 and 5 m in height, and the weather was cloudy and cool. The ship slowed for a few hours on 20 June while 6 km of the winch cable was extended and re-wound under tension.

FS *SONNE* reached the first station at the northern axial high of the PAR (37°40'S) early on 23 June. Hydrothermal exploration with OFOS and the TV-grab took place during daylight hours of the next 8 days at the northern and central axial highs of the PAR, and at the large off-axis seamount that represents one of the youngest Foundation seamounts. The petrology program, involving dredging at semi-regular closely-spaced intervals along the northern and central axial highs and off-axis seamounts near the PAR crest, took place overnight. A dredge was lost on 27 June together with 250 m of winch cable; apparently the cable was abraded and severed by rubbing on sharp rocks. Sea and weather conditions remained marginal throughout much of this time, with wave heights often between 4 and 5 m. Dredging overnight on 28 June had to be abandoned due to heavy seas and strong winds.

Damage to the TV-grab occurred on 29 June, when the ship was unexpectedly hit by a series of particularly large waves while the grab was directly under the hull and within 10 m of the surface. Minor technical difficulties also developed with OFOS on 30 June. As almost all targets in the northern area had now been investigated, the ship sailed to the southern end of the work area (41°43'S). During this short 1 day transit, the SIMRAD system generated the first comprehensive bathymetric map of the PAR crest and both OFOS and the TV-grab were repaired.

Dredging of the southern area (~41°40'S) started in the early hours of 2 July, but sea and wind conditions deteriorated throughout the day and the evening program had to be abandoned. A severe Beaufort 11 storm with wave heights of 10 to 15 m then developed, and brought all work to a halt for 48 hours. Dredging re-commenced in the late evening of 4 July when the storm was subsiding. Further dredging and OFOS operations continued in the southern area for the next 3 days, with the ship moving progressively to the north.

A driveshaft bearing needed to compensate for sea heave on the driveshaft broke late on 7 July. This resulted in 50–70 % loss of propulsive power for the FS *SONNE*, as increasing the propeller revolutions led to overheating of the hydraulic oil with risk of damage to the electric engines. Unfortunately, repairing the driveshaft requires specialist equipment and flat sea conditions. The exploration program had to be terminated at this point, and the ship made for Easter Island (~750 miles distant). Sea and wind conditions remained mild for most of the next week as the FS *SONNE* slowly approached Easter Island at speeds varying between 2 and 6 knots, although a sudden severe wind squall was encountered for 8 hours on the evening of 12 July (wind peaking at 45 m/s). The ship reached Easter Island at

daybreak on 14 July. Difficult sea conditions meant the ship had to anchor off the northern end of the island, some 20 km from Hanga Roa. The Shipboard Scientific Party left the ship in the early afternoon, and were taken to Hanga Roa on a bus organised by the ship's agent.

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5. PETROLOGY

5.1. Introduction

The paramount objective of the petrology program was to recover representative lava suites at semi-regular 10 km intervals of the PAR from 36.5–41.5°S in order to determine the area within which silica-rich lavas have been emplaced and allow a subsequent evaluation of plume–ridge interaction. The working area was sub-divided into four regions; (i) the far north PAR crest from 36.5–37.5°S, (ii) the northern PAR crest from 37.5–38.5°S and coincident with the known area of silica-rich lavas and hydrothermal targets, (iii) the central PAR crest from 38.5–39.5°S, and (iv) the southern PAR crest from 39.5–41.5°S. Both the far north and southern work areas terminated on the adjacent major PAR segments. The order of precedence was to be the northern area followed by the southern area, then the central area, and finally the far north as the ship left for Easter Island.

A total of 50 dredges were completed (34 successful), and suitable rock specimens were also returned by 2 of the 10 TV-grabs (the remaining 6 stations were for OFOS). Despite the success of the program, dredging conditions were difficult. Many stations returned 3–10 rocks of small size, yielding only 1–5 rocks suitable for further work. Based on seafloor observations with OFOS and the TV-grab, it is thought that the initial medium-size dredge (and later the smaller tonnen dredge) did not have enough forward weight to scoop rocks from the very gentle and very smooth slopes that prevail along much of the PAR crest. Considerably better rock yields were achieved using a very large heavy dredge late in the program. Figure 4.1 provides an overview of the dredge and TV-grab locations. All targets within the northern and southern areas were achieved. However, the unfortunate breakage of the driveshaft bearing on the FS *SONNE* led to the premature termination of the cruise before the central and far north areas could be dredged.

Porphyritic lavas can readily be classified as basalt, andesite and dacite from their phenocryst compositions and abundances, even in hand specimen. Spreading centres and plume-generated seamount chains present greater difficulties, as the majority of these lavas are aphyric or at most sparsely phyric. Under such circumstances, clues to lava composition can sometimes be garnered from other properties. Silica-rich magmas erupt at lower temperatures, and thus are more likely to show features associated with high viscosity flow (e.g., large or elongated/distorted vesicles, flow banding, pull-apart structures) or supercooling (e.g., glass development and subsequent appearance of devitrification features such as spherulites). Silica contents above 65 wt.% SiO_2 in glassy lavas often lead to the development of conchoidal fractures. Silica-rich lavas may have microphenocrysts or groundmass crystals of pyroxene that can just be discerned. Colour is not a reliable guide, nevertheless many basalts are black to dark grey, most andesites are

grey to blue-grey, and crystalline dacites are usually light grey. Note, however, that glassy varieties of all lavas may be black (e.g., obsidian). None of these properties can take the place of a geochemical analysis, but they do provide some immediate indication of aphyric lava composition to the shipboard scientists.

A summary of the number of samples and lithologies recovered from the dredge and TV-grab stations is given in Table 5.1. In total, 230 samples were recovered from the 36 successful stations, of which 147 were selected for detailed geochemical investigation back in Germany. Notably, most of the selected lavas have fresh glass crusts and are thus ideal for geochemical analysis. Many stations reported only one lithology, although textural variants that may reflect similar lavas of different ages were common. The predominant lithologies were aphyric andesite (16 stations) and aphyric basalt (13 stations), together with plagioclase basalt (10 stations). Other lithologies were rare, and included aphyric dacite (3 stations), olivine-plagioclase basalt (2 stations), olivine basalt (1 station), pyroxene-plagioclase andesite (1 station) and dolerite (1 station).

5.2. Northern PAR Area (37°33'–38°35'S)

5.2.1. Northern Axial High (~37°40'S)

The northernmost dredge station (06-DS) was situated on the lower southern flank of a small axial dome rising to 2230 m depth (Fig. 5.1), and recovered an old MnOx-encrusted and moderately weathered aphyric lava. Trace pyroxene and disaggregating plagioclase-rich clusters suggest a relatively evolved (andesitic?) composition.

Further south, a series of 7 dredge stations were completed along the crest of the northern axial high: a prominent 10 km-long axial dome whose highest point is near 37°40'S at 2170 m depth (Fig. 5.1). The central peak of this axial high was the subject of an intensive mapping program for hydrothermal activity (section 6.1 below). Dredging on the lower to mid-northern flank of the northern axial high recovered a series of relatively old (MnOx rinds) vesicular flow-banded pyroxene-plagioclase andesite lavas often with well-developed glassy crusts (station 05-DS), and pillows of a dark grey aphyric lava (andesite?) with strongly elongate vesicles and a well-developed glass crust (station 15-DS). Lavas from both stations often had thin films of pyrite-marcasite lining the inner surfaces of vesicles, and disseminated fine-grained pyrite occurred in one lava from 05-DS.

Dredging on the northern summit of the northern axial high (station 04-DS) recovered a series of fresh young dark grey to black aphyric lavas (andesite?) with large vesicles and intermittently developed glass crusts, including one particularly glassy lava with well-developed conchoidal fractures (dacite). Similar lavas were recovered from the central summit of the northern axial high (stations 02-DS, 03-DS), and consisted of fresh to weakly weathered, dark grey to black, aphyric lavas with glassy crusts. Changes in the

Table 5.1: Petrology Samples and Lithologies

Station Number	Samples recovered	Selected analysis		Aph Bas	Ol Bas	Ol-Pl Bas	Plag Bas	Aph And	Px-Pl And	Aph Dac	Doler
02 DS	2	2						X			
03 DS	11	6						X		X	
04 DS	7	4						X		X	
05 DS	7	7							X		
06 DS	6	3						X			
12 DS	12	4					X				
15 DS	7	7						X			
17 DS	6	3		X		X	X				
18 DS	7	5		X			X	X			
24 DS	6	4						X			
29 DS	8	3		X							
30 GTV	2	1								X	
31 GTV	7	2						X			
32 DS	1	1						X			
34 DS	4	3					X	X			
36 DS	5	2						X			
37 DS	7	4						X			
38 DS	9	9		X			X				
40 DS	4	3						X			
42 DS	7	6		X							
44 DS	7	5		X							
45 DS	2	2					X				
46 DS	2	2					X				
48 DS	3	2						X			
49 DS	19	12		X			X				X
50 DS	5	3					X				
51 DS	4	4		X							
52 DS	10	5				X					
53 DS	10	8		X	X						
54 DS	6	4		X							
55 DS	4	3		X							
56 DS	5	3		X							
60 DS	1	1		X							
61 DS	7	3					X				
63 DS	8	5						X			
65 DS	12	6						X			
Stns: 36	**230**	**147**		**13**	**1**	**2**	**10**	**16**	**1**	**3**	**1**

Notes

- Samples recovered: the total number of samples collected from each station (Kiel + Freiberg + Toronto).
- Selected analysis: the number of samples selected for analytical work at Kiel (electron microprobe analyses of glass, phenocrysts or sulfides; XRF and ICPMS analyses of glass or whole rock).
- Lithology abbreviations: Aph- aphyric, Ol- olivine, Px- pyroxene, Pl- plagioclase, Bas- basalt, And- andesite, Dac- dacite, Doler- dolerite.
- Stations 07, 11, 16, 21, 22, 23, 27, 28, 35, 43, 47, 57, 58, 59, 62, and 64 DS did not recover any samples.
- Stations 08, 09, 10, 13, 14, 19, 26, and 33 GTV did not recover any rocks (but 08, 09 and 33 GTV did recover two Fe-silica chimneys and a sulfide chimney respectively).
- Stations 01, 20, 25, 39, 41, and 66 were OFOS stations.

Fig. 5.1: Bathymetry and dredge stations in the northern working area, Pacific–Antarctic Ridge 37°30'–38°40'S

degree of weathering, vesicle content, trace plagioclase and in one case trace pyroxene phenocrysts indicate that several different flow units were sampled at these stations. Long and strongly elongated vesicles in some lavas suggest they were relatively viscous when erupted and silica-rich (andesite?). Two lavas were particularly glassy and had well-developed conchoidal fracturing; they are probably dacite. The recovered samples confirm the OFOS and TV-grab observations along the central summit (section 6.1 below), which reveal a very young flow (correlated with the extremely fresh conchoidal dacite) erupted over a series of older flows and pillow mounds.

In marked contrast to these lavas, a series of fresh to moderately weathered pillow basalts with glassy crusts were recovered from somewhat deeper water (>2225 m depth) on the southern flank of the northern axial high (stations 17-DS, 18-DS). Lavas from station 17-DS typically have trace olivine phenocrysts, whereas those from station 18-DS have trace plagioclase and one unit from this site can be classified as a plagioclase basalt.

5.2.2. Central Axial High (~37°48'S)

The central axial high is another prominent 15 km-long axial dome near 37°48'S: This is the longest axial dome on the PAR, and rises to 2210 m depth (Fig. 5.1). The central area of this axial high was also the subject of an intensive mapping program for hydrothermal activity (section 6.2 below). Two TV-grab stations on the central high returned lava samples. Station 30-GTV recovered very fresh glassy dark blue to black aphyric dacite with well-developed conchoidal fractures and abundant devitrification features including incipient spherulites. Station 31-GTV recovered an older unit (MnOx rinds) of dark grey aphyric pillow lava (andesite?) with trace plagioclase and a glass crust. The OFOS and TV-grab observations indicate much of the central axial high consists of a youthful lava plain overlying older partly sedimented flows. Dacite from 30-GTV is interpreted to represent the young lava plain, and andesite from 31-GTV to represent the older lavas.

5.2.3. Northern PAR crest (37°54'–38°35'S)

To the south of the central axial high, the PAR crest was dredged at ~10 km intervals primarily to locate the southern limit of the silica-rich lavas (Fig. 5.1). These dredges took place in slightly deeper water (2230–2260 m). A dark grey aphyric pillow lava (andesite?) with a well-developed glass crust, pull-apart structures and devitrification features, was recovered from station 24-DS. Thin pyrite-marcasite films were noted on some vesicle surfaces in this lava. A series of dark grey aphyric pillow basalts with glass crusts from station 29-DS could be distinguished from their variable trace plagioclase, trace pyroxene and trace olivine contents. One of these units also had pyrite-marcasite films on some vesicles. Continuing south, station 32-DS returned another dark grey aphyric pillow lava (andesite?) with a glass crust and more pyrite-marcasite films on vesicle surfaces. Sulfide-coated vesicles seem to be an almost ubiquitous feature of this region. Lavas from the next

two potential dredge sites were obtained during the SO 100 cruise of 1995 (Fig. 5.1), and these dredges were not repeated during SO 157. Station 91-DS of SO 100 recovered aphyric dacite, and station 92-DS returned glassy aphyric andesite.

Stations 36-DS and 40-DS were located on the northern and southern summit (respectively) of a ridge built where the southern Foundation chain intersects the PAR crest (Figs 4.1, 5.1). Dredging at both stations recovered blue-grey aphyric pillow lavas (andesite?) with glass crusts. Trace plagioclase and pyroxene are present in the lava from station 36-DS. Lavas at these two stations were nearly indistinguishable from those recovered at the nearby off-axis stations 34-DS and 37-DS (section 5.2.5 below).

A significant structural change occurs to the south of 38°20’S, where the PAR crest deepens by ~50 m to 2255–2270 m and remains essentially flat for a considerable distance (Figs 4.1, 5.1). Lavas recovered from this region also differ, and were predominantly aphyric pillow basalts with thin but well-developed glass crusts. Several units with different degrees of glass development, trace plagioclase, vesicle contents and MnOx crust development were recovered from station 42-DS, similar but younger lavas lacking MnOx crusts from station 44-DS were characterized by spectacular pillow tubes and internal lava drips, and pillows of plagioclase basalt were recovered from station 45-DS.

The shipboard interpretation of these results is that silica-rich lavas predominate along the PAR crest from the northern and central axial domes at least as far south as 38°20’S. Relatively few MORB-like lavas were recovered from stations in this area (e.g., station 29-DS), and these tend to be the stations at lower elevations. A major change in PAR structure and lava composition occurs near 38°20’S, with more MORB-like lavas predominating to the south.

5.2.4. Off-axis seamount: the central Foundation chain at 37°42’S

The large off-axis seamount at 37°42’S represents the easternmost seamount on the central Foundation chain, and is adjacent to the PAR (Figs 4.1, 5.1). It is one of the youngest Foundation Seamounts, and has a probable age of 0.2–0.3 Ma (based on an extrapolation of known Foundation Seamount Ar/Ar ages). Hydrothermal deposits were observed in its 3 km-diameter crater during the NO *L’ATALANTE* cruise, and re-visited during SO 157 (section 6.3 below). Observations made during SO 157 suggest the last major activity involved catastrophic draining of a large lava lake, probably contemporaneous with a major flank eruption, to produce the precipitous walls of the crater. Subsequent minor eruptions have partly re-surfaced the crater, and are notably less sediment-covered.

Two attempts were made to dredge the seamount, with the aim of recovering either young Foundation plume lava or a plume-rich mix of Foundation–PAR lava. An attempted dredge on the upper SE flank failed to return any rocks (station 11-DS). However, numerous mildly weathered glassy pillow tubes composed of strongly porphyritic

plagioclase basalt were recovered from the mid-SE flank of the seamount (station 12-DS). All blocks represent the same distinctive lithology, and testify to a magmatically robust system involving magma chamber development in the past. Both the mild degree of weathering, thin MnOx dusting, and OFOS/TV-grab observations indicate the seamount has been inactive for a significant period of time.

5.2.5. Off-axis seamounts: the southern Foundation chain near 38°15'S

Further south, the southern Foundation chain intersects the PAR near 38°15'S (Figs 4.1, 5.1). This area is characterized by seamounts on both sides of the PAR crest, and only here do the Foundation seamounts appear to cross to the eastern side of the PAR. Nevertheless, the large easternmost seamount (~60 km east of the PAR crest) was dredged during SO 100 and the recovered lavas were N-MORB. Three dredges, one to the west of the PAR crest and the other two to the east (Fig. 5.1), were completed during SO 157 to verify the presence or absence of Foundation plume material.

Dredging of the seamount 12 km west of the PAR crest recovered two lithologies (station 34-DS); (i) fresh glassy black aphyric pillow tubes with traces of olivine and plagioclase phenocrysts, complete with spherulites and other devitrification features that suggest a relatively silica-rich and probably andesitic composition, and (ii) somewhat older MnOx-coated pillow sectors of glass-encrusted plagioclase basalt. Glass-encrusted pillow sectors of grey aphyric lava (andesite?) were recovered from the upper flanks of the large seamount 5 km east of the PAR crest (station 37-DS). Further east, older MnOx-encrusted lavas consisting of porphyritic plagioclase basalt and two different flows of vesicular, sporadically glassy, aphyric basalt with traces of plagioclase were obtained from the upper flanks of a narrow eastward-striking ridge 18 km east of the PAR crust (station 38-DS).

Samples from the closer eastern and the western off-axis seamounts near 38°15'S are indistinguishable from those elsewhere along the northern PAR crest, in particular those from the on-axis stations 36-DS and 40-DS near this location. However, the strongly porphyritic plagioclase basalt from the ridge 18 km east of the PAR crest closely resembles the distinctive strongly porphyritic lavas of the central Foundation chain seamount at 37°42'S. Geochemical analyses are needed to investigate the presence of any plume-derived component in these lavas.

5.3. Southern PAR Area (39°30'–41°43'S)

5.3.1. Southern PAR crest (39°30'–41°23'S)

The PAR crest was dredged at 10–20 km intervals throughout the southern area from 39.5–41.5°S (Figs 4.1, 5.2, 5.3), in part to ascertain whether silica-rich magmas had erupted and in part to clarify whether plume–ridge interactions persist this far south. Four

Fig. 5.2: Bathymetry and dredge stations in the northern part of the southern working area, Pacific–Antarctic Ridge 39°25'–40°20'S

Fig. 5.3: Bathymetry and dredge stations in the southern part of the southern working area, Pacific–Antarctic Ridge 41°00’–41°40’S

axial domes are located in the northern part of this area at 39°20', 39°27', 39°33' and 39°40'S respectively, but further south the PAR is characterized by a series of short (5–22 km-long) ridge segments separated by left-stepping overlapping spreading centres at 39°48', 40°09', 40°34', 40°55' and 41°19'S. Attempts were made to obtain lavas from both the eastern and western limbs of the overlappers, but time constraints prevented several unsuccessful dredges from being repeated.

Viscous lava flows observed during station 66-OFOS near the summit of the 39°27'S axial dome in water depths as shallow as 2030 m suggest outcrops of silica-rich lava (Fig. 5.2, section 6.4 below). However, these could not be sampled due to the breakdown of the ship at this time. Dredging across the PAR crest between the 39°27'S and 39°33'S axial domes at 2190 m depth recovered highly vesicular fresh black aphyric lava (andesite?) with trace plagioclase and a well-developed glass crust, together with an older comparable flow bearing skeletal pyroxene needles up to 3 mm long (station 65-DS). Similar black aphyric lava (andesite?) with trace olivine, plagioclase and skeletal pyroxene needles up to 1 cm long, a thick glass crust, strongly elongated vesicles and numerous xenoliths of older lavas, was recovered from station 63-DS in 2250 m of water at the junction between the area characterized by axial domes and that characterized by overlapping spreading centres. Several lavas from both of these stations had pyrite-marcasite linings on some vesicles. The thick glass crusts, elongate vesicles and supercooling features testify to the silica-rich nature of lavas from these stations, and it is evident that silica-rich lavas have been emplaced on the axial domes as far south as 39°48'S.

To the south of 39°48'S, the PAR crest deepens by 50 m to 2300 m and depths progressively increase to 2500 m before the southern end of the work area (Figs 5.2, 5.3). This is again reflected by changes in lava composition. No further evidence of silica-rich lavas was found south of station 63-DS. Lavas recovered from the rest of this segment were instead dominated by rather monotonous MORB-like dark grey aphyric pillow basalts with thin glass crusts and often trace plagioclase +/- olivine, varying from fresh to weakly weathered (stations 60-DS, 56-DS, 55-DS, 54-DS, 53-DS, 51-DS). Plagioclase basalt with a thin glass crust was recovered from stations 61-DS and 50-DS, whereas pillows of olivine basalt were found at station 53-DS and olivine-plagioclase basalt at station 52-DS.

5.3.2. Off-axis seamount: the southern overlap basin at 41°22'S

A large isolated conical seamount rising to 2200 m depth, 6 km in diameter and 450 m-high, has been built within the overlap basin at 41°22'S and is closer to the eastern limb than the western limb (Fig. 5.3). The summit of this seamount was dredged (station 49-DS), and a wide range of lithologies was recovered. A series of very fresh to moderately weathered (the latter MnOx-encrusted) aphyric basalts predominate, with variably developed thin glass crusts and occasional trace plagioclase +/- olivine. One of the older

flows has been weakly silicified and contains traces of disseminated pyrite. Less common is strongly porphyritic plagioclase basalt, and this unit is always MnOx-encrusted and weakly weathered. Columnar jointed blocks of weathered dolerite, consisting of sub-equal plagioclase and pyroxene with local traces of olivine, were also recovered.

The mixed variety of lavas from the seamount testify to long-lived magmatism, which at times was evidently robust (e.g., strongly porphyritic lavas from a magma chamber, hydrothermal alteration). Dolerite outcrops suggest a significant interval of erosion or collapse in the recent past, followed by a mild resurgence of magmatism and eruption of the freshest aphyric lavas.

5.3.3. Next major segment to the south (41°29'–41°43'S)

The PAR crest on the eastern side of the southern overlap basin was dredged at two localities in order to obtain lavas from the next segment of the PAR (Fig. 5.3). The PAR crest on this segment is lower than in the main working area to the north, and is mostly between 2500 and 2550 m depth. Fresh black aphyric lava with elongated vesicles and pyrite-marcasite films forming on vesicle surfaces was recovered from station 48-DS at the northern end of the segment, just within the curved zone of decreasing spreading rate. The elongated vesicles suggest a viscous composition (andesite?). Both the youthful age and apparent silica-rich composition of this flow were a surprise, as this side of the overlap basin was predicted to be the dying limb and not magmatically robust. Further south, a series of MORB-like dark grey plagioclase basalts with thin glass crusts were recovered from station 46-DS.

5.4. Summary and Unresolved Issues

Silica-rich lavas were recovered from the northernmost station at 37°33'S as far south as 39°48'S. Combined with the results from the earlier FS *SONNE* and NO *L'ATALANTE* cruises, silica-rich lavas have now been recognised along a 290 km-long section of the PAR extending from 37°11'–39°48'S. This unexpected result indicates that silica-rich volcanism can be widespread along spreading centres influenced by mantle plumes, and raises questions concerning the generation and composition of average oceanic crust. However, the presence or absence of a plume component in all of these lavas will await geochemical analysis.

At the time the dredge program terminated, three issues remained to be resolved:

- Does silicic volcanism occur along the central PAR crest from 38°30'–39°30'S? Silicic volcanism in the north appears to cease near 38°15'S, with MORB-like lavas recovered from 38°15'–38°30'S. However, we discovered a second area of widespread silicic

volcanism from 39°30'–39°48'S. Because of the ship breakage, no dredges could be completed in the area joining these two regions.

- Do the small off-axis seamounts west of the PAR from 38°45–39°40'S represent flow of material from the Foundation plume towards the PAR crest? The geochemistry of these seamounts is important for resolving the question of plume-ridge interaction in the southern area of silica-rich volcanism.
- What is the northern limit of silica-rich volcanism and plume-ridge interactions along the PAR? Further dredge stations are needed to the north of 37°30'S to determine this limit.

6. SEAFLOOR OBSERVATIONS AND TV-GRAB SAMPLING

A total of 4 successful camera tows and 10 TV-guided grab stations were completed in order to locate, map and sample areas of hydrothermal activity along the Pacific–Antarctic Ridge (PAR), and at an off-axis seamount near the eastern end of the Foundation Seamount Chain. Summary tables of these stations are given below (Tables 6.1, 6.2). Each working area is described separately in this report, and a geological map of its main features is provided. Detailed geological observations for each area can be found on a series of 4 fold-out maps in the back-cover envelope.

6.1. Northern Axial High (PAR 37°40'S) [Stations 01-OFOS, 20-OFOS, 13-GTV, 14-GTV, 19-GTV]

6.1.1. Summary

OFOS-01 and OFOS-20 were surveys of the central cleft of the northern segment of the PAR, along the original 1997 SCAMPI-2 and 1995 SO-104 EXPLOS tracks (Figs 6.1, 6.2). During OFOS-01 two tracks were mapped, the first going from south to north along the central cleft and the west wall, followed by a return track north to south along the east wall and central cleft (OFOS-01 and continued during OFOS-20). Approximately 5 km of the ridge axis was mapped (6 line-km during OFOS-01 and 3 line-km during OFOS-20).

The main feature of interest was a large field of very fresh, glassy lava onlapping two generations of older pillows and sheets in the southern half of the axial cleft. The new lava flows occupy a total area of about 1 km^2 (ca. 3,500 m x 200 m). These lavas seem to have erupted since the SCAMPI-2 survey of 1997 and possibly within the last year. The fresh lavas appear to have erupted along a series of now buried fissures in the south central part of the cleft, indicated by the location of collapse pits. Older, mainly tectonic fissures are exposed at the southern end of the cleft, adjacent to the east wall. Widespread diffuse venting occurs over a strike length of more than 3 km along the talus-covered walls of the central part of the axial cleft and is also associated with the most recent lavas. Several outcrops of older sulfide material were observed in the talus along the east wall of the cleft and have been partly buried by younger lava flows.

6.1.2. Structure

The axial high in this area is dominated by a series of large pillow ridges or mounds on opposite sides of the central cleft. These ridges are 1–2 km in length, 0.5–1 km wide and 60–70 m high and are composed of large sedimented pillows. Near vertical walls 30–50 m in height occur along the inner margins of the pillow mounds with extensive talus slopes at

Table 6.1: Summary of OFOS Stations

Station (date)	On bottom (UTC)	START Lat. (S) Long. (W)	END Lat. (S) Long. (W)	Comments
01-OFOS (23.06.01)	16:06 –22:07	37°39.754 110°52.513	37°40.249 110°52.661	771 slides, very fresh lava covering older lava generations, talus, old pillow mounds, inactive sulfide chimneys, diffuse low temperature flow and biological communities
20-OFOS (26.06.01)	19:50 –23:53	37°39.240 110°52.408	37°40.821 110°52.476	780 slides, very fresh lava covering an older lava generation, talus, old pillow mounds, inactive sulfide chimneys, diffuse low temperature flow and biological activity
25-OFOS (27.06.01)	16:37 –20:51	37°46.202 110°54.516	37°47.927 110°54.984	404 slides (two rolls), N–S track along the bathymetric high; massive sulfides and a large hydrothermal faunal community were observed (+ possible smoker ?)
39-OFOS (30.06.01)	15:48 –15:53	38°04.226 110°59.646	38°04.271 110°59.651	Abandoned due to technical problems
41-OFOS (01.07.01)	–	–	–	Abandoned due to technical problems at a water depth of 140 m
66-OFOS (08.07.01)	00:03 –04:45	39°24.003 111°18.448	39°26.499 111°19.434	596 slides, N–S track along axial high consisting of large (1–2 m diameter) pillows and tubes, lava morphology suggests the occurrence of felsic rocks

Table 6.2: Summary of TV-Grab Stations

Station (date)	On Bottom (UTC)	*START Lat. (S) Long. (W)	*END Lat. (S) Long. (W)	Comment
08-GTV (24.06.01)	18:32 –19:26	37°42.265 111°07.327	37°42.215 111°07.735	Fe-oxides recovered
09-GTV (24.06.01)	21:57 –23:30	37°42.226 111°07.765	37°42.232 111°07.745	Fe-oxides recovered
10-GTV (25.06.01)	02:10 –04:47	37°42.396 111°08.402	37°42.386 111°07.539	No samples
13-GTV (25.06.01)	14:52 –17:17	37°38.313 110°52.029	37°38.566 110°51.779	No samples
14-GTV (25.06.01)	19:31 –23:11	37°38.139 110°52.079	37°38.141 110°52.009	No samples
19-GTV (26.06.01)	15:02 –17:23	37°38.227 110°52.062	37°38.370 110°52.098	No samples
26-GTV (28.06.01)	00:03 –02:40	37°47.409 110°54.843	37°47.480 110°54.908	No samples
30-GTV (28.06.01)	16:14 –18:57	37°47.448 110°54.856	37°47.467 110°54.868	Glassy silica-rich lava and vent related fauna (crabs, mussels, barnacles, polychaetes)
31-GTV (28.06.01)	21:41 –22:55	37°46.541 110°54.623	37°46.544 110°54.633	Glassy basalt and a few very small pieces of massive sulfide
33-GTV (29.06.01)	17:00 –18:36	37°46.555 110°54.615	37°46.558 110°54.635	45 kg of pyritic massive sulfide and one piece enriched in chalcopyrite + sphalerite cemented by silica. Fossil worm tubes and possibly shells are present

* Co-ordinates give the ship's position

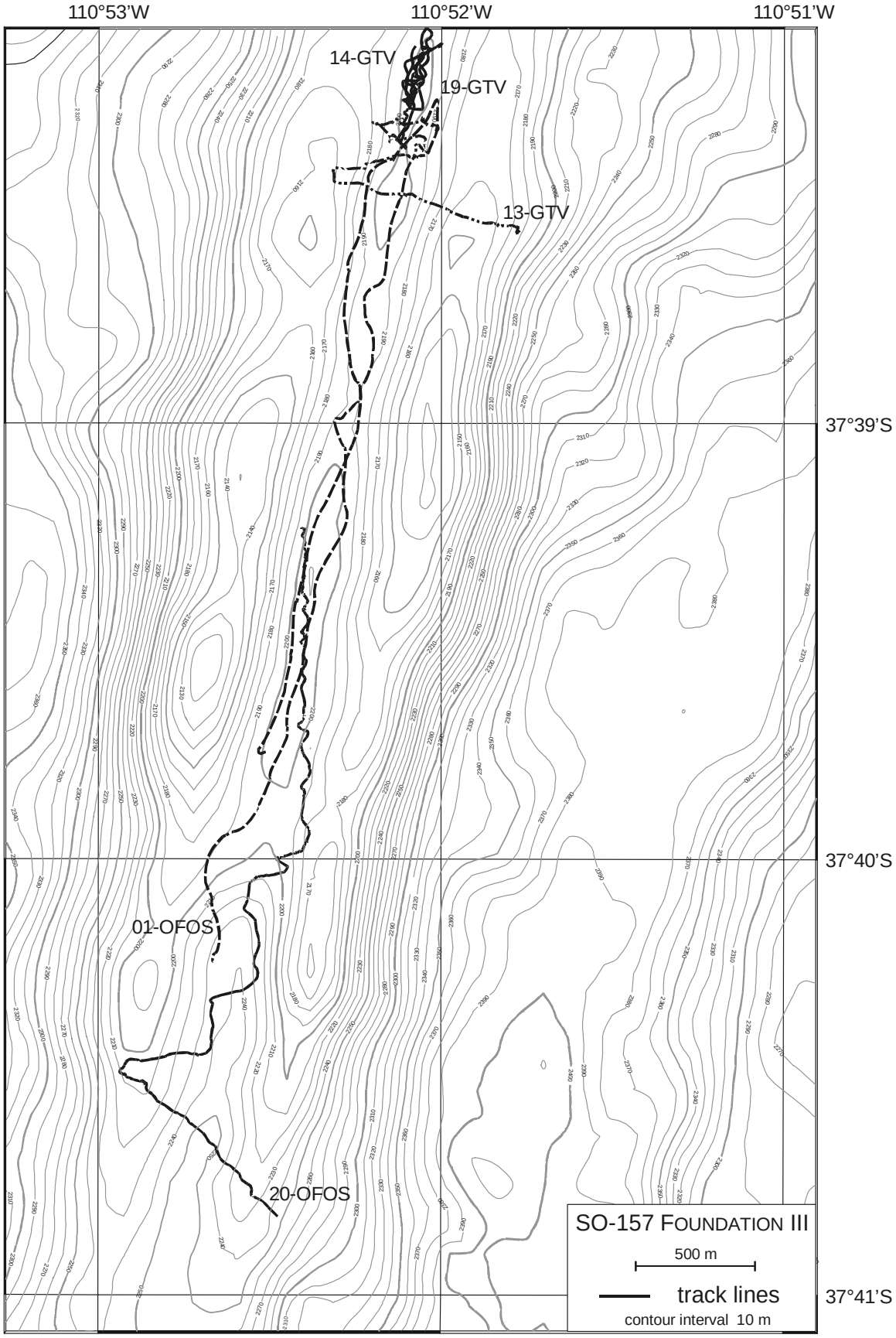

Fig. 6.1: Bathymetry and station tracks across the northern axial high of the Pacific–Antarctic Ridge.

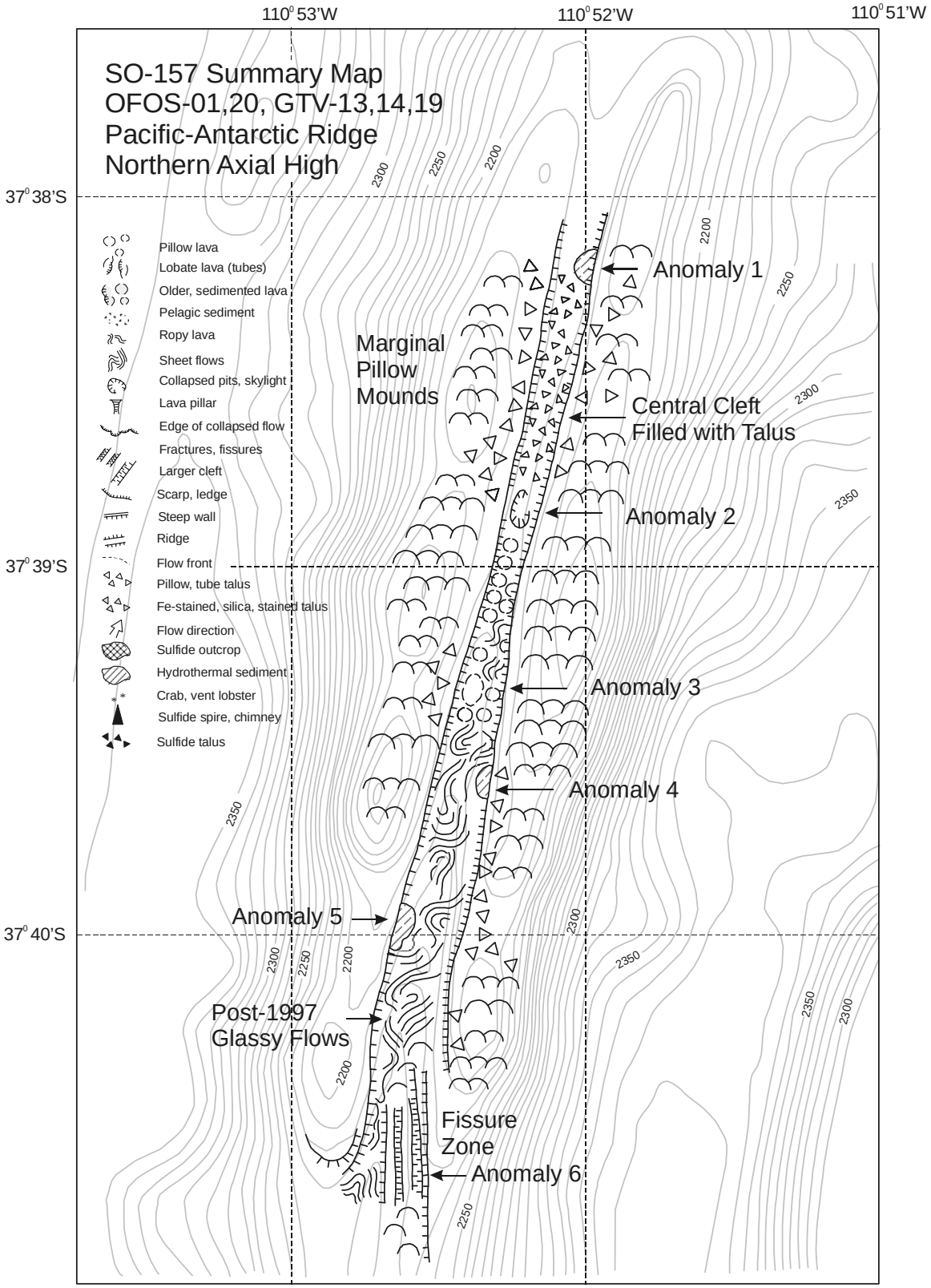

Fig. 6.2: Geological summary for the northern axial high of the Pacific–Antarctic Ridge.

their base, up to 75 m wide and 10–20 m high. Pillows and tubes shed from the ridges are found locally among the fresh lavas within the central cleft. The high inner walls of the cleft that have dissected the older pillow ridges indicate that this part of the ridge is at an advanced rifting stage.

The central cleft is less than 100 m wide at the northern end of the survey area and broadens to 200 m in an area of ponded fresh lavas in the south. In the northern half of the survey area, the cleft is filled with talus from the adjacent pillow ridges; the southern half is filled with more recent, fresh glassy lavas. A 50–100 m wide fissure zone adjacent to the east wall of the central cleft was mapped at the southern extension of the young glassy flows (OFOS-20). The fissure zone consists of a cluster of deep, 2–10 m wide fissures that appear to be mainly tectonic in origin. The fissures occur in an earlier generation of lavas that occupied the central cleft before the most recent glassy lavas were erupted (see Series II lavas below).

6.1.3. Volcanism

At least four generations of lava are evident along the ridge axis. The youngest lavas (Series I) consist of small glassy pillows, lobate and ropy lava flows, and broken sheet flows with collapsed pits. These lavas were not observed on parallel camera tracks in 1995 or 1997. The glassy flows are completely free of sediment, and obvious water-escape features are still evident among the pillows. A light dusting of Fe-oxides and silica is common between the pillows and is thought to be a product of trapped and heated seawater escaping from beneath the flows during eruption. This Fe-oxide floc typically does not last for more than a few months after an eruption, eventually dissolving back into seawater, and confirms that the lavas are very young. The glassy lavas clearly onlap the most recent talus along the margins of the cleft. No talus was observed on top of the lavas, indicating little or no mass wasting of the cleft walls since their eruption. Local collapse features were found at the southern end of the survey area, possibly indicating ponding of the recent lavas where the axial cleft is widest. New lavas occupy the entire width of the central cleft in this area, and the collapse features indicate drain-back. The eruptive fissures may have been partly buried by the younger, glassy lavas. At the northern limit of the glassy lavas, the flows consist mainly of small pillows (<1 m diameter).

At least two generations of older lavas could be seen beneath the fresher, glassy lavas. Series II lavas are related to pre-1997 eruptions and consist of pillows, lobate flows, rare sheets and ponded lavas. The pre-1997 pillows have a very light dusting of pelagic sediment trapped in expansion cracks on the surfaces of the pillows. They typically lack fresh glass or have faded glassy surfaces. Lavas of a similar age are widespread on other parts of the ridge (see OFOS-25). A number of old pillars were observed in the Series II lavas, near the central part of the map area, indicating local ponding of these older lavas. Series III lavas comprise moderately sedimented pillows and lobes and are observed

infrequently within the cleft in windows through the two younger generations of lava. The glass on these lavas has completely spalled off into hyaloclastite-filled pockets surrounding the larger pillows. These lavas may be related to eruptions that built the older pillow mounds and ridges at the margins of the cleft. The oldest generation of lava (Series IV) occurs on top of the marginal highs and consists of large, 2-m diameter, sediment-covered pillows.

6.1.4. Hydrothermal Activity and Fauna

Diffuse hydrothermal venting was observed at six locations along the length of the cleft. One site was observed in talus at the northernmost end of the cleft segment (see also 13-GTV, 14-GTV, and 19-GTV). Warm water venting also occurs in at least three locations within the fresh glassy lavas, with near-bottom temperature anomalies of 0.1–0.25°C (Figs 6.3, 6.4). Diffuse venting elsewhere in the cleft is indicated by widespread occurrences of vent specific fauna (e.g., vent crabs, vent lobsters) and Fe-oxide and silica stained talus. Staining of the talus and broken sheets and pillows also suggests that low-temperature discharges may be common along the walls of the cleft. Dredged samples revealed mainly Fe-oxides and silica lining the exposed fractures on the talus and pillow fragments.

A distinctive zonation in bottom fauna was evident in the area of the temperature anomalies, from outermost populations of swimming crinoids and rat tail fish to innermost populations of vent crabs and vent lobsters. Local concentrations of barnacles and polycheates were also observed in areas of altered talus. However, no obvious bacterial mats were observed colonising the diffuse vents.

Near-bottom anomalies of up to 0.25°C were measured above several of the large fissures along the eastern wall of the cleft at the southern end of the map area. No obvious hydrothermal products were observed in the fissures, although a number vent crabs, barnacles and swimming crinoids were found in this area. The diffuse venting associated with the fissure zone likely reflects deep fracturing and faulting along the margins of the cleft and escape of warm water through the fractured lavas. This venting may be distinct from the more widespread warm-water venting associated with the recently erupted (Series I) glassy lava flows closer to the center of the cleft.

6.1.5. Mineralization

Hydrothermal sediments were observed at five locations: two associated with old, partly oxidized sulfide outcrops, and three areas of dark dusty sediment with the appearance of plume fallout. The occurrence of plume fallout coincided with weak temperature anomalies in the bottom water. Two sites (40–50 m in diameter) were located in collapsed lava pits in the central part of the cleft. One was close to a location of vent clams observed in 1995 (SO-100). A third area of plume fallout, up to 100 m in strike length, occurs in fresh glassy lava at the southern end of the cleft. This site was populated by crabs and other vent-

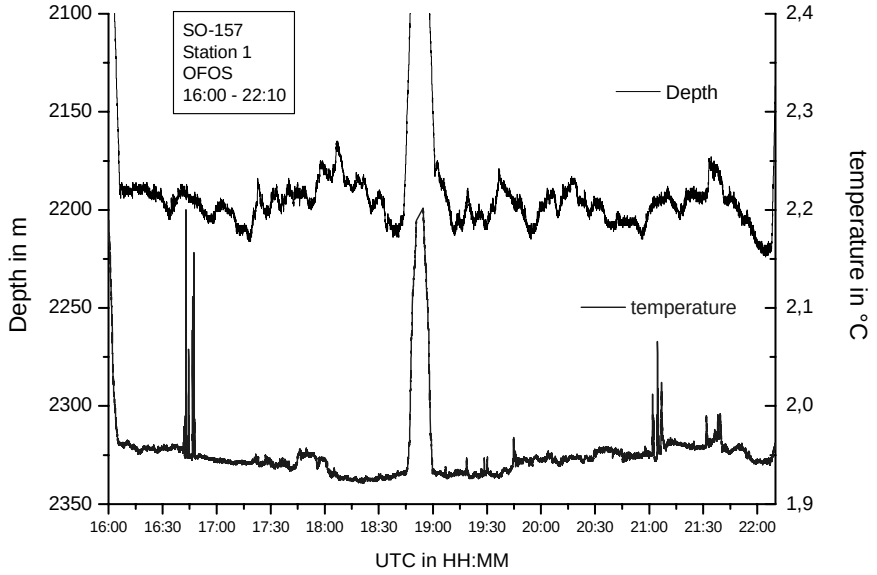

Fig. 6.3: Potential temperature and depth profile over time for station 01-OFOS. The track consists of 2 subprofiles, one from south to north and a parallel track going south. Note that the OFOS was brought up between the two subprofiles, hence the strong increase in depth and temperature from 18:45 to 19:00 UTC.

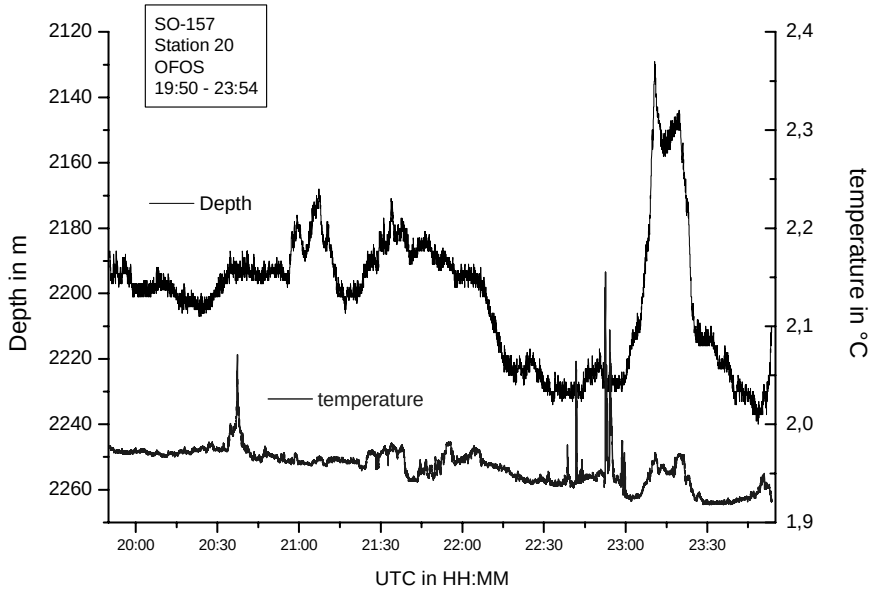

Fig. 6.4: Potential temperature and depth profile over time for station 20-OFOS. The track starts parallel to the second profile of station 01-OFOS and continues further south. The steep cliff encountered at 23:05 is the western wall of the central cleft which the OFOS had to climb up and then returned to the central cleft.

related fauna including barnacles and rat tail fish. A source for the plume fallout was not located, however, the dark color of the sediment suggests that this fall-out was recent (most plume-fallout oxidizes rapidly to bright red and orange Fe-oxides) and may be an indication of recent black smoker activity somewhere along the cleft.

Two partly buried and weathered sulfide outcrops were found along the eastern wall of the central cleft, close to the northern limit of mapping and in the central part of the cleft. The outcrop areas are less than 25–30 m in diameter and comprise mainly sulfide rubble with haloes of metalliferous sediment and Fe-oxide staining extending up to 25 m from the outcrops. The northern site was located within old talus along the east wall. Free-standing structures (old spires) were observed at this site, but no obvious fauna were associated with the sulfide outcrops (see 13-GTV, 14-GTV, and 19-GTV). The southern site was at the edge of the glassy lava flows where they onlap talus from the east wall. A small temperature anomaly was recorded at both sites, but the weathered nature of the sulfides suggests that they are part of older vent fields. The sulfides are partly covered by talus and are likely associated with older generation lavas.

6.2. Central Axial High (PAR 37°47.5'S) [Stations 25-OFOS, 26-GTV, 30-GTV, 31-GTV, and 33-GTV]

6.2.1. Summary

OFOS-25 surveyed the axial high of a central segment of the northern PAR, immediately opposite the youngest of the Foundation Seamounts. Approximately 3.5 km of the ridge axis was mapped by OFOS (Figs 6.5, 6.6); two hydrothermal areas (fossil and active) were also mapped during GTV-26, 30, 31 and 33. This part of the ridge is characterized by an elongate axial high approximately 15 km in length, which is oriented at an oblique angle to the axis of spreading. The orientation of the axial high on this part of the ridge may be related to proximity of the adjacent seamount chain. No obvious central cleft was observed, but the constructional high exhibits a tectonic fabric which is co-linear with the rest of the ridge. Two generations of lava have built up the axial high. An older series of sedimented pillows and locally collapsed lavas occurs in the central part of the axial high. Younger glassy flows cover the sedimented pillows and locally infill collapsed features in the older flows. A presently active low-temperature vent field was located in the south. This site consists of a series of deep fissures in the relatively young, unsedimented lavas of the southern lava plain. The fissures are surrounded by a large mussel bed (up to 50 m in diameter), with abundant living animals and older clam shells. Warm water venting occurs in several of the fissures, with near-bottom temperature anomalies of up to 0.25°C. White smoke was observed in the water column near an exposure of sulfides, but the active vent could not be located. A fossil sulfide occurrence was located in the northern

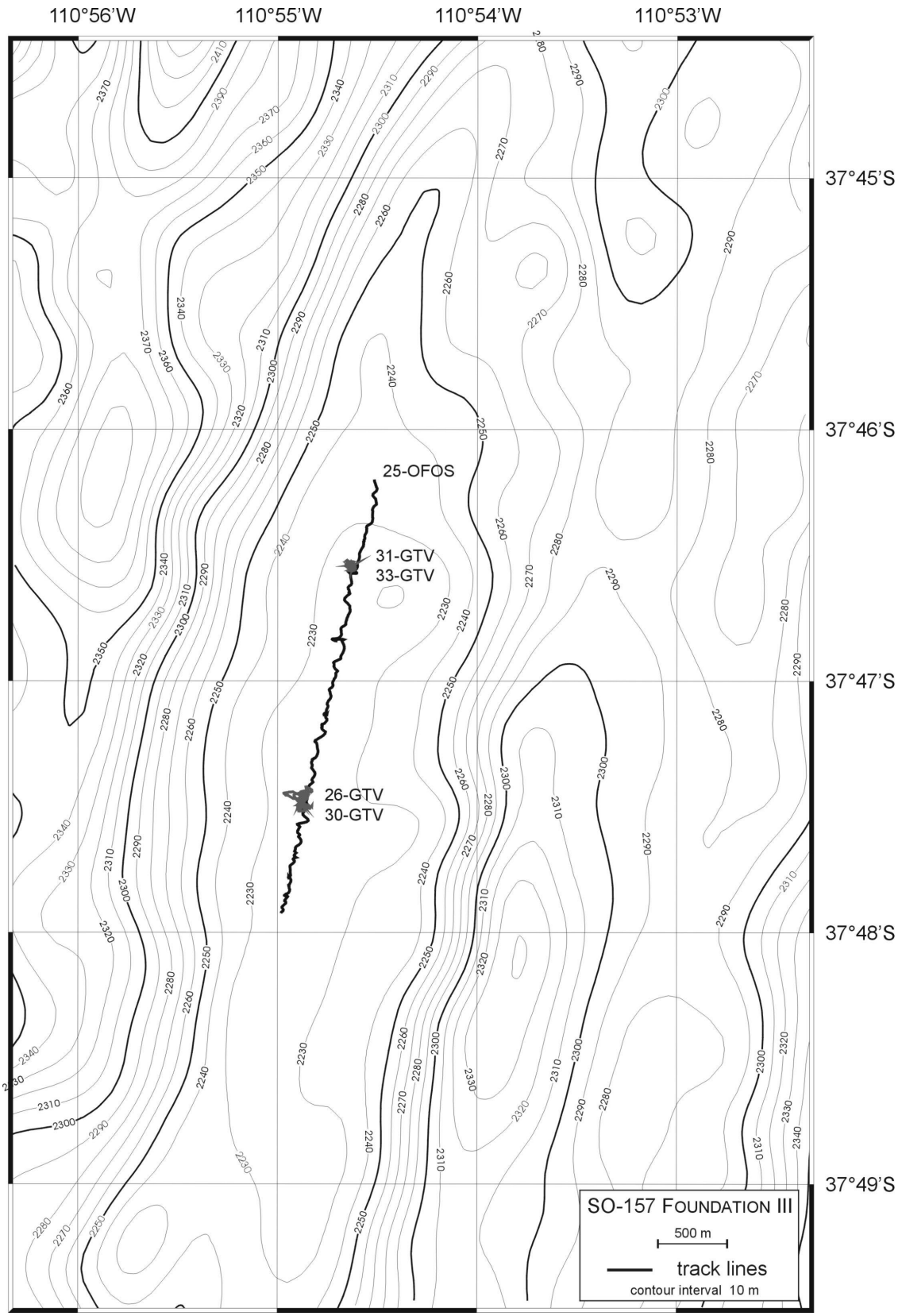

Fig. 6.5: Bathymetry and station tracks across the central axial high of the Pacific–Antarctic Ridge.

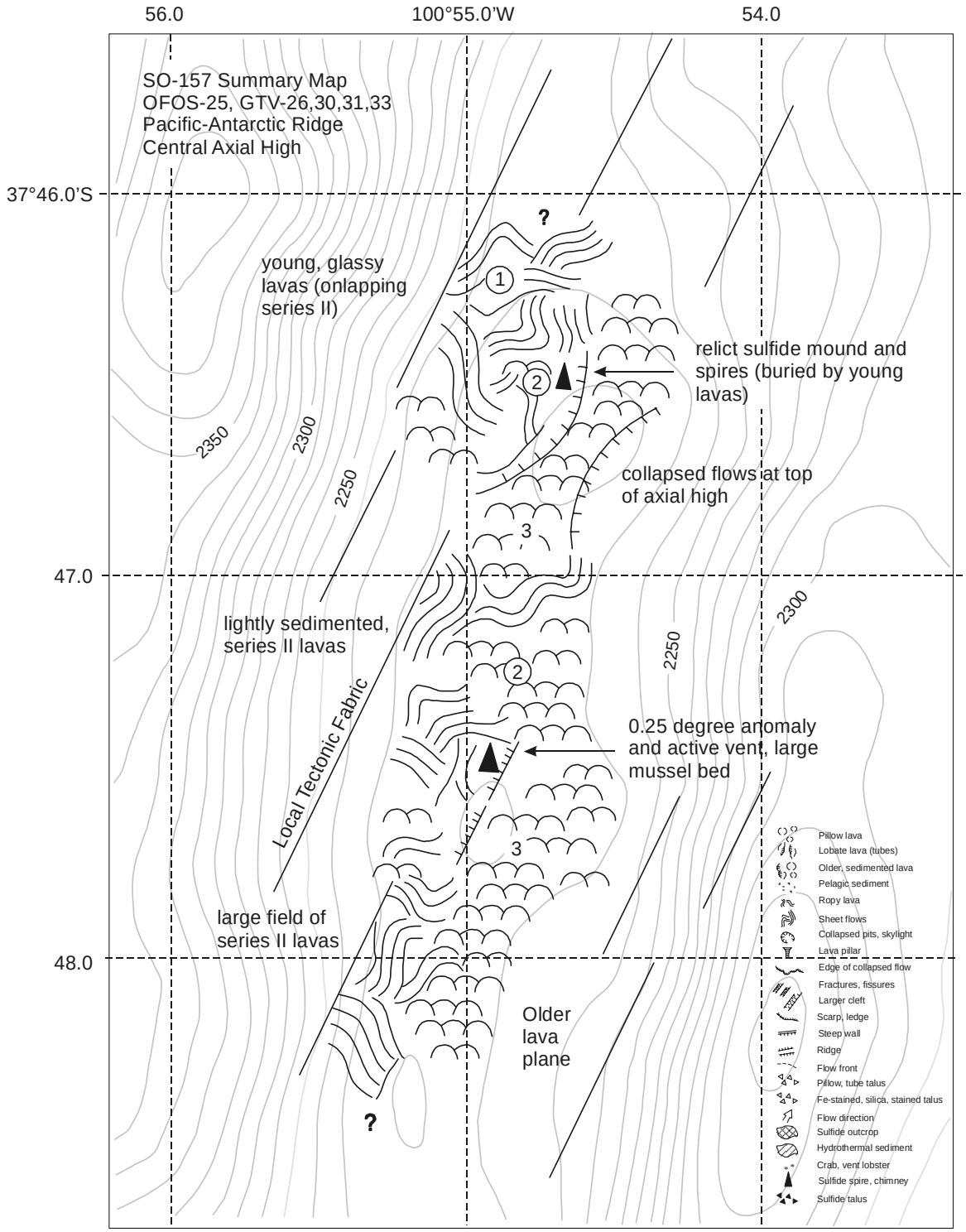

Fig. 6.6: Geological summary for the central axial high of the Pacific–Antarctic Ridge.

part of the map area. The old sulfides occur at the edge of a flow of young lavas, where the young lavas appear to have partly buried and disrupted a pre-existing sulfide mound. Abundant sulfide talus and large blocks occur on top of the flow, and windows of sulfide outcrop and old spires were found between the younger pillows. Sulfide blocks recovered from the talus field consisted of old mound material (coalesced pyrite chimneys and locally massive recrystallized sphalerite and chalcopyrite) and likely formed in a high-temperature black smoker field. Fossilized clams and large worm tubes (up to 1.5 cm in diameter) in the sulfides attest to the former presence of high-temperature vents in the area.

6.2.2. Structure

The north–south trending axial high in this area is dissected by a series of en echelon faults or fissures oriented approximately 30° to the trend of the volcanic axis. The fractures and fissures appear to be mainly tectonic in origin (no obvious drain-back features), and they are roughly parallel to the ridge axis north and south of the map area. The relief along the top of the axial high is very subdued, with only a few scarps mainly produced by lava collapse. This contrasts with the northern axial high, where fault scarps of up to 30–40 m are common along the axial cleft. This part of the ridge appears to be in a constructional phase, with extensive pillow flows affected by widespread but narrow fissures.

6.2.3. Volcanism

Two low-relief accumulations of older flows occupy the central high. The raised portions of the flows are up to 10 m high but are punctuated by large areas of collapse (up to several hundred meters across) indicated by old lava pillars and collapse talus and infilled by younger lavas. A series of flow fronts along the OFOS track are recognized by alternating collapsed sheet flows and pillow lavas. The central part of the axial high is dominated by the remnants of older flows that are surrounded by younger sheets and lobate flows. An extensive plain of younger sheet lavas and lobate flows occurs between the elevated portions of the axial high. This large field of younger lavas was traced over nearly 1.3 km. The younger flows are composed mainly of glassy lava with relatively little sediment. These lavas resemble the second generation lavas (Series II) along the northern axial high (see OFOS-01). Numerous skylights, flattened and broken tube pillows, and larger collapse pits (up to 10 m in diameter) occur in the younger lavas. Talus in these pits is visibly altered (stained by silica and Fe-oxides on fracture surfaces), and isolated vent crabs were sighted along the entire length of the OFOS track in these younger lavas.

6.2.4. Hydrothermal Activity, Fauna, and Mineralization

Two areas of active and fossil hydrothermal deposits were located on the central high. The southern area comprises a series of deep fissures in the young lava plain with obvious diffuse hydrothermal venting. A bottom temperature anomaly of 0.25°C was recorded over the fissures (Fig. 6.7), and a large field of mussels, dead clams, and related vent fauna occurs at the centre of the fissure zone occupying an area of about 40 x 40 m. In the area with the highest temperature anomaly, the bottom water is visibly cloudy and the pillows are festooned by barnacles, mussels, clams and polycheates, with local clusters of snails. Farther from the fissures, clam shells are common in the cracks between the glassy pillows, and vent crabs and vent lobsters are abundant at the periphery of the field. Locally, intense alteration of the glassy pillow lavas is also evident in talus along one of the bounding faults of the fissured area.

A small outcrop of older sulfide was observed at the centre of the clam field, suggesting that the present hydrothermal activity may represent a late stage of venting within the fissure zone. This is supported by the large number of empty clam shells and dead animals (tubes, mussels, etc.) at the margins of the field, suggesting that the field may have once been larger and more active. The sulfide outcrop occurs at the edge of one of the central fissures in the field and is about 5–10 m in diameter. Stained sediment occurs between the pillows in the immediate vicinity of the outcrop. An apparent relict spire was observed in the OFOS track, but no samples of hydrothermal material were recovered in the TV-grabs (GTV-26, 30).

A fossil hydrothermal field was located about 1.7 km to the north of the mussel bed, near a flow front where younger glassy lavas onlap onto older pillow flows. The site contains two large, solitary spires (one 3 m tall spire and a second 1 m tall spire) within a field of weathered sulfide talus (abundant 0.5–1 m sulfide blocks). The spires are inactive and obviously old, and they are most likely related to the earlier lava generation beneath the glassy lavas. The talus field is about 30–40 m across and 20 m wide and is restricted to the margins of the young flow.

Blocks of sulfide talus sit on top of the younger lavas flows (GTV-31) and outcrops of the massive sulfide can be seen in windows between the pillows. The distribution of talus and the proximity to the flow front imply that this deposit was plowed under by the lava flow, and talus from collapsed chimneys and spires may have ridden on top of the advancing flow. The talus is strongly weathered and stained by bright red Fe-oxides, yellow jarosite, and locally bright green atacamite. Several large sulfide blocks recovered from this site (GTV-33) consisted of massive pyrite (coalesced chimneys) with locally massive, recrystallized chalcopyrite and sphalerite. This material is typical of mound material in larger high-temperature vent fields. Fossils of large vestimentiferan tube worms (1.5 cm diameter) and mussels were found in the sulfides.

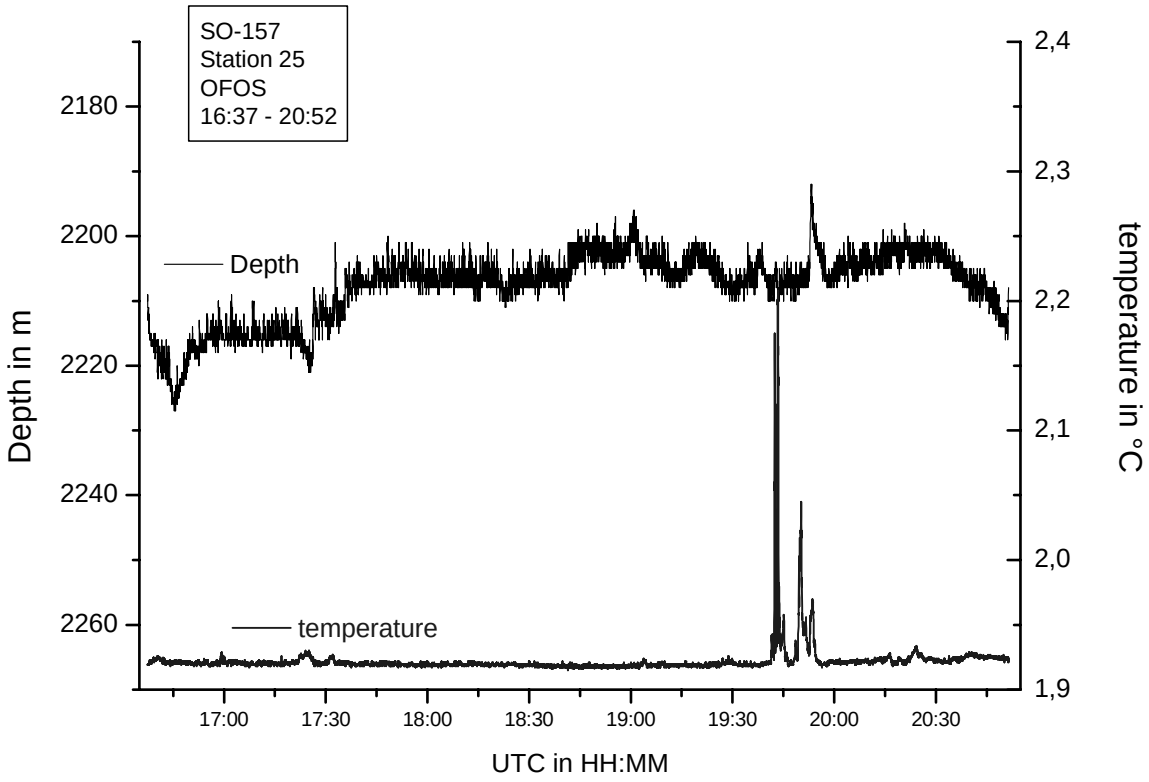

Fig. 6.7: Potential temperature and depth profile over time for station 25-OFOS. The track is heading in a SSW direction along the central cleft. The highest temperature anomaly is associated with a larger community of hydrothermal vent fauna including the very abundant *Bathymodiolus*.

6.3. Hydrothermal Activity at an Off-Axis Seamount (37°42'S) [Stations 08-GTV, 09-GTV, and 10-GTV]

6.3.1. Summary

Three GTV stations were completed at an off-axis seamount at approximately 37°42'S and 111°07'W (Figs 6.8, 6.9). The primary objective was to re-examine inactive hydrothermal vent sites discovered during the SCAMPI-4 dive of the N/O *L'ATALANTE* cruise in 1997, just prior to the loss of the instrument.

GTV-08, 09 and 10 surveyed the western part of the summit crater of the youngest of the Foundation Seamount Chain off-axis volcanoes. Approximately 2 km of trackline were mapped on the western side of the crater. Heavy sediment cover on top of the volcano is consistent with the old age of the edifice. Younger lavas have erupted as sheet flows and as a small pillow dome in the summit crater. The TV grabs targeted known hydrothermal deposits on the flank of the small lava dome in the western part of the crater and bacterial mats on the upper part of the crater wall. The hydrothermal deposits comprise mainly low-

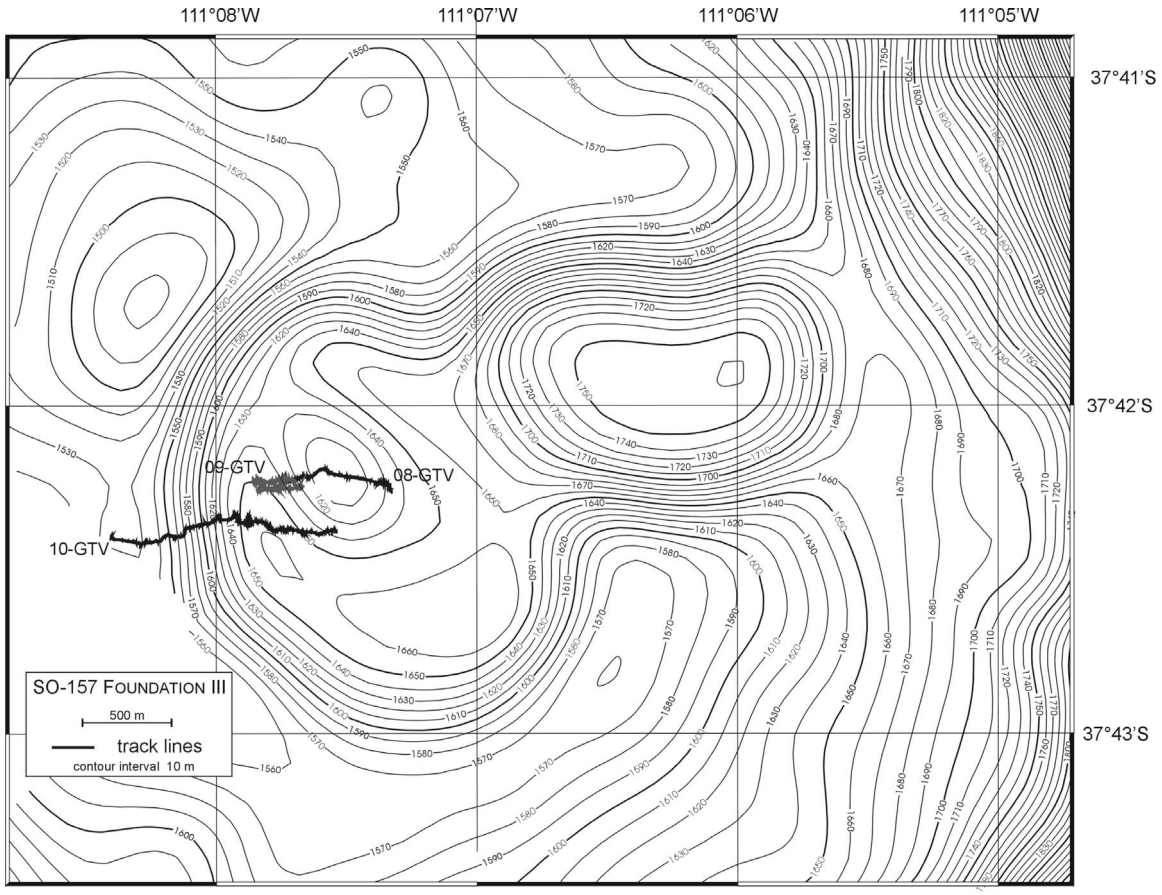

Fig. 6.8: Bathymetry and station tracks across the off-axis seamount (37°42.5'S).

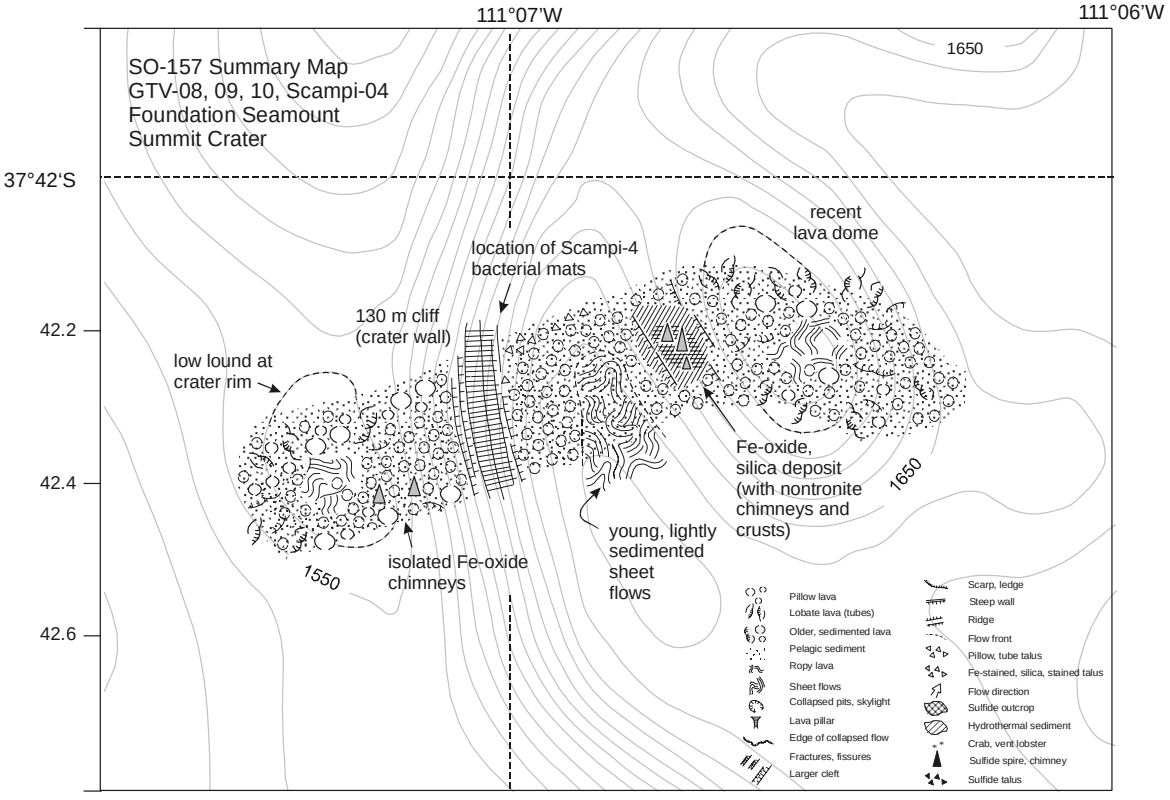

Fig. 6.9: Geological summary of the off-axis seamount summit crater.

temperature Fe-oxide and silica chimneys on a substrate of hydrothermal nontronite crusts. The size of the Fe-oxide chimneys and the abundant Fe-oxide debris and sediment suggest that the hydrothermal field is mature. However, the fact that the chimneys are still standing suggests that the summit area of the volcano must experience relatively little seismic activity. No evidence for hydrothermal venting was found at this location and no vent-related fauna was observed.

6.3.2. Structure

The off-axis volcano has the typical steep-sided, flat-topped shape of other off-axis seamounts of the Foundation Chain. It is 15 km in diameter at its base and at least 1 km high. The circular, flat-topped summit plateau is at 1500 m depth and is approximately 7 km in diameter. The summit crater is 2.5–3 km in diameter, circular in shape and approximately 250 m deep. Bathymetric details suggest that two nested craters may be present, but this was not tested by seafloor mapping. The crater rim is punctuated by several broad pillow mounds that have been incised by the crater wall. The walls of the crater are nearly vertical, with 100–150 m scarps that cannot be resolved by acoustic mapping (Fig. 6.10). The circular shape and steep sides of the crater are typical of piston-like craters in other Pacific seamounts and could indicate rapid, large-scale evacuation of the underlying magma chamber by basal eruptions on the outer flanks of the volcano. Remarkably little talus has accumulated in the crater at the base of the wall, implying a rapid drop of the crater floor and little mass-wasting of the pillow lavas at the summit plateau. The base of the eastern wall is partly obscured by the development of a small lava dome on the crater floor, approximately 800 m in diameter and 50–60 m high (Fig. 6.11). Pillow lavas erupted from this dome abut against the crater wall.

6.3.3. Volcanism

The summit plateau of the volcano is dominated by low pillow mounds with moderate to heavy sediment cover. A survey of the east rim of the crater during GTV-10 crossed one of these mounds (400 m in diameter and 20–30 m high). The mound consists of large-diameter (1–2 m) pillows with a thick cover of sediment (30–40 % by area compared to 10–20 % on the lavas in the crater). Local collapsed pits at the summit of the mound suggest it formed from eruptions originating on the summit plateau.

Lavas in the crater are notably younger. The youngest lavas occur at the top of the small lava dome in the eastern part of the crater. The top of the dome is covered by flattened lobate flows and broken sheets which occupy an area about 200–250 m in diameter. The flanks are covered by lobate lavas and pillow tubes. A small area of collapsed pits (drain-back) at the top of the dome likely coincides with the eruptive fissures that fed the lobate flows and tubes on the flanks. These lavas have only a light dusting of sediment (10–15 % by area). The next youngest lavas are located in a small (?) lava pond between the dome

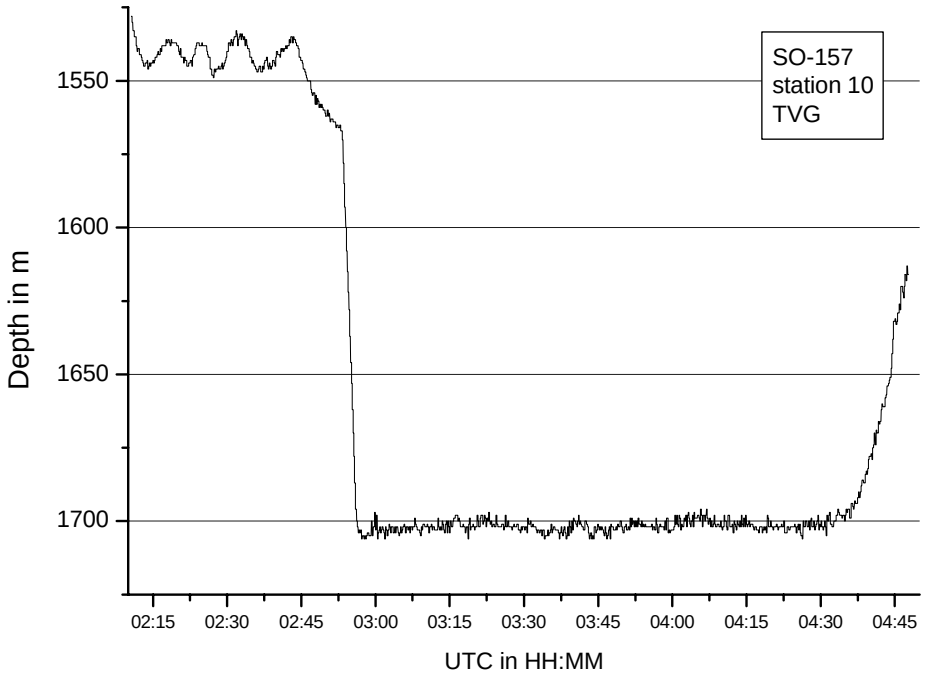

Fig. 6.10: Instrument depth vs time for station 10-GTV. The traverse provides a cross-section over the western crater rim. The track started at the western crater rim and was towed towards the east passing along the crater floor and then climbing the central dome.

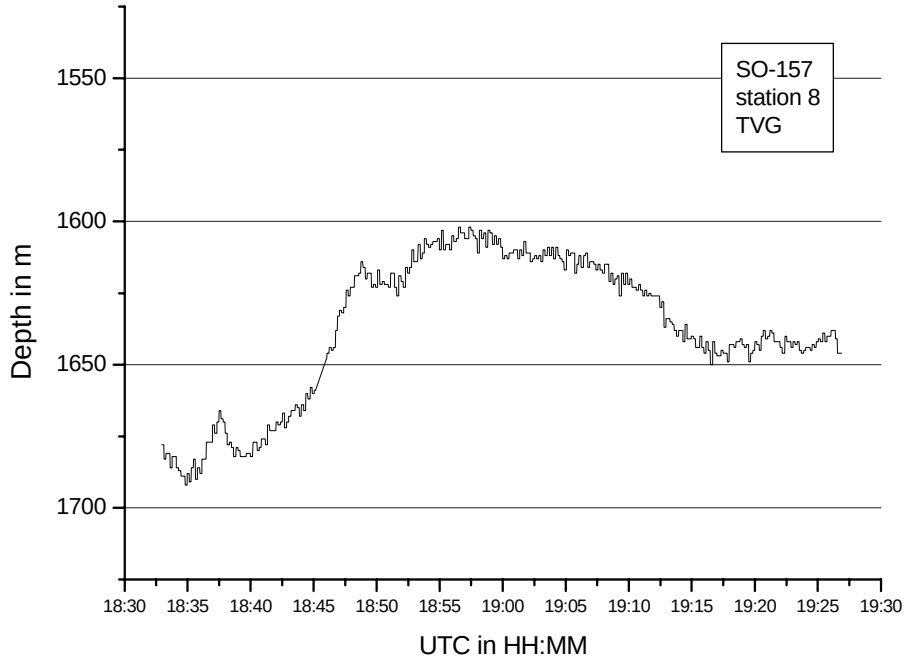

Fig. 6.11: Instrument depth vs time for station 08-GTV. The traverse provides an E–W profile across the central dome complex. The track started at the base of the central dome and was towed towards the west. Note: the Fe-oxide chimneys were observed at 19:25 at the western rim of the dome complex.

and the adjacent crater wall. The extent of the sheet flows was not determined, but they may be part of more widespread, ponded lavas on the crater floor. Pillows and tubes form the small lava dome and appear to have been erupted onto these sheets.

6.3.4. Hydrothermal Activity and Mineralization

An unusual hydrothermal Fe-oxide, silica and nontronite deposit with free-standing chimneys or spires, crusts and hydrothermal sediments was located on the lower western flank of the small lava dome. The deposit is located between several steps (<5 m scarps) on the flanks of the dome at a depth of 1640–1650 m. A large area of Fe-oxide, silica and nontronite was crossed on two separate tracks about 60 m apart. TV-grab coverage of the seafloor in this area suggests that the deposit may be up to 100 m in diameter.

The surface material is mainly bright orange, yellow and brown in color. Individual Fe-oxide and silica chimneys are up to 2 m in height and 1 m in diameter at the base. The surrounding seafloor is covered mainly by debris from collapsed chimneys and Fe-oxide rich sediment. This material has been shed from the deposit and is also found in sediments at the base of the lava dome. All of the Fe-oxide chimneys appeared to be extinct, and no obvious alteration of the surrounding pillow talus was observed. This suggests that the hydrothermal activity that gave rise to the deposit was low-temperature and possibly short-lived.

The chimney structures are extremely friable and essentially collapsed into Fe-oxide, silica and nontronite debris when hit by the TV-grab. Many fragments of soft, friable Fe-oxide and silica were recovered in the grabs. The samples included bright orange amorphous Fe-oxides, dark-brown to red semi-crystalline Fe-oxides (lepidocrocite), and filamentous silica possibly overgrowing bacteria. Weakly indurated, massive nontronite crusts were recovered from beneath the Fe-oxide chimneys and sediments. TV-grab samples revealed a substrate of mainly dark green (reduced) nontronite beneath the Fe-oxide sediments and crusts. The crusts comprise upper layers of mainly Fe-oxides and silica (30 cm thick) and essentially pure nontronite to a depth of up to 1 m.

Additional small Fe-oxide chimneys were photographed close to the rim of the crater on the summit plateau (GTV-10). A half-dozen isolated chimneys (<1 m high), surrounded by lightly stained sediment, were observed over a strike length of 100–150 m on the eastern rim. These deposits may be related to the low-temperature hydrothermal upflow and bacterial mats previously documented in this area during the SCAMPI-4 survey in 1997. However, the bacterial mats could not be relocated and may now be gone.

No evidence for hydrothermal venting was found at this location and no vent-related fauna was observed.

6.4. The Pacific–Antarctic Ridge at 39°25'S [Station 66-OFOS]

6.4.1. Summary

Station OFOS-66 surveyed approximately 4 km of the axial crest of the PAR between 39°24'S and 39°26'S (Figs 6.12, 6.13). The ridge axis in this area is characterized by large, old pillow material and a 150 m-high sedimented pillow mound constituting the regional bathymetric high. The axial graben is very narrow and was only encountered slightly to the east of the bathymetric high. Lava pillars and collapse pits near the ridge high indicate the importance of local drain-back. For the most part, the pillows and individual lobate flows are heavily sedimented. Evidence for fresh volcanic activity was only observed at the beginning of the station, north of the regional bathymetric high. Here, fresh ropy lavas and sheet flows were noted, indicating the presence of a lava plain on the ridge flank.

Clusters of crabs (up to 20 per 100 m^2) occurred at two sites close to the axial high indicating the presence of an enhanced food supply. However, evidence for hydrothermal activity was not recorded by the temperature probe of the OFOS system (Fig. 6.12), nor was there any visible sign of metalliferous sediments on the lava surfaces. Iron and silica staining occurred locally at flow fronts.

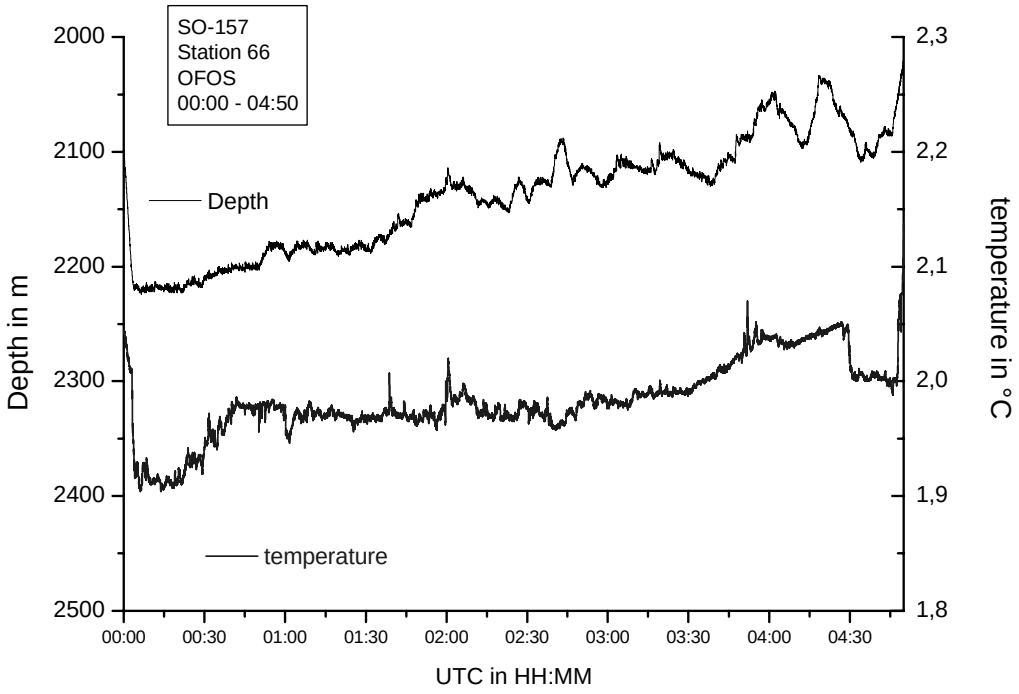

Fig. 6.12: Instrument depth vs time for station 66-OFOS. The traverse provides a N–S profile along the ridge crest. The valley from 04:00–04:30 represents a W–E crossing of the central cleft near the axial high.

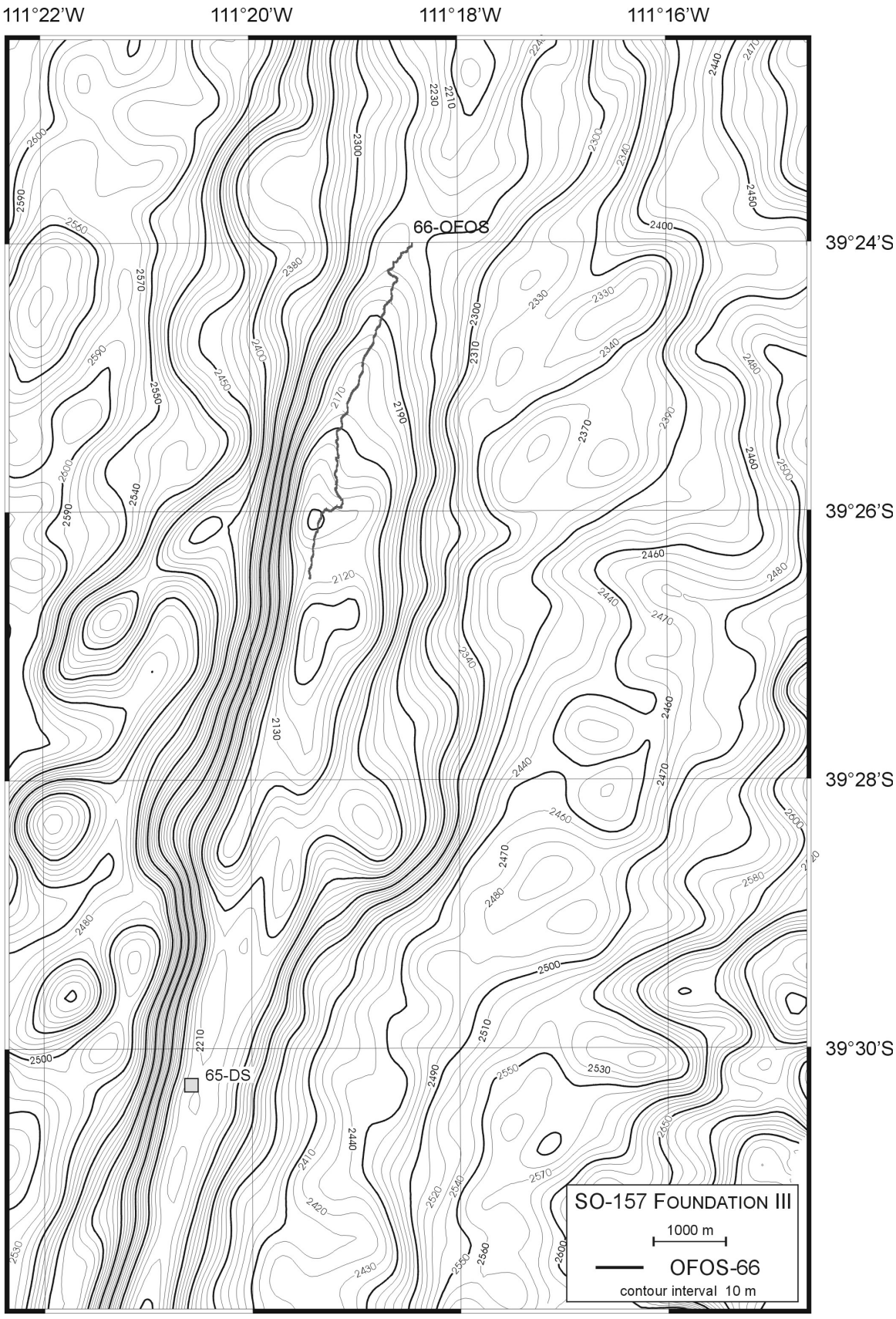

Fig. 6.13: Bathymetry and station track at the Pacific–Antarctic Ridge (39°25'S).

7. MINERALIZATION AND ALTERATION

7.1. Alteration at the Off-Axis Seamount (37°42'S) [Stations 08- and 09-GTV]

The Fe-oxide chimneys consist exclusively of craggy, spiny branched stacks up to 4 m in height that are composed of iron-silicates, silica and supporting but lesser iron oxides. They are long inactive. No adhering biology, but sparse evidence of once alive polychaete tube worms. Chimneys sampled or hit by the TV-guided grab disintegrated in clouds of mud/ooze and a shower of flakes and shards. Downslope from the fields, the talus of pillow rubble and the constructional slopes are covered with turbiditic debris from structures long since collapsed. Both grab samples consisted of a shard-rich ooze of brown orange to green mud from which surviving pieces were collected. The rest was washed overboard. About 500 kg of material were retrieved during each haul.

Overall impression from fragments is that these structures are pagoda-like, in that they are constructed of concentric layers of iron-silicate + silica enclosing tortuous fluid channelways framed on thin limonite shells. A good analogy is "a house of cards". The chimneys may have once been composed entirely of green nontronite, but over time the exterior and some open channelways have allowed oxygenated seawater to convert it to orange/yellow nontronite (i.e., oxidation of ferrous iron to ferric). We achieved the same oxidation overnight in an aerated drying oven at 60°C, where olive-green nontronite turned brown. Unoxidized green nontronite shards were preserved wet for Kiel and the GSC.

7.1.1. Detailed Descriptions: Station 08-GTV (37°42.215'S, 111°07.735'W)

This chimney stump appeared to be a well oxidized structure with a greater proportion of recovered shards and thixotropic sludge consisting of ferric clays. The original green shards were often interbedded with yellow to black forms. No sulfides were seen and no sulfurous odour was noted. Numerous pieces of inner walls and conduit nets were collected and dried. They are very light and friable. Some pieces are multi-platy, others are honeycombed and massive, while others appear as more fibrous boxworks – especially internal surfaces that were once active fluid channelways.

Conduits are finely (mm) fibrous pale-yellow silica (?) after bacterial threads. Walls consists of thin black limonite (0.2 mm) within orange-brown, sintery to massive porous layers (5 mm). The conduits are open and lined by fibrous yellow silica, platy bright yellow clay perforated by tiny (mm) fluid passageways. The overall porosity must be greater than 80 vol.%.

Several pieces were subsampled for $\delta^{18}O$, trace element chemistry, and clay mineralogy:

- pieces to GSC: wet and dry sludge (for mineralogy and trace chemistry)

- pieces to Kiel: wet and dry sludge (for oxygen isotopes and clay mineralogy)
- pieces to TUBAF: dry (chemistry)

7.1.2. Detailed Descriptions: Station 09-GTV (37°42.232'S, 111°07.745'W)

The chimney sampled was a 1 m^2 structure adjacent to a taller (2–3 m) spiny edifice. It collapsed instantly on sampling and yielded a full grab of sludge, ooze and platy relict walls. By comparison with station 08-GTV, the material is 50:50 dark to pistachio-green interior nontronite mud and pale brown to yellow outer walls. A similar "house of cards" or pagoda structure is envisaged for the interior structure. Pieces are similarly platy to fibrous in texture and highly porous, friable masses. Green shards are layered. These as well as yellow pieces were oven-dried at 60°C overnight. The green pieces oxidized to pale green-yellow when dry.

Detailed description and sample distribution as for station 08-GTV.

7.2. Mineralization and Alteration at the Central Axial High (PAR 37°47'S) [Stations 31- and 33-GTV]

Both TV-grabs tried to grab old (2–20 years?) chimney material and talus partly buried by recent lava flows. Some large sulfide blocks have been seen on top of the lava, suggesting on-going erosion of the sulfide edifices. There is no obvious sign of contemporaneous hydrothermal activity. Several attempts to grab chimney debris failed due to inability to close the grab before it toppled and lost its load. Bright green crusts, suspected to be atacamite, were seen in the color video, suggesting abundant chalcopyrite in some of the samples. The first "successful" grab lost the cupriferous sulfides except for a few tiny pieces, because basaltic material blocked the grab.

7.2.1. Detailed Descriptions: Station 31-GTV (37°46.544'S, 110°54.633'W)

About 10 kg of fresh lavas were collected together with a few pieces of massive sulfide (31-GTV-7 to 31-GTV-10). One 10 g piece of chalcopyrite-rich massive sulfide and about 200 mg of tiny pyrite and chalcopyrite bits were recovered together with few small (<1 cm) silica crusts and Fe-oxyhydroxides. All pieces were taken to TUBAF.

Sample 31-GTV-7: ca. 200 mg of bronzy pyrite consisting of tiny crystal clusters (0.1 mm)

Sample 31-GTV-8: porous piece (10 g) of chimney wall, slightly oxidized exterior and composed largely of chalcopyrite crystals (0.1–0.5 mm) and some pyrite granules. Interspace is filled in one part by soft white matter thought to be amorphous silica. A vague concentric view of one end suggests a former small fluid conduit now occupied by silica (?).

Sample 31-GTV-9: white silica crusts (ca. 5 g)

Sample 31-GTV-10: 20 g of brown iron oxide crusts (= remnants of chimney walls?)

7.2.2. Detailed Descriptions: Station 33-GTV (37°46.558'S, 110°54.635'W)

The grab acquired ~100 kg of sulfide material, but a quantity was lost accidentally during recovery.

Sample 33-GTV-1: The largest piece recovered (piece #1) is estimated to weigh 45 kg and consists of a cylindrical chunk (ca. 50 x 25 cm) of massive pyrite with visible chalcopyrite and sphalerite on surfaces. Numerous blisters of limonite infilled by gelatinous natrojarosite sit on top of a generally red-brown stained oxidized surface. The surface also displays a number of open orifices to the interior (cm to dm in diameter) that are partly filled by red-brown iron oxide mud. The largest of these is surrounded by euhedral pyrite cubes that radiate outwards. Some pore space is filled by amorphous silica (?). The presence of these orifices suggests a set of side spigots or branches of a chimney structure, now gone. It also suggests that this piece is a basal chunk of mound material from which chimneys grew upwards. This is further indicated by several platy, ridged outcroppings along the length of the piece, orthogonal to chimney orifices. Its close proximity to the current neovolcanic zone suggests an age of only several years, which is also supported by the limited weathering of the surfaces.

The chimney fragment was cut across the structure for seven slabs and three longitudinal slices (Fig. 7.1). The cross sections exposed small vent orifices, generally open or only partly filled by sphalerite or pyrite and silica. Chalcopyrite seems rarer but is present locally. Some orifices were clearly relict worm tubes, others true hydrothermal fluid conduits. All are dominantly sugary granular pyrite with hard and soft coalesced zones that imply fused chimney tops in early growth stages. Sphalerite is unevenly distributed (~5 %) amongst the matrix, often dendritic. Some relict beehive structures are also discernible. Overall the specimen is well weathered, locally fractured and likely 2–20 years in age. Radiochemical dating is required. It is also clear that sample 33-GTV-2 does not derive from this specimen.

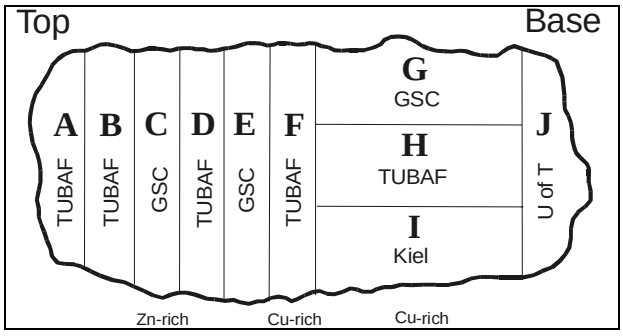

Fig. 7.1: Sample location and distribution for the large chimney fragment recovered at station 33-GTV (sample 33-GTV-1).

The top of the structure (sample 33-GTV-1A) is typical. It consists of a chimney cross-section composed of pyrite with small dispersed quantities of sphalerite and chalcopyrite. Fluid conduits up to 2 cm across consist of both evacuated worm tubes and vuggy tortuous channelways. All are partly lined or filled by sub-mm euhedral pyrite and chalcopyrite. Sphalerite occurrs more rarely as infill, and seems to be late stage. At least 3 coalesced spires are evident.

Slabs 33-GTV-1B and -1C are notable for abundant cm-sized worm tube conduits. More central ones display aureoles of dispersed chalcopyrite. Pyrite is generally massive fine granular to fine dendritic in texture, suggesting replacement of bacterial matte.

Slabs 33-GTV-1D and -1E display a well preserved conduit lined by brown sphalerite (~2 mm thick) and the interior filled with significant (>5 %) chalcopyrite dispersed within. Open voids are lined by latest stage euhedral pyrite and silica.

Slab 33-GTV-1F is of more massive sugary pyrite with chalcopyrite and a 5 cm thick rind of wormy conduits carrying sphalerite.

The longitudinal slabs 33-GTV-1G, -1H, and -1I reveal a number of worm tube conduits partly filled with sphalerite, but the main sulfide mass is chalcopyrite-impregnated pyrite of fine sugary texture. These and slab 33-GTV-1J represent the basal part of the chimney fragment.

Sample 33-GTV-2: Finely crystalline massive pyrite contains about 35 % intergranular chalcopyrite and some sphalerite. The surface is oxidized except for a broken end which exposed well preserved massive sulfides. The sample contains well preserved sulfidized mussel shells (Fig. 7.2) that have been replaced and infilled by euhedral chalcopyrite and coarse massive black to brown sphalerite. There are some relict worm tube walls (now pyrite), that are also partly infilled by chalcopyrite and sphalerite. The orange-brown weathering surface is characteristic of Cu-rich sulfides (e.g., Galapagos East Rift, TAG).

Upon cutting (3 cuts) it became clear that several shells occur within the sample. The nested upper shells are filled by mm-crystalline chalcopyrite capped by bladed (mm) dark brown sphalerite, all radiating towards the interior of the fill. Obviously hot fluids passed through the shell area, already replaced by pyrite, and filled void space. The morphology of the chalcopyrite suggests high temperatures for the hydrothermal fluids passing through (>350°C). The matrix consists of patchy, fine-grained pyrite, sphalerite, and chalcopyrite. A second shell fragment became visible after cutting and is completely filled by euhedral chalcopyrite.

The shells are so well preserved that species identification might be possible. Three pieces were sent to Dr. Little (Natural History Museum in London) for examination, two pieces went to TUBAF (2A, 2B), and one piece to GSC (2B).

Fig. 7.2a: Section through nested fossilized shells of sample 33-GTV-2. The shell in this photo is infilled by euhedral chalcopyrite. Scale in cm.

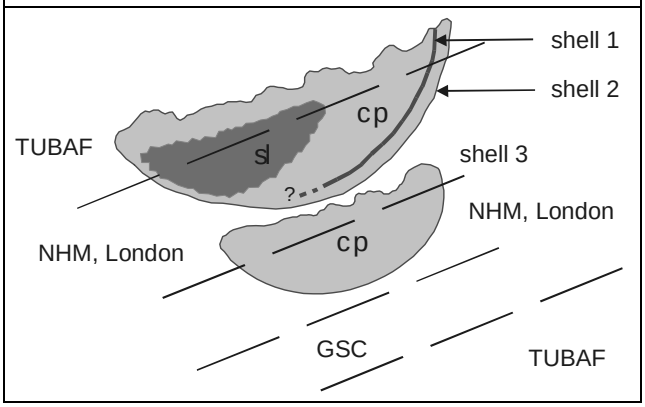

Fig. 7.2b: Schematic view through nested fossilized shells of sample 33-GTV-2 and sample distribution. Possibly three shell fragments can be seen, with two of them being close together in the upper slab (see arrows). The shells are infilled by euhedral chalcopyrite (cp) and coarse grained black to dark brown sphalerite (sl). The lines indicate the cutting faces.

Sample 33-GTV-3: Piece of chimney wall with a thick marcasite rind (cm) over dendritic pyrite and fibrous sphalerite + amorphous silica (?). Several well exposed half worm tubes are present within the wall. Typically 3–5 cm long and 1.5 cm in diameter, these are plugged by sphalerite. Textures are reminiscent of EPR chimneys with large vestimentifera incorporated into the walls and ultimately acting as fluid channelways.

The sample was cut longitudinally to preserve worm tubes intact for examination, however, no more tubes were exposed. Mineralogy consists of iron sulfides of a pale buff white color. Some of it appears to have replaced bacterial threads or matte. Parts of the oxidized outer rind are more massive and darker grey, suggesting the presence of marcasite. Worm tube fill is poorly preserved, but where seen consists of euhedral, cubic pyrite (1–2 mm) within a white matrix (silica or barite?).

Two pieces (3A1, 3B1) were sent to the Natural History Museum of London (Dr. Little), one piece to TUBAF (3B2), and one piece to GSC (3A2).

Sample 33-GTV-4: This piece is similar to sample 33-GTV-3, being part of a chimney wall (16 x 9 x 6 cm thick). It too is composed mainly of an externally oxidized marcasite crust over a pyrite/sphalerite interior enclosing worm tubes up to 9 cm long and 2 cm in diameter. Its difference is that the tubes remain open in places and walls are NOT wholly replaced by pyrite. Rimpled surface textures are preserved and altered chitinous material is black (carbonized?). Other tubes are filled by sphalerite.

Low temperature conduits are rimmed by recrystallized pyrite and filled with granular brown sphalerite.

Sample 4A: Slicing revealed that certain growth lobes, where coalesced, are cemented by hard layers of pale grey pyrite in which bacterial remains and worm tube wall fragments can be discerned. The infill growth is dendritic and void fill consists of darker grey, porous pyrite and sphalerite (?). The sample seems to have formed rapidly but at lower temperatures (<250°C).

Sample 4B: Cutting across the wall into interior sulfide shows similar composition (pyrite) and textures. However, a few small later breakout conduits lined with euhedral pyrite indicate proximity to major fluid channelways. Dark fine grained passages suggest the presence of sphalerite.

Two pieces were distributed to TUBAF (4B1a, 4B2) and one piece to GSC (4B1b).

Sample 33-GTV-5: A small (5 x 4 x 3 cm) piece of massive sulfide wall consisting almost entirely of clustered parallel aligned worm tubes (1–2 cm in diameter) filled by pyrite and sphalerite. The oxidized outer wall is composed of marcasite and is 0.5–1 cm thick. These samples have the same source as sample 33-GTV-4. All the sample was taken by TUBAF.

The rest of 33-GTV, including small pieces of #1 and others totalling 500 g, have been bagged together (sample # 33-GTV-6) and taken to TUBAF.

7.3. Mineralization and Alteration at the PAR, 39°25'S [Stations 63-DS and 65-DS]

Samples from dredge station 63-DS are siliceous (?) glassy, frothy lobated basaltic sheet flows. Some pieces contained abundant 0.2–1.0 cm vesicles throughout glassy rinds and holocrystalline interiors (see magmatic sulfides chapter). Bronzy pyrite was observed in some vesicles. These formed rare pyritohedra and, more commonly, thin plates of either circular or rounded hexagons covering radial plates of presumed amorphous silica lining vesicle walls. Vesicles in the interior of the sheets contained no pyrite. Other vesicles were lined by thin films of silica and/or plagioclase (bluish). Small samples were retained by Kiel, Freiberg, and the GSC for SEM-EDS, probe, and isotopic studies.

Samples from 65-DS are frothy, tubular and small pillow flows similar to 63-DS, and likely of basaltic composition. Some rinds of frothy glass were up to 5 cm thick and contained abundant elongated vesicles and displayed well developed flow banding with complex curtain folds on the mm scale. The most striking characteristic of all lava pieces was a strong H_2S odour when cut or broken, and abundant platy to subhedral pyrite partly

filling gas vesicles as well as some pipe vesicles in both glass crusts and the interior. The glass itself was black grading into a bluish color, possibly from carrying tiny devitrification spheres and abundant sulfide in minute vesicles. The glass chemistry should be checked for increased Fe and S contents.

7.4. Implications for Mineralization along the Pacific–Antarctic Ridge

Hydrogen sulfide degassing was a common feature of many iridescent fresh lavas dredged from various locations on the spreading ridge. Pyrite was less commonly found, but was always present in “smelly” lavas, even if only sparsely. Secondly, evidence for warm water circulation was seen in all OFOS traverses. This, and the presence of ferruginous or silica stained lavas, indicates that low-temperature emanations are widespread and that hydrothermal activity (heat loss) is voluminous but unfocussed. The cruise yielded no conclusive direct evidence of current high-temperature hydrothermal activity. Biological communities are luxuriant in some locations, perhaps attesting to a continuous, sustained low level of hydrogen sulfide emanations. The H_2S firstly saturated the erupting lavas with sulfides, and later caused pyrite infilling of vesicles. Magmatic sulfide droplets should be sought in thin section studies of lavas. All of these sulfur forms provide an abundant reservoir of nutrient supply for thiotrophic organisms, provided warm waters continue to flow unimpeded.

8. MANGANESE OXIDES

Mn oxide coatings on rocks were sampled from all dredge and GTV stations where they occurred. The volcanic rocks from the PAR consist of different generations of lava flows and rock types. Mn oxide coatings occur on all generations and rock types. Slightly thicker crusts were recovered from the hydrothermal field of the central axial high of the PAR at 37°47.5'S and in the crater of a large seamount at 41°22.5'S and 111°23.0'W. The occurrence of Mn coatings on very young volcanic rocks, which may only 10 years old, suggests widespread diffuse hydrothermal venting along this part of the PAR.

To sample the Mn oxides, the coatings were brushed off the rocks. They will be sequentially leached to get the Mn oxide phase, which will be analyzed for its chemical composition to look for hydrothermal signals (Mn/Fe ratio, Co, Ce, REE pattern, calculated growth rate with Co formula). This study along different PAR sections will give information on the hydrothermal potential throughout even the unexplored parts of the PAR.

Table 8.1: Sample Stations with Mn Oxides

Station	Coordinates of tracks	Sample description
03 DS	From 37°39.518S 110°52.327W, 2226m To 37°39.263S 110°52.262W, 2215m	Thin (1-2 mm) Mn oxide coatings on surface and in vesicles of two older generations of volcanic rocks (Unit C and E). No oxides on young glassy basalt.
05 DS	From 37°36.368S 110°51.345W, 2208m To 37°36.515S 110°51.188W, 2268m	Up to 1mm Mn oxide coatings on basalts of 2nd and 3rd generation (Unit A).
06 DS	From 37°33.710S 110°49.560W, 2228m To 37°33.502S 110°49.341W, 2264m	Continuous Mn oxide rind up to 1mm thick on older basalts (Unit A).
08 GTV	Ship: 37°42.2148S 111°07.7345W, 1608 m	Three sample types: (i) a dark reddish brown material consisting of Fe oxyhydroxides forming the outer parts of the samples, (ii) a thin, dark, hard layer (about 1 mm) probably consisting of limonite that marks the border between the inner and outer parts of the samples, (iii) the inner part represents the fluid channelways consisting of yellow-brownish material of fibrous texture (biogenic silica?) and yellow clayish phases.
09 GTV	Ship: 37° 42.2317S 111°07.7452W, 1598 m	Samples as in 08-GTV and green material with layered texture probably consisting of pure nontronite.
12 DS	From 37°44.488S 111°04.020W, 2316m To 37°44.282S 111°03.860W, 2331m	Patchy Mn oxide coatings (partly up to 1mm), velvet-like, partly intergrown with Fe oxyhydroxides (Unit A).
15 DS	From 37°37.07S 110°51.78W, 2209m To 37°37.29S 110°51.93W, 2211m	Mn oxide (1 mm) coatings in large vesicles of basalts (Unit A).
18 DS	From 37°40.987S 110°52.982W, 2220m To 37°41.827S 110°53.272W, 2258m	Mn oxide coatings only in fractures but not on the glassy surface of basalts (Unit A).

Station	Coordinates of tracks	Sample description
24 DS	From 37°54.201S 110°56.845W, 2260m To 37°54.008S 110°56.850W, 2266m	Local minor Mn oxides (< 1mm) on basalt glass (Unit A).
29 DS	From 37°58.222S 110°58.137W, 2249m To 37°58.632S 110°58.296W, 2228m	Mn oxides on top and in fractures of basalts of different generations (Unit A).
31 GTV	Ship: 37° 46.5379S 110°54.6379W, 2225 m	Two types of Mn oxides: (i) a crust that comes loose by itself after drying, (ii) a velvet-like crust which is similar to Mn crusts known from other hydrothermal sites. The latter contains some clay and Fe oxides.
34 DS	From 38°12.86S 111°11.17W, 2308m To 38°12.68S 111°11.09W, 2157m	Minor orange Mn oxides (<<1 mm) on glass, basically fresh (Unit A). Mn oxide coating consistently 1 mm thick over entire boulder (Unit B).
38 DS	From 38°18.282S 110°51.776W, 2501m To 38°17.653S 110°51.487W, 2351m	Mn oxide crust up to 1 mm thick on relatively old lava (Unit A). Orange Mn oxides up to 1 mm thick on Unit B. Mn oxide coating up to 1 mm thick over glass (Unit C).
42 DS	From 38°24.99S 111°04.91W, 2266m To 38°24.606S 111°04.559W, 2259m	Mn oxides up to 1 mm thick on glass surface (Unit A). Thin Mn oxides and orange Fe-staining along fractures (Unit B).
44 DS	From 38°29.580S 111°06.194W, 2253m To 38°29.01S 111°06.15W, 2256m	Thin Mn oxides and orange Fe-staining along fractures (Unit B).
49 DS	From 41°22.379S 111°23.226W, 2210m To 41°22.862S 111°22.910W, 2225m	Rather thick Mn coatings on different rocks: sample type 49-6: on altered volcanic glass (Unit C) sample type 49-7: 1 mm coating (Unit C) sample type 49-10: 2-3 mm thick cauliflower-like structure like typical hydrothermal crusts (Unit E).
50 DS	From 41°23.153S 111°30.798W, 2464m To 41°23.608S 111°30.464W, 2507m	Mn oxides up to 1 mm thick on top of glass (Unit A). Two subsamples: (i) thin coating on basalt glass, (ii) coatings in fractures.
51 DS	From 41°18.733S, 111°30.799W, 2443m To 41°19.237S 111°30.378W, 2579m	Minor Mn oxides in patches up to 1 mm thick on different small specimen (Unit A).
52 DS	From 41°10.846S 111°33.201W, 2525m To 41°11.23S 111°33.375W, 2537m	Thin Mn oxide coating (1 mm) on more weathered pillow over glass (Unit A). Some Mn oxides on fresher glassy basalt (Unit B).
56 DS	From 40°23.278S 111°27.588W, 2325m To 40°22.953S 111°27.118W, 2342m	Mn oxide coating up to 1 mm thick on fractures (Unit A).
61 DS	From 40°07.40S 111°24.98W, 2442m To 40°07.81S 111°25.04W, 2402m	Patchy Mn oxides on some fractures (Unit A).
63 DS	From 39°48.226S 111°25.608W, 2253m To 39°47.760S 111°25.398W, 2260m	Patchy, very thin Mn oxide coating (< 1mm) on volcanic rock lacking glass crust (Unit A).
65 DS	From 39°30.271S 111°20.585W, 2203m To 39°29.68S 111°20.48W, 2189m	Thin Mn oxide coatings only on fractures of old basalts, no coatings on young surfaces (Unit C?).

9. MAGMATIC SULFIDES

Previous investigations of the rock samples collected during the SO 100 cruise revealed the occurrence of magmatic sulfides (e.g., SO 100, 91DS-6). Electron microprobe work has shown that large euhedral pyrrhotites with hexagonal habit coat the walls of some vesicles and have inclusions of rounded chalcopyrite and pentlandite grains (Table 9.1). Therefore, we tried to select further samples during SO 157. Presently, there is not much data available for magmatic sulfides from intraplate regions and spreading axes, or on their relationships to the other metallic oxides in seafloor lavas.

The occurrence of sulfides in rock samples is usually associated with a smell of H_2S when cutting these lavas. Furthermore, the bright glimmer of the vesicle walls given by flat euhedral grains is an indication of sulfides. It is possible that such sulfide-bearing phases are not limited to the vesicles, but might also occur as a magmatic phase in the groundmass or glass matrix. But with the equipment onboard, we were not able to observe such grains. Metallic oxides are identified in nearly all samples with the described sulfide-bearing phases.

The following 13 samples were sulfide-bearing and selected for further research into the occurrence and composition of the sulfides: 05DS-5, 15DS-4, 18DS-1, 24DS-3, 28DS-4, 32DS-1, 48DS-2, 49DS-9, 63DS-1, 63DS-5, 65DS-3, 65DS-8, 65DS-9. Some initial electron microprobe analyses of sulfides are given in Table 9.1 and shown in Figure 9.1.

Table 9.1: Representative Analyses of Sulfides Coating Vesicle Walls

A: SO 100, 91DS-6 (analyses in wt.%)

	pyrrhotite		chalcopyrite		pentlandite	
Fe	57.8	56.5	30.9	30.1	15.0	9.0
Ni	0.2	0.1	0.1	–	66.1	77.0
Cu	–	0.2	30.5	31.5	–	–
Zn	0.1	0.1	–	–	–	–
S	37.5	36.0	38.0	39.1	15.0	10.0

B: SO 157 (pyrrhotite; analyses in wt.%)

	05DS-5		48DS-2		65DS-09	
Fe	58.9	57.4	55.6	50.1	59.6	56.9
Mn	0.05	0.04	0.3	0.02	0.2	0.2
Ni	0.02	0.1	0.2	–	0.01	0.05
Cu	0.05	0.1	1.8	–	0.07	0.07
Zn	0.06	0.05	0.05	–	0.05	0.05
S	37.6	36.0	38.1	47.1	37.8	36.9

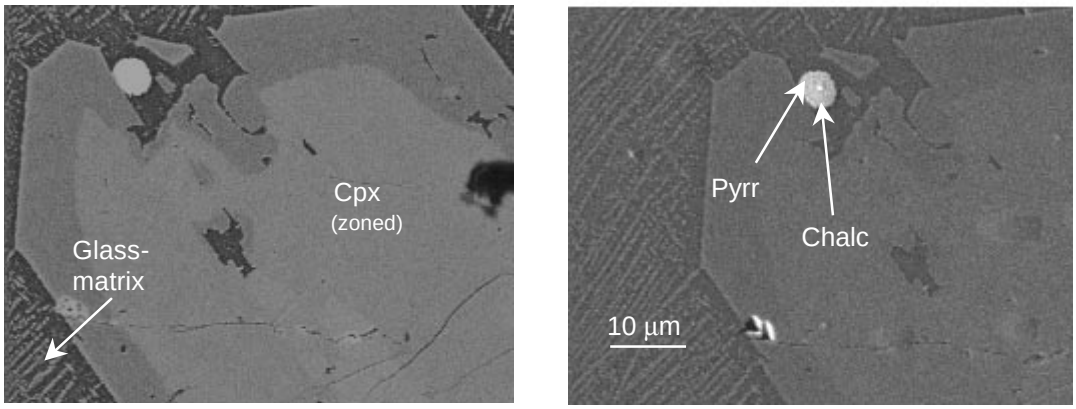

Fig. 9.1: Magmatic sulfides in SO 157 lavas. At left, a rounded pyrrhotite crystal rests in glass at the rim of a strongly zoned clinopyroxene phenocryst. At right, closer inspection reveals a small chalcopyrite core within the pyrrhotite crystal.

10. BIOLOGICAL INVESTIGATIONS

10.1. Overview

The biological investigations were centred around hydrothermal systems, but all material from the dredges was logged and secured, and non-hydrothermal fauna seen during OFOS and GTV stations was also recorded. Very few specimens were recovered by the dredges, and these were mostly serpulid worms and small crusts of sponges. Sample details are given in Table 10.1.

With the TV-grab, hydrothermal communities were observed and successfully sampled at the central axial high of the PAR around 37°47.5'S. Details of the locality and the environmental setting are given elsewhere in this volume (see Chapter 6: Seafloor observations and TV-grab sampling). The most successful sampling was from station 30-GTV at 37°47.443'S, 110°54.834'W in a depth of 2212 m (uncorrected) on 28 June 2001 at 18:56:24 (UTC) [= 12:56:24 local time]. The grab fell over during the sampling of a mussel bed, and not much material was recovered (Table 10.1).

From the OFOS observations and sampling, the following picture of the hydrothermal animal communities arises. The communities are similar to those of the Eastern Pacific Ridge, but show some peculiarities. The fauna collected by the TV-controlled grab around the active venting sites consisted mainly of *Bathymodiolus* and *Neolepas*. Mobile animals in these patches are bythograeid crabs, *Munidopsis* (at least two species), and zoarcid fish. Polychaete worms and snails could also be collected, but due to their small size their abundance could not be estimated on the video pictures and slides. In the peripheral beds, vesicomyid clams probably are (or have been) present, but only dead shells were seen. Also, a bit further from active venting serpulid tubes and unidentified actinians were seen to form larger assemblages. The mobile fauna is still present, and supplemented by Macrourid (= rat-tail) fish and swimming crinoids. The latter seem to be very characteristic of the hydrothermal communities described here, as they occur in large numbers at some distance from the active vents and can even be used as indicators for such areas. They are rare at the centre of venting activity and outside the influence of the vents.

Outside the active venting area bythograeid crabs were widespread, and also *Munidopsis* occurred at a number of locations. While the latter is only characteristic for vent communities at the species level, the former suggests that diffuse venting activity is widespread and not confined to the region in which mussel beds were seen. This impression is further supported by the abundance of filter-feeders such as hexactinellid sponges, and stalked (*Hyocriantus*) and unstalked (Brisingidae) crinoids. Such animals tend to cluster around vents and indicate a high particle flow. They were particularly

Table 10.1: Biological Samples Obtained During Cruise SO 157

Nr.	Station	Sampling device	Fixative	Conc.	Short description
1	SO 157-04TD	Cylinder dredge	Formalin	4%	Tiny sponge
2	SO 157-05KD	Chain-sack dredge	Formalin	4%	Piece of a gorgonian
3	SO 157-05KD	Chain-sack dredge	Formalin	4%	Piece of sponge
4	SO 157-08GTV	TV-Grab	Formalin	4%	Unsieved sediment/Meio
5	SO 157-08GTV	TV-Grab	Formalin	4%	All fractions
6	SO 157-09GTV	TV-Grab	Formalin	4%	Unsieved sediment/Meio
7	SO 157-09GTV	TV-Grab	Formalin	4%	All fractions
9	SO 157-15KD	Chain-sack dredge	Formalin	4%	Unknown tube
10	SO 157-24DS	Chain-sack dredge	Formalin	4%	Peduncle of ??
11	SO 157-30GTV	TV-Grab	Formalin	4%	Sieve refuse
12	SO 157-30GTV	TV-Grab	Formalin	4%	Stone with organisms
13	SO 157-30GTV	TV-Grab	Formalin	4%	Ophiurids
14	SO 157-30GTV	TV-Grab	Formalin	4%	*Neolepas*
15	SO 157-30GTV	TV-Grab	Formalin	4%	Polychaetes
16	SO 157-30GTV	TV-Grab	Formalin	4%	Div. tubes
17	SO 157-30GTV	TV-Grab	Formalin	4%	Molluscs
18	SO 157-30GTV	TV-Grab	Alcohol	96%	Crabs
19	SO 157-30GTVa	TV-Grab	Formalin	4%	Chaetopterid worms
20	SO 157-30GTVa	TV-Grab	Formalin	4%	Chaetopterid tubes
21	SO 157-30GTVa	TV-Grab	Formalin	4%	*Bathymodiolus* & *Neolepas*
22	SO 157-31GTV	TV-Grab	Formalin	4%	Basalt with organisms
23	SO 157-33GTV	TV-Grab	Formalin	4%	Worm tubes and ?eggs from massive sulfide
24	SO 157-41DS	Cylinder dredge	Formalin	4%	Sponge?
25	SO 157-49DS	Cylinder dredge	none	–	Plastic bag with clam shell
26	SO 157-49DS	Cylinder dredge	Formalin	4%	Stone with serpulid
27	SO 157-50DS	Cylinder dredge	Formalin	4%	Lava with coating

common at the edges of some cracks and fissures, thus indicating diffuse and weak venting at those structures. Other animals with some relation to venting areas in the Eastern Pacific are several species of actinians (*Actinostola*, *Cyanathea* and others) and rhodalids (*Thermopalia taraxaca*) for which, however, the reason for their relation to vents is not known. Such organisms were also observed in the OFOS pictures from the larger surrounding areas of active fields. They belong to the same types as on the EPR. Species identification was not possible because no specimens were collected. A closer examination

of the spatial distribution of such animals will allow conclusions about their relationship to the venting centres.

The following descriptions give more details on the animals and communities observed during those OFOS and GTV tracks that showed high biological activity on the sea bottom.

10.2. Station 01-OFOS

During this OFOS station, the central cleft of the PAR spreading axis was mapped in a transect from SW to NE. Five areas of high biological activity were detected. These areas showed marked temperature anomalies. From north to south their positions were:

Area I:	from: 37°38.4546' S, 110°52.0777' W	to: 37°38.5101' S, 110°52.1864' W
Area II:	from: 37°38.7491' S, 110°52.2437' W	to: 37°38.9535' S, 110°52.2304' W
Area III:	from: 37°39.0767' S, 110°52.2630' W	to: 37°39.1053' S, 110°52.2703' W
Area IV:	from: 37°39.4769' S, 110°52.4067' W	to: 37°39.5332' S, 110°52.4108' W
Area V:	from: 37°39.8329' S, 110°52.5092' W	to: 37°39.8748' S, 110°52.5552' W

Area III consists of two small patches containing shells and bacterial mats. Area IV covers a northern and southern sub-area, connected through an intergrading zone.

During this station, two types of sponges (an encrusting one and a stalked one) could be observed regularly, also outside the specifically active vent areas. Stalked crinoids (*Hyocriantus*) were also abundant, especially at the junctions of old and young lavas. Often they were accompanied by flagelliform gorgonians. Pelagic holothurians and rat-tail fish (Macrouridae) also occurred regularly. Vent crabs (Bythograeidae) were more abundant than *Munidopsis*. Close to the temperature anomalies, free swimming crinoids were particularly abundant.

A descriptive narrative is given in Table 10.2 and arranged chronologically. Because of this, areas II and IV appear twice in the Table.

Table 10.2: Biological Narrative of 01-OFOS

TAPE-TIME	Position (OFOS)	Remarks
Start: 16:36:34 End: 16:43:08	37°39.6031' S 110°52.4264' W 37°39.5332' S 110°52.4108' W	SW Periphery of area IV: Rat-tail fish, sparse bythograeid crabs on large old pillows. During approach to the central area, increasing densities of free swimming crinoids on young lava.
Start: 16:43:58 End:	37°39.5179' S 110°52.4352' W 37°39.4978' S	SW-part of the centre of area IV, southern sub-area: numerous bythograeid crabs. (>20 spcm.) and *Munidopsis* (5 spcm.). Barnacles, serpulid worms and actinians on old pillows.

TAPE-TIME	Position (OFOS)	Remarks
16:46:27	110°52.4078' W	Temperature anomaly at 16:44:20
Start: 16:46:27 End: 16:47:01	37°39.4978' S 110°52.4078' W 37°39.4875' S 110°52.3807' W	Intergrading zone between the two sub-areas of area IV: Sponges and swimming crinoids along young lava structures.
Start: 16:47:21 End: 16:48:00	37°39.4816' S 110°52.3925' W 37° 39.4769' S 110° 52.4067' W	SW-part of the centre of area IV, northern sub-area: Free swimming crinoids getting more abundant again, bythograeid crabs, *Munidosis*, serpulid worms and sponges on pillows. Temperature anomaly at 16:47:21.
Start: 16:48:00 End: 16:49:30	37°39.4769' S 110°52.4067' W 37°39.4571' S 110°52.3880' W	NW Periphery of area IV: Few free swimming crinoids on top of young lava.
Start: 17:20:21 End: 17:31:49	37°39.1619' S 110°52.2755' W 37°39.0291' S 110°52.2438' W	Sponges, flagelliform gorgonians and *Hyocriantus* dominated patch along the edge of old lava covered by red (hydrothermal?) sediment. Few rat-tail fish.
Start: 17:32:36 End: 17:37:57	37°39.0136' S 110°52.2304' W 37°38.9725' S 110°52.2316' W	Periphery of the southern part of area II: Sponges, *Hyocriantus* sp, flagellate gorgonians and rat-tail fish were observed along the talus and old pillows.
Start: 17:38:38 End: 17:54:36	37°38.9535' S 110°52.2304' W 37°38.8152' S 110°52.2630' W	Western limit of the central zone of area II: Sponges, *Hyocriantus* and free swimming crinoids followed by pelagic holothurians and a community consisting of bythograeid crabs, *Munidopsis* and actinians. Of special interest were a zoarcid vent fish (17:43:48) and free living nemertean worms (17:50:55). The bottom was predominantly formed by old pillows covered by sediment and talus. Small temperature anomaly (17:49:21). The only gradually changing community structure and the weak temperature anomaly suggest that only the western part of the central area was touched and thus the central area must be towards the northeast.
Start: 17:54:51 End: 17:56:54	37°38.8110' S 110°52.2231' W 37°38.7871' S 110°52.2312' W	Northern periphery of locality II: Free swimming crinoids, rat-tail fish, *Hyocriantus* and stalked sponges characterized this zone, which ended up in a steep slope formed by old talus material and continued into an old pillow field.
Start: 18:36:02 End: 18:40:04	37°38.4092' S 110°52.1436' W 37°38.3851' S 110°52.0984' W	Talus field with red sediments, massive sulphides (18:38:18). Accompanying fauna included gorgonians and a single bythograeid crab (18:39:21).
18:43:33	37°38.3533' S 110°52.1033' W	End of the transect in northern direction, start of a new transect towards the southeast.
Start: 19:15:00 End: 19:20:15	37°38.4546' S 110°52.0777' W 37°38.5101' S 110°52.1864' W	Area I: Sponges and *Hyocriantus* characterized the border-zone of this area. In the immediate vicinity of the temperature anomaly (19:18:52) Brisingidae and a few *Munidopsis* were observed. The sediment on well sorted talus material was reddish and thus showed hydrothermal influence.

TAPE-TIME	Position (OFOS)	Remarks
Start: End:	37°38.6224' S 110°52.1777' W 37°38.7502' S 110°52.1794' W	NE limit of the periphery of area II: Sponges were the dominant faunal elements of this site. Besides these a few specimens of bythograeid crabs and *Munidopsis* occurred. Other remarkable animals were *Hyocriantus*, flagelliform gorgonians and Brisingidae. The bottom was formed by well sorted talus material.
Start: 19:44:34 End: 19:59:23	37°38.7491' S 110°52.2437' W 37°38.8907' S 110°52.2302' W	Eastern reaches of the central zone of area II: Increasing occurrence of free swimming crinoids, *Hyocriantus* and sponges. In this part of the field there were significantly less bythograeid crabs and *Munidopsis* than in the western part. Four temperature anomalies (19:44:34, 19:45:45, 19:51:44, 19:57:26) could be observed. The bottom was formed by talus material, covered with red, clearly hydrothermal sediments.
Start: 20:29:18 End: 20:31:40	37°39.0767' S 110°52.2630' W 37°39.1053' S 110°52.2703' W	Area III: This area consists of two spots of a few meters diameter, a northern (20:30:28) and a southern (20:31:16) one. These spots include bacterial mats, sponges and dead shells. A temperature anomaly could be observed (20:29:52). Bottom consists of well sorted talus material.
Start: 21:01:30 End: 21:14:43	37°39.3935' S 110°52.3900' W 37°39.6466' S 110°52.3907' W	NE to SE reaches of locality IV: In this second visit to the area much less animals were observed than in the first one. The fauna was restricted predominantly to free swimming crinoids. Bythograeid crabs and *Munidopsis* were observed only two times. This suggests that the pictures seen corresponds to the easternmost part of the area. Three temperature anomalies were observed (21:01:56, 21:04:27, 21:06:43).
Start: 21:31:02 End: 21:37:40	37°39.8058' S 110°52.4887' W 37°39.8329' S 110°52.5092' W	Northern periphery of area V: Swimming crinoids clearly dominate the fauna. A few bythograeid crabs, rat-tail fish, and free living nemerteans could be observed. Bottom consisted of well sorted talus material.
Start: 21:37:40 End: 21:39:06	37°39.8329' S 110°52.5092' W 37°39.8748' S 110°52.5552' W	Central zone of area V: Significant increase in the numbers of bythograeid crabs. Temperature anomaly at 21:38.12. Bottom consisting at times of pillow lava, sheet lava, young lava, and talus material, respectively.
Start: 21:39:41 End: 21:46:21	37°39.8744' S 110°52.5612' W 37°39.9334' S 110°52.5969' W	Southern periphery of area V: Again free swimming crinoids dominate the fauna, the numbers of bythograeid crabs decrease. Bottom formed by young, tubulous lava.

10.3. Station 20-OFOS

The area covered by this OFOS overlaps in the north with the southern part of the 01-OFOS transect. It is characterized by up to three generations of pillows. Massive sulfides were present in one location. Six areas of high biological activity were seen. Two of these showed clear hydrothermal influences, in three others the fauna indicated a high particle

flow, and the sixth showed intergradations between the two other types. Due to the overlap with 01-OFOS, the areas I and III described in Table 10.3 below correspond to the areas IV and V of 20-OFOS, respectively.

Table 10.3: Biological Narrative of 20-OFOS

TAPE-TIME	Position (OFOS)	Remarks
Start: 20:33:35 End: 20:47:04	37°39.4781' S 110°52.3792' W 37°39.5551' S 110°52.3870' W	Active area I (identical with area IV of OFOS 01): Beginning with swimming crinoids and brisingids, numerous rat-tail fish, young lava, temperature anomaly. Hydrothermal influence, field probably only touched marginally. 20:43:00 Frame filling image of swimming crinoid.
21:00:15	37°39.6546' S 110°52.3858' W	Massive sulphides, no particular biological activity.
Start: 21:04:21 End: 21:08:09	37°39.6882' S 110°52.3974' W 37°39.7018' S 110°52.3730' W	Active area II: Beginning with *Hyocriantus*. Numerous vent crabs along a large fissure and on well sorted talus with silica staining. Sediment coloured green to red-brown (hydrothermal?). Area ends with a 5m cliff. No temperature anomaly.
Start: 21:19:52 End: 21:25:02	37°39.7836' S 110°52.3682' W 37°39.8311' S 110°52.3848' W	Active area III (Corresponds probably to the NW reaches of area V of OFOS 01): Beginning with sponges and *Hyocrianthus* standing along the edge of a fissure (21:13:00), numerous bythograeid crabs, a few *Munidopsis*, one shrimp and one sea star. Old very large pillows (2m) with few sediment. At the end of the area again sponges and *Hyocriantus* sp.
Start: 22:24:20 End: 22:25:39	37°40.2918' S 110°52.5539' W 37°40.2951' S 110°52.5632' W	Intergradation area IV: Sponges, *Hyocriantus*, flagelliform gorgonians and rat-tail fish on large pillows with weak sediment cover.
Start: 22:38:45 End: 22:55:17	37°40.3596' S 110°52.6516' W 37°40.4450' S 110°52.7715' W	Active area V: Small temperature rise, worked pillows. Swimming crinoids were observed swimming across a large fissure, the edges of which were lined with *Hyocriantus* and sponges (22:37:30). Other associated fauna consisted mainly of *Munidopsis*, bythograeid crabs and actinians. Two temperature anomalies 22:42:01; 22:54:16.
Start: 23:11:12 End: 23:21:25	37°40.4951' S 110°52.8846' W 37°40.5536' S 110°52.7913' W	Active area VI: Along the western wall individuals of *Hyocriantus* sp, Brisingidae, sponges and single *Munidopsis* (23:20:30) were observed.

10.4. Station 25-OFOS

In the region covered by this OFOS, two areas of higher biological activity could be distinguished. Area I in the northern part and area II in the southern part. No temperature anomalies were recorded in area I, whereas in area II two locations showed temperature anomalies.

At the beginning of the transect there were clearly more eel-shaped fish than in the former OFOS (and also TV-grab) stations. Pelagic holothurians were quite common, also gelatinous items that looked like jelly-fish with tentacles, but were sessile at times. In the outer periphery of the active areas, galatheoid squat lobsters were present and had very long chelipeds and a narrow carapace, thus significantly differing from the common Munidopsis. The lava was coated with an Hydrozoa-like pelt in both active areas. The active areas are described in Table 10.4.

Table 10.4: Biological Narrative of 25-OFOS

TAPE-TIME	Position (OFOS)	Remarks
18:50-19:10	37°47.1475' S 110°54.7351' W 37°47.3048' S 110°54.7952' W	Area I: Rich fauna along the edges of a cleft, dominated by *Hyocriantus*, rat-tail fish and free swimming crinoids. No temperature anomaly.
19:37-19:39	37°47.4975' S 110°54.8303' W 37°47.5014' S 110°54.8505' W	Single free standing pillar with crinoids, sponges and actinians growing on it. No temperature anomaly.
19:42-19:50 Nucleus at 19:48	37°47.5214' S 110°54.8525' W 37°47.5679' S 110°54.8727' W	Area II: In the surroundings numerous *Hyocriantus*, with increasing densities of free swimming crinoids when moving towards the centre of the area. In the periphery pillows with numerous dead *Calyptogena* shells. In the centre: dense *Bathymodiolus* patches in pockets formed between pillows, many dead shells. Living colonies of *Bathymodiolus* were observed at the basis of an evidently active smoker. Mussels were accompanied by bythograeid crabs and *Munidopsis*. Two temperature anomalies (19:42; 19:49).

10.5. Station 30-GTV

This was the only grab station with successful biological sampling, taking place in area II of station 25-OFOS. The grab was directed in concentric curves to the centre of activity seen before. For a description of the sampling and the sample size refer to section 10.1 at the start of this chapter. The biologically active sites are listed in Table 10.5.

Table 10.5: Biological Narrative of 30-GTV

TAPE-TIME	Sub-position (GTVA)	Remarks
16:14	37°47.45' S 110°54.86' W	Bottom sight, pillows, shells, *Munidopsis.*
16:18:30	37°47.47' S 110°54.84' W	Typical mussel patch.
16:21	37°47.48' S 110°54.89' W	Massive sulfides, Cirripedia (*Neoplepas*) sampling effort, grab empty.
16:24	No signal	After re-opening of grab, *Neolepas* and holothurians on pillow.
16:28	37°47.48' S 110°54.89' W	Galatheid crab similar to *Munidopsis lentigo.*
16:41	37°47.47' S 110°54.87' W	Living *Bathymodiolus* and a galatheid crab similar to *Munidopsis lentigo* on pillow.
16:43	No signal	*Bathymodiolus*, *Neolepas*, Shrimp, *Munidopsis* on pillow.
17:03	37°47.49' S 110°54.87' W	Galatheid crab similar to *Munidopsis lentigo.*
17:06-17:10	37°47.50' S 110°54.83' W	Clam assemblages between pillows (*Calyptogena* shells?), holothurians, *Neolepas*, diameter of field about 12m.
17:16-17:21	37°47.51' S 110°54.89' W	Clam assemblages (*Calyptogena* shells?), *Munidopsis* & free swimming crinoids.
17:23	37°47.51' S 110°54.90' W	Holothurians.
17.27	37°47.50' S 110°54.89' W	Free swimming crinoids, periphery of the hydrothermal field.
18:19	37°47.47' S 110°54.88' W	Galatheid crab similar to *Munidopsis lentigo.*
18:22	37°47.49' S 110°54.87' W	Dead clam assemblages (*Calyptogena*-shells?), followed by *Bathymodiolus*, accompanied by *Munidopsis* & *Neolepas.*
18:36	37°47.45' S 110°54.91' W	Galatheid crab similar to *Munidopsis lentigo*, clam assemblages (*Calyptogena*-shells?), many *Neolepas*, *Munidopsis.*
18:41	37°47.45' S 110°54.85' W	Dead clam assemblages (*Calyptogena* shells?), snails (Buccinidae?) on pillow.
18:46	37°47.46' S 110°54.87' W	*Neolepas* patches, zoarcid vent fish, NE-periphery of the field?
18:49	37°47.48' S 110°54.87' W	Again *Bathymodiolus* beds, *Bythograea*, *Neolepas.*
18:56:24	37°47.4426' S 110°54.8337' W	Successful sampling.

10.6. Station 66-OFOS

Generally this track showed a higher number of observations of rat-tail fish (Macrouridae), which were presumably more common in this area. Also the crustaceans showed a higher diversity. Besides bythograeid vent crabs and squat lobsters of the genus *Munidopsis*, another species of galatheoid decapod and a lithodid were regularly observed. For the first time, two areas with dead gorgonians were seen. Higher abundance of unstalked crinoids (Brisingidae) and large actinians (similar to *Actiostola*) were obvious. Two types of animal communities could be distinguished: a crustacean-dominated and a gorgonian-dominated community. In the latter, it was obvious that the gorgonians showed

strong calcification at their stems suggesting they were about to die. This interpretation is based on observations of dying gorgonian beds in other regions of the world (e.g., Mediterranean), and is further supported by the existence of heavily calcified dead specimens in the same community.

The observations suggest the following distribution of biota. In the outer periphery of the biologically active areas Macrourid fish usually dominate. Between these peripheral areas and areas occupied by the crustacean type community there is often a small zone with swimming crinoids. Such a crinoid zone was missing around the gorgonian-dominated communities.

The N–S directed transect crossed the following areas:

Crustacean area I:	from: 39°25.1506’ S, 111°19.0537’ W	to: 39°25.3055’ S, 111°19.0758’ W
Crustacean area II:	from: 39°25.9117’ S, 111°19.1323’ W	to: 39°25.9241’ S, 111°19.3247’ W
Gorgonarian area I:	from: 39°26.0140’ S, 111°19.3107’ W	to: 39°26.0999’ S, 111°19.3468’ W
Gorgonarian area II:	from: 39°26.2198’ S, 111°19.3554’ W	to: 39°26.3150’ S, 111°19.3587’ W

The two recorded times with higher temperature (01:39:36 UTC and 03:52:06 UTC) were not classified as marked temperature anomalies, and thus cannot clearly be attributed to any hydrothermal influence. The biologically active areas are described in Table 10.6. The Table only includes larger accumulations (observation of specimens >1 per minute) of rat-tail fish and all squat lobsters (*Munidopsis* and others have been treated globally under their English name).

Table 10.6: Biological Narrative of 66-OFOS

TAPE-TIME	Sub-position (GTVA)	Remarks
00:06:58	39°23.9916’ S 111°18.4189’ W	Brisingidae (3x) on pillow-lava.
00:25:30	39°24.0866’ S 111°18.4510’ W	Polychaete?
00:29:16	39°24.0803’ S 111°18.5547’ W	Actinian.
00:38:26	39°24.1166’ S 111°18.5748’ W	Try to drift towards the east.
00:42:41	39°24.0803’ S 111°18.5547’ W	Brisingidae on pillow lava.
00:43:32	39°24.1849’ S 111°18.6467’ W	Brisingidae on pillow lava.
00:51:58	39°24.2068’ S 111°18.6087’ W	Squat lobster & eel-shaped fish on lava tubes.
00:53:50	39°24.2171’ S 111°18.6213’ W	Brisingidae on old lava tubes.
00:59:28	39°24.2840’ S 111°18.6680’ W	Actinian on pillow lava, high particle flow from one side.
01:02:53	39°24.2975’ S 111°18.5847’ W	Free swimming crinoid and sponge on pillow lava.

TAPE-TIME	Sub-position (GTVA)	Remarks
01:03:29	39°24.2975' S 111°18.5847' W	Gorgonaria (flagelliform) on the edge of old pillow lava.
Start: 01:10:40 End: 01:14:00	39°24.3564' S 111°18.6309' W 39°24.4059' S 111°18.6279' W	4 Macrouridae, Gorgonaria (flagelliform) and sponges on the edge of lava tubes and pillows.
Start: 01:17:21 End: 01:18:01	39°24.4346' S 111°18.6290' W 39°24.4484' S 111°18.6992' W	Gorgonaria (flagelliform) and sponges on the edge of large old pillow lava.
Start: 01:27:54 End: 01:37:02	39°24.4956' S 111°18.7350' W 39°24.5925' S 111°18.7703' W	Far outer periphery of crustacean area I: 17 Macrouridae, sponges, actinians and gorgonians on the edge of pillow lava.
01:39:36	39°24.6006' S 111°18.7348' W	Small temperature anomaly.
Start: 01:43:38 End: 01:54:14	39°24.6770' S 111°18.7870' W 39°24.7823' S 111°18.8423' W	Periphery of crustacean area I: Free swimming crinoids, a few *Hyocriantus* and actinians on the edge of lava tubes.
Start: 01:54:54 End: 02:18:39	39°24.7510' S 111°18.8263' W 39°25.0425' S 111°18.9343' W	Flank of crustacean area I: Increasing numbers of squat lobsters (1 spcm./3min), which together with actinians, sponges and *Hyocriantus* settle on old lava and talus.
Start: 02:19:14 End: 02:29:42	39°25.0506' S 111°18.9704' W 39°25.1506' S 111°19.0537' W	Flank of crustacean area I: Increasing numbers of squat lobsters (in total 12 spcm. ≈ >1 spcm./min.), a few sponges, a few Macrourid fish and one eel-shaped fish on talus and old lava.
Start: 02:29:42 End: 02:41:10	39°25.1506' S 111°19.0537' W 39°25.3055' S 111°19.0758' W	Centre of crustacean area I: In a well sorted talus field, numerous squat lobsters (>20 spcm./min; 02:35:04 and 2:36:06) accompanied by few Individuals of bythograeid crabs and actinians.
Start: 02:47:36 End: 02:49:20	39°25.3954' S 111°19.1150' W 39°25.4145' S 111°19.1076' W	3 Macrourid fish specimens along the edge of old lava tubes.
Start: 02:52:47 End: 02:54:04	39°25.4224' S 111°19.1536' W 39°25.4460' S 111°19.1584' W	6 Macrourid fish specimens and an eel-shaped fish along the edge of old lava tubes.
03:03:43	39°25.5701' S 111°19.1244' W	4 Macrourid fish specimens along the edge of old lava tubes.
03:11:38	39°25.5989' S 111°19.1221' W	3 Macrourid fish specimens along old pillow lava.
Start: 03:12:47 End 03:33:21	39°25.6218' S 111°19.1309' W 39°25.7944' S 111°19.1402' W	Observation sequence of squat lobsters: 1 spcm./ 3,5min (n=3 spcm.). Observation of a specific squat lobster type similar to *Shinkaia* (03:14:15). In addition a few sponges, as well as one eel-shaped fish and one specimen of Macrourid fish. The substrate consisted of old lava.

TAPE-TIME	Sub-position (GTVA)	Remarks
Start: 03:34:07 End 03:37:40	39°25.7899' S 111°19.1307' W 39°25.8281' S 111°19.1514' W	Observation sequence of squat lobsters: 2 spcm./ min (n=7 spcm.). Observation of a specific squat lobster type similar to *Shinkaia* (03:34:07, 03:36:06). No further accompanying fauna on old lava tubes.
Start: 03:42:04 End 03:51:32	39°25.8374' S 111°19.1648' W 39°25.9054' S 111°19.1203' W	Observation sequence of squat lobsters: 1 spcm./ 3 min (n=3 spcm.). Observation of one lithodid (03:42:04, 03:43:17) and a specific squat lobster type similar to *Shinkaia* (03:51:32). The substrate consisted of old lava tubes.
03:52:06	39°25.9075' S 111°19.1119' W	Small temperature anomaly.
Start: 03:53:05 End 03:55:12	39°25.9242' S 111°19.1018' W 39°25.9279' S 111°19.1132' W	Free swimming crinoids, actinians and one squat lobster on the edge of large lava tubes, relatively much sediment.
Start: 03:55:43 End 04:05:50	39°25.9117' S 111°19.1323' W 39°25.9241' S 111°19.3247' W	Centre of crustacean area II: Numerous squat lobsters, Their densities are a bit higher than in crustacean area I, but the area II is smaller. Accompanying fauna composed of actinians and sponges. The substrate consisted of old tube and pillow lava and talus.
Start: 04:16:05 End 04:24:19	39°26.0140' S 111°19.3107' W 39°26.0999' S 111°19.3468' W	Gorgonian area I: Predominantly heavily calcified and dead gorgonians accompanied by sponges, actinians and a few squat lobsters. The substrate consisted of coarse talus material.
Start: 04:38:08 End 04:41:37	39°26.2198' S 111°19.3554' W 39°26.3150' S 111°19.3587' W	Gorgonian area II: Living gorgonians, partly with heavily calcified stems. The accompanying fauna was composed of actinians, sponges and a few squat lobsters. The substrate consisted of weakly sorted talus.

10.7 Analyses of Symbioses

The animal material obtained with the 30-GTV sample included some specimens of *Bathymodiolus* ranging in size from <5 to 93 mm body length. Brief inspection of the shell morphology of some larger specimens suggested that they do not belong to *B. thermophilus*, which is a common species at the hydrothermal vent areas of the EPR and the Galapagos Rift. Four specimens designated for analyses of symbioses were stored in chilled water and dissected within 20 hours after sample recovery. Gill filaments, muscle tissues, internal organs and commensal polychaete specimens of the genus *Branchipolynoe* were dissected, and tissue samples or entire specimens (commensals) were fixed in several fixatives (Trump's fixative, 96% ethanol, 4% formaldehyde solution) or frozen (-20°C). These treatments will allow various analyses in the home laboratory, e.g. (*i*) investigation of the ultrastructural morphology of gills and digestive glands, (*ii*) DNA analyses of genes from hosts and symbionts, (*iii*) verification of symbiotic gene sequences in host tissues with Fluorescence *in situ* Hybridisation, (*iv*) determination of stable isotope ratios, (*v*)

ultrahistochemical localisation of trace elements and polarographic determination of their concentration, and (*vi*) immuno-ultracytochemical localisation of microbial key enzymes.

The PAR mytilids showed some peculiarities which may promise interesting results from the analyses mentioned above. The gill morphology appeared unusual because this organ was only moderate hypertrophic in all dissected specimens. Commensal polychaetes were found in only 50% of all opened mussels. Unlike other *Bathymodiolus* specimens from hydrothermal vent areas with sulfide-rich fluids, the PAR specimens did not spread the typical smell of H_2S when the shells where opened for tissue dissection. This may indicate a possible minor role of diluted sulfide in the emerging hydrothermal fluids, at least within some time immediately before sampling. Some specimens are shown in Fig. 10.1.

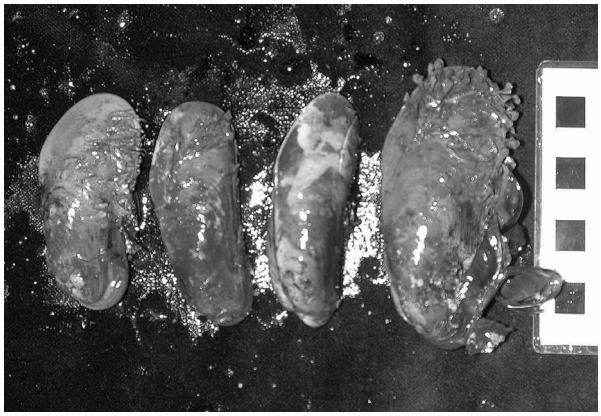

Fig. 10.1: Specimens of PAR *Bathymodiolus* from 38°S designated for analyses of symbioses.

Appendices

No. of Pages

APPENDIX 1: SHIPBOARD SCIENTIFIC PARTY CONTACT DETAILS

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APPENDIX 2: PETROLOGY STATIONS AND SAMPLE DESCRIPTIONS

station DS: dredge GTV: TV- grab	**on bottom:** day time lat long depth **off bottom:** day time lat long depth *day time = UTC	**sample number: description** <u>station</u> <u>dredge used</u> 02, 29-64 DS: small cylinder with large teeth (tonnendredge) 03-28 DS: medium-sized curving frame with large teeth + chain-sack (Old Faithful) 65 DS: large heavy flat frame with serrated teeth + chain-sack (Bella Maria) * each different lithology recovered from a station is designated **Unit A**, **Unit B**, etc. These "units" are for classification at each station. Note that **Unit A** at 02 DS is **NOT** the same as **Unit A** at 03 DS or any other station	**sample type** Gl: glass Ts: section Gc: block Ms: sulfide
02 DS	24.06 00:14 37°39.936S 110°52.519W 2224m	1: 7 x 5 cm dark grey aphyric lava (andesite?) with trace black pyroxene phenocrysts, glass crust up to 5 mm thick, 10% vesicles 1-2 mm across which are often Fe-stained. **Unit A**.	Gl, Gc
	24.06 01:05 37°39.505S 110°52.345W 2225m	2: 22 x 14 cm dark grey aphyric lava, identical to **Unit A** but lacks glass crust. Well-developed small quench joints along one surface, weak silica and Fe-staining also along this surface but fresh interior.	Ts, Gc
03 DS	24.06 03:07 37°39.518S 110°52.327W 2226m	1: 8 x 4 cm black aphyric lava (dacite?), conchoidal fracture, extremely fresh with slight Fe-staining on some fractures, 5% small elongate vesicles. **Unit A**.	Gl, Gc
		2: 7 x 4 cm **Unit A**.	Gl, Gc
	24.06 03:47 37°39.263S 110°52.262W 2215m	3: Bulk sample of 9 **Unit A** pieces, each about 7 x 5 cm. 4: 7 x 3 cm very dark grey aphyric lava (dacite?), conchoidal fracture, slightly less fresh with yellowish-orange film on some surfaces, 5% small vesicles. **Unit B**.	Gl, Gc
		5: Bulk sample of 3 **Unit B** pieces, each about 5 x 4 cm.	
		6: 23 x 9 cm dark grey aphyric lava (andesite?), one glassy patch, 10% elongate vesicles up to 8 cm long, thin MnOx film on most surfaces. **Unit C**.	Gl, Gc
		7: 16 x 7 cm **Unit C**, but with no glass. Sub-sampled by Toronto.	Ts, Gc
		8: Bulk sample of 3 **Unit C** pieces, each about 10 x 4 cm.	
		9: 13 x 5 cm dark grey aphyric lava (andesite?), 15% large vesicles up to 1 cm across but not elongate, thin MnOx layer over most surfaces and in vesicles. **Unit D**.	Ts, Gc
		10: Bulk sample of 2 **Unit D** pieces, each 7 x 4 cm.	
		11: 3 **Unit A** pieces taken by Freiberg for devitrification study (11-FG).	
04 DS	24.06 05:35 37°38.085S 110°52.077W 2232m	1: 9 x 4 cm dark grey aphyric lava (andesite?), 10% large vesicles to 7 mm across and circular, glass developed at one rim, surface coating of cream silica and minor orange Fe-staining up to 1 mm thick. **Unit A**.	Gs, Gc
	24.06 06:12 37°38.372S 110°51.990W 2193m	2: 16 x 8 cm **Unit A**, but no glass. Silica and Fe-staining are developed along fractures throughout the clast.	Gs, Gc
		3: 12 x 5 cm **Unit A** (no glass). 4: 9 x 6 cm **Unit A** (no glass).	
		5: 14 x 5 cm black dense glassy lava (dacite?), conchoidal fracture, incipient devitrification on some surfaces with a few elongate vesicles, thin silica and Fe-stained surface rind. **Unit B**. Sub-sampled by Freiberg for devitrification study (5-FG).	Gs, Gc
		6: 15 x 9 cm black aphyric lava (andesite?), somewhat glassy at one rim, mostly consisting of devitrified glass,	Ts, Gc

		thin (1 mm thick) MnOx crust. **Unit C**. 7: 12 x 7 cm **Unit C**.	
05 DS	24.06 08:14 37°36.368S 110°51.345W 2208m 24.06 08:43 37°36.515S 110°51.188W 2268m	1: >40 cm pillow fragment, pyroxene-plagioclase andesite, 5% black pyroxene phenocrysts up to 3 mm long, 5% plagioclase phenocrysts shed from diasggregating plagioclase-rich clusters that include rare altered olivines. Vesicle-free cores are surrounded by 10% vesicles in outer rim. Traces of disseminated pyrite in more vesicular areas. Well-developed glass crust up to 1.5 cm thick. Older than previous dredge samples, with intermittent MnOx rind up to 1 mm thick. **Unit A**. Sub-sampled by Freiberg for plagioclase phenocrysts (1-FG), and also Toronto. 2: >30 cm pillow fragment, **Unit A**. Particularly well-developed darker glassy bands every few mm which are more vesicular (incipient pull-aparts). 3: >30 cm pillow fragment, **Unit A**. Poorly-developed glass crust only 2 mm thick. 4: >30 cm pillow fragment, **Unit A**. About 10% small (<1 mm across) vesicles throughout. Sub-sampled by Toronto. 5: >20 cm pillow fragment. As for Unit A, but has much higher number of vesicles (15%) and they are larger (to 4 mm across), **Unit B**. Traces of marcasite-pyrite as a film on inner vesicle surfaces. Sub-sampled by Freiberg for pyrite (5-FG), and also Toronto. 6: 18 x 7 cm **Unit A**, as for 4. Sub-sampled by Toronto. 7: 10 x 5 cm **Unit B**.	Gl, Ts Gl, Ts Ts, Gc Gl, Ts Gl, Ms Ts, Gc Ts, Gc
06 DS	24.06 10:42 37°33.710S 110°49.560W 2228m 24.06 11:23 37°33.502S 110°49.341W 2264m	1: >30 cm pillow fragment, aphyric andesite, traces of black pyroxene phenocrysts up to 2 mm long and disaggregating plagioclase-rich clusters. Poorly-developed glass crust locally up to 5 mm thick. Relatively old, with continuous black MnOx crust up to 1 mm thick. **Unit A**. 2: >30 cm pillow fragment, **Unit A**. 3: 24 x 14 cm **Unit A**, but no glass. 4: 23 x 6 cm **Unit A**, but columnar jointed and with no glass. Concentric orange weathering bands penetrate to core. Numerous small pull-apart structures sub-parallel to the clast margins, Fe-staining along some of these. Sub-sampled by Toronto. 5: >23 cm pillow fragment, **Unit A**. One other **Unit A** piece sampled by Toronto.	Gl, Ts, Gc Gl, Ts, Gc Ts, Gc
07 DS	24.06 13:56 37°41.629S 110°52.833W 2261m 24.06 15:00 37°41.622S 110°52.992W 2268m	Empty dredge.	
11 DS	25.06 07:19 37°42.096S 111°07.847W 1626m 25.06 07:50 37°42.415S 111°07.884W 1664m	Empty dredge.	
12 DS	25.06 09:50	1: 9 x 7 cm dark grey plagioclase basalt, 15% large	Gl, Ts, Gc

	37°44.488S 111°04.020W 2316m 25.06 10:56 37°44.282S 111°03.860W 2331m	plagioclase phenocrysts up to 4 mm across and averaging 2 mm across which are stained pale yellow along fractures, a pillow tube with a glass crust up to 2 mm thick, plagioclase concentrated at the pillow rim. Thin patchy MnOx crust locally up to 1 mm thick. **Unit A**. 2: 13 x 11 cm **Unit A**, pillow tube. 3: 9 x 7 cm **Unit A**, pillow tube. Sub-sampled by Toronto. 4: 16 x 6 cm **Unit A**, but pillow interior only. 5: 15 x 10 cm **Unit A**, half pillow tube. 6: 14 x 12 cm **Unit A**, pillow tube; display specimen. 7: 12 x 15 cm **Unit A**, half pillow tube with drained 4 cm diameter core; display specimen. 8: 10 x 7 cm **Unit A**, sampled by Freiberg only for plagioclase phenocrysts (8-FG). 9: 9 x 6 cm **Unit A**, sampled by Freiberg only for plagioclase phenocrysts (9-FG). 10: 9 x 7 cm **Unit A**, sampled by Freiberg only for plagiolclase phenocrysts (10-FG). 11: 10 x 7 cm **Unit A**, sampled by Freiberg only for display collections (11-FG). 12: 16 x 10 cm **Unit A**, sampled by Freiberg only for display collections (12-FG).	 Gl, Ts, Gc Gl, Ts, Gc Ts, Gc
15 DS	26.06 01:38 37°37.07S 110°51.78W 2209m 26.06 02:09 37°37.29S 110°51.93W 2211m	1: 35 x 10 cm dark grey aphyric pillow lava (andesite?), well-developed glass crust up to 5 mm thick, 10% elongate vesicles to 2 cm long at the crust decreasing to trace amounts in the core. **Unit A**. Sub-sampled by Freiberg for display collections (1-FG), and also by Toronto. 2: 35 x 20 cm **Unit A** pillow, particularly well-developed glass crust up to 1 cm thick, pillow interior has orange concentric weathering on some fracture surfaces. Sub-sampled by Freiberg for a plagioclase xenocryst (2-FG), and also by Toronto. 3: 20 x 8 cm **Unit A**. 4: 15 x 7 cm **Unit A**, with a thin film of pyrite-marcasite in on inside of some vesicles. 5: 11 x 4 cm **Unit A**. 6: 11 x 6 cm **Unit A** pillow interior, dark grey with no glass or vesicles. Possibly small agglomerates of plagioclase or clinopyroxene. Sub-sampled by Toronto. 7: 15 x 6 cm **Unit A**, as for 6 but with much orange staining along fractures.	Gl, Ts Gl, Ts Gl, Ts Ts, Ms Ts Ts, Gc Ts
16 DS	26.06 05:40 37°40.116S 110°52.710W 2208m 26.06 06:17 37°40.377S 110°52.780W 2226m	Empty dredge.	
17 DS	26.06 08:04 37°40.042S 110°52.610W 2222m 26.06 08:43 37°40.356S 110°52.732W 2230m	1: 13 x 12 cm pillow sector, basalt, 5% plagioclase +/- olivine phenocrysts up to 2 mm across, 3% vesicles up to 1 cm across, glass crust up to 5 mm thick. **Unit A**. 2: 15 x 15 cm sheet flow?, wrinkled glass surface up to 1 cm thick, 5% round to irregular vesicles, 15% plagioclase +/- olivine phenocrysts to 5 mm across. **Unit B**. 3: 15 x 10 cm pillow sector, 5 mm thick glass crust, minor Fe staining, 5% vesicles to 5 mm across, 5% plagioclase +/- olivine phenocrysts to 4 mm across. **Unit A** (?). 4: Pillow sector, glass crust to 5 mm thick, no phenocrysts,	Gl, Ts Gl, Ts Gl, Ts

		rare elongate vesicles. Sub-sampled by Freiberg for display collections (4-FG). 5: 9 x 6 cm pillow sector, 5 mm glass crust, minor Fe staining, 5% vesicles. Sub-sampled by Toronto. Plus 2 extra pieces to Kiel.	
18 DS	26.06 10:42 37°40.987S 110°52.982W 2220m 26.06 12:16 37°41.827S 110°53.272W 2258m	1: 23 cm pillow fragment, aphyric basalt with traces of small (<1mm) plagioclase, intermittent glass crust to 5 mm thick, 5% circular vesicles to 3 mm across, pyrite-marcasite in some vesicles at glass crust. **Unit A**. 2: 19 cm pillow fragment, aphyric with traces of small (<1mm) plagioclase, thick well-developed glass crust to 3 cm thick, no vesicles, orange Fe-staining along fractures. **Unit B**. Sub-sampled by Freiberg for glass (2-FG). 3: 17 x 10 cm blocky aphyric basalt, numerous pull-aparts subparallel to surface and highly vesicular, minor orange Fe-staining on pull-aparts. **Unit C**. 4: 9 x 5 cm plagioclase basalt, 5% small (1mm) phenocrysts, columnar jointed blocks with glass crusts up to 5 mm thick, 5% small vesicles throughout. **Unit D**. Sub-sampled by Toronto. 5: 7 x 3 cm **Unit D**. Sub-sampled by Freiberg for devitrification study and display collections (5-FG). 6: 12 x 7 cm aphyric lava (andesite?), glassy surface, 10% vesicles near surface decreasing inwards, vesicles distinctively stretched to >5 mm long, probably younger flow as less orange Fe-staining. **Unit E**. Sub-sampled by Toronto. 7: 14 x 8 cm **Unit E**. Sub-sampled by Freiberg for display collections (7-FG).	Gl, Ts, Ms Gl, Ts Ts, Gc Ts, Gc Ts, Gc
21 DS	27.06 03:34 37°58.213S 110°58.105W 2232m 27.06 04:21 37°58.548S 110°58.232W 2243m	Empty dredge.	
22 DS	27.06 06:04 37°58.182S 110°58.086W 2234m 27.06 06:59 37°58.566S 110°58.308W 2243m	Empty dredge.	
23 DS	27.06 09:21 37°53.893S 110°56.481W 2234m 27.06 10:11 37°54.114S 110°56.774W 2243m	Empty dredge.	
24 DS	27.06 11:47 37°54.201S 110°56.845W 2260m 27.06 13:55 37°54.008S	1: 15 x 15 cm pillow, dark grey aphyric lava (andesite?), well-developed glass crust up to 2 mm thick, rare (<2%) vesicles up to 5 cm across but most very small and with irregular margins, incipient pull-aparts(?) are relatively devitrified suggesting >55% SiO_2, concentric orange Fe-staining through outermost 3 cm, local minor MnOx	Gl, Ts

	110°56.850W 2266m	coating (<1 mm thick). **Unit A**. Sub-sampled by Toronto. 2: 30 x 30 cm pillow sector, **Unit A**. 3: Pillow, **Unit A**. Thin pyrite-marcasite film on margin of one vesicle. 4: Pillow, **Unit A**, sampled by Freiberg only for glass and devitrification study (4-FG). 5: Pillow, **Unit A**, sampled by Toronto only. 6: Pillow, **Unit A**, sampled by Toronto only.	 Gl, Ts Gl, Ts, Ms Ts
27 DS	28.06 05:03 37°50.41S 110°55.59W 2233m 28.06 05:50 37°50.63S 110°55.76W 2266m	Empty dredge.	
28 DS	28.06 07:41 37°50.40S 110°55.61W 2243m 28.06 08:57 37°50.56S 110°55.37W 2230m	Lost dredge, cable snapped 250 m from dredge due to severe abrasion on sharp rocks.	
29 DS	28.06 12:14 37°58.222S 110°58.137W 2249m 28.06 13:19 37°58.632S 110°58.296W 2228m	1: 9 x 6 cm dark grey aphyric basalt, trace plagioclase phenocrysts to 1 mm across, glass crust up to 3 mm thick, pillow fragment, dense, 5% vesicles grading to incipient pull-aparts and mostly in layer 2 cm below crust, yellow-orange concentric Fe-staining along fracture surfaces. **Unit A**. 2: 10 x 3 cm **Unit A** pillow sector. 3: 7 x 4 cm **Unit A** pillow sector. 4: 7 x 3 cm pillow sector, as for Unit A but with 2% black pyroxene needles up to 2 mm long, also a speck of pyrite-marcasite in one vesicle. **Unit B**. 5: 12 x 6 cm **Unit A** pillow sector. 6: 5 x 3 cm small black sheet flow with glass crusts on both sides, aphyric but with one olivine phenocryst 3 mm across, glass crust up to 1 cm thick. **Unit C**. 7: 5 x 3 cm **Unit A**, sampled by Freiberg only for plagioclase phenocrysts (7-FG). 8: Bulk sample of 2 small **Unit A** pieces each 4 x 3 cm taken by Kiel.	Gl, Ts, Gc Gl, Ts, Ms, Gc Gl, Ts
30 GTV	28.06 16:14 37°47.448S 110°54.856W 2199m 28.06 18:57 37°47.469S 110°54.903W 2214m	1: Numerous pillow sector pieces up to 9 x 2 cm of black to dark blue aphyric dacite, conchoidal fractures, numerous spherulites on more devitrified inner surfaces, glass crust up to 1 cm thick, no vesicles. **Unit A**. 2: 18 small **Unit A** pieces representing six different stages of devitrification, sampled by Freiberg only for the devitrification study (2-FG).	Gl*2, Ts, Gc
31 GTV	28.06 21:42 37°46.541S 110°54.623W 2204m 28.06 22:55 37°46.544S 110°54.633W 2201m	1: 19 x 10 cm pillow, very dark grey aphyric (trace plagioclase) andesite, glass crust up to 5 mm thick, orange clay and MnOx up to 1 mm thick on glass. **Unit A**. 2: 9 cm pillow sector of **Unit A**, sampled by Freiberg only for glass and devitrification study (2-FG). 3: 15 x 6 cm **Unit A**, 2 interlocking small pillows. 4: 13 x 4 cm **Unit A**, pillow with hollow core. 5: 9 x 8 cm pillow sector of **Unit A**, denser core with 2%	 Ts Gl, Ts*2,

		vesicles up to 1 mm across. 6: Bulk sample of two 6 x 4 cm small pillows, each **Unit A** and predominantly consisting of glass. One other piece sampled by Toronto.	Gc
32 DS	29.06 02:24 38°01.89S 110°58.79W 2235m 29.06 03:14 38°01.64S 110°58.77W 2243m	1: 10 x 4 cm dark grey aphyric lava (andesite?), wrinkly glass crust up to 5 mm thick, local small patches of <1 mm thick MnOx, 2% vesicles up to 2 mm across and round, vesicles have pyrite-marcasite films, a pillow sector, rock smells of H_2S when cut. **Unit A**.	Gl, Ts, Ms, Gc
34 DS	29.06 23:34 38°12.86S 111°11.17W 2308m 29.06 23:57 38°12.68S 111°11.09W 2157m	1: 24 x 11 cm pillow tube of black aphyric (trace plagioclase, 1 olivine seen) andesite, glass crust up to 5 mm thick, numerous spherulites below glass, hollow core up to 5 mm diameter, minor orange-MnOx (<<1 mm) on glass, basically fresh. **Unit A**. Sub-sampled by Freiberg for glass (1-FG). 2: 14 x 10 cm pillow sector, dark grey plagioclase basalt, with 5% plagioclase up to 1 mm across, trace olivine to 1 mm across, 5% small empty vesicles to 1 mm across, MnOx coating consistently 1 mm thick over entire boulder. **Unit B**. Sub-sampled by Freiberg for glass and devitrification study (2-FG). 3: 15 x 15 cm pillow sector, **Unit B**, locally with glass crust up to 5 mm thick.. 4: 23 x 10 cm pillow sector, **Unit B**, locally with glass crust up to 5 mm thick. Sub-sampled by Freiberg for glass and devitrification study (4-FG), and by Toronto.	Gl, Ts, Gc Ts, Gc Gl, Ts, Gc
35 DS	30.06 02:17 38°13.205S 111°02.990W 2244m 30.06 03:08 38°12.904S 111°02.937W 2238m	Empty dredge.	
36 DS	30.06 04:43 38°12.900S 111°03.013W 2246m 30.06 06:00 38°12.385S 111°03.007W 2243m	1: 16 x 12 cm pillow, blue-grey essentially aphyric andesite, up to 2% plagioclase often in clusters up to 6 mm across, trace black pyroxene needles to 2 mm long, glass crust up to 2 mm thick (normally 1 mm), 5% small vesicles 2 mm across mostly in a band 1 cm below the crust, concentric orange Fe-staining to 2 cm from crust. **Unit A**. 2: 11 x 6 cm pillow sector, **Unit A**. Sub-sampled by Toronto. 3: 10 x 6 cm pillow sector, **Unit A**. 4: Bulk sample of 6 pillow sector pieces, each about 6 x 5 cm, **Unit A**. 5: 6 x 4 cm pillow sector **Unit A**, sampled by Freiberg only for glass and plagioclase phenocrysts (5-FG).	Gl*2, Ts, Gc Gl, Ts, Gc
37 DS	30.06 08:09 38°16.874S 111°00.088W 2187m 30.06 08:50 38°16.490S 110°59.680W 2108m	1: 15 x 7 cm grey aphyric lava (andesite?), wrinkly glass crust 1-3 mm thick, small flat pillow, trace empty vesicles, numerous internal fractures but fresh. **Unit A**. 2: 11 x 4 cm **Unit A**, but locally orange clay-Fe staining on top of glass to 1 mm thick. 3: 10 x 5 cm **Unit A**, but extensive orange clay-Fe staining on top of glass to 1 mm thick. 4: 10 x 6 cm pillow sector, **Unit A**, but glass is smooth. 5: 5 x 4 cm **Unit A**, sampled by Freiberg only for glass (5-	Ts, Gc Ts, Gc Ts, Gc Ts, Gc

		FG). Bulk sample of 6 **Unit A** pieces, each about 6 x 4 cm, taken by Kiel. One other **Unit A** piece sampled by Toronto.	
38 DS	30.06 11:04 38°18.282S 110°51.776W 2501m	1: 12 x 4 cm dark grey plagioclase basalt, 15% plagioclase up to 3 mm across, 10% small (1 mm across) empty vesicles, MnOx crust up to 1 mm thick, relatively old lava. **Unit A**.	Ts, Gc
	30.06 12:10 38°17.653S 110°51.487W 2351m	2: 11 x 7 cm pillow fragment, dark grey aphyric basalt, trace plagioclase to 2 mm across, 10% small empty vesicles (1 mm across), poorly-developed glass crust to 1 mm thick overlain by orange MnOx to 1 mm thick. **Unit B**.	Ts, Gc
		3: 12 x 5 cm pillow sector, **Unit B**.	Ts, Gc
		4: 5 x 5 cm pillow sector, **Unit B**, with well-developed glass.	Gl, Ts, Gc
		5: 15 x 6 cm pillow sector, **Unit B**, weak yellow staining in core. Sub-sampled by Toronto.	Ts, Gc
		6: 12 x 7 cm pillow sector, aphyric grey basalt, 15% small (1 mm across) empty vesicles, poorly-developed glass crust 1 mm thick, MnOx crust up to 1 mm thick over glass, yellow-orange Fe-staining along fractures. More weathered older lava. **Unit C**.	Ts, Gc
		7: 8 x 7 cm **Unit C**. Sub-sampled by Toronto.	Ts, Gc
		8: 15 x 6 cm pillow sector, aphyric grey basalt, trace plagioclase to 3 mm across (+/- olivine in very rare clusters), 10% small (1 mm across) empty vesicles, hollow pillow core 2 cm in diameter, glass crust up to 1 mm thick and locally with MnOx <1 mm thick. **Unit D**.	Ts, Gc
		9: 10 x 9 cm **Unit D**.	Ts, Gc
40 DS	30.06 20:48 38°20.30S 111°04.37W 2256m	1: 27 x 15 cm pillow fragment of blue-grey aphyric lava (andesite?), glass crust 2 mm thick going from smooth to wrinkle textured as it thickens, concentric orange Fe-staining up to 4 cm within the rock, hollow pillow core 6 cm in diameter. **Unit A**.	Gl
	30.06 21:31 38°19.87S 111°04.12W 2259m	2: 6 x 2 cm pillow sector, **Unit A**, only of outermost glass crust.	Gl
		3: 11 x 7 cm pillow sector, **Unit A**, but thin (<1 mm thick) smooth glass crust with striations.	Gl
		4: 8 x 6 cm pillow sector, **Unit A**, sampled by Freiberg only for glass (4-FG).	
42 DS	01.07 02:51 38°24.99S 111°04.91W 2266m	1: 23 x 9 cm pillow sector, grey essentially aphyric basalt (?), trace to 2% plagioclase, poorly-developed smooth glass crust up to 1 mm thick, MnOx up to 1 mm thick, 5% vesicles in a band 1.5 cm below the crust, orange Fe-staining penetrates to 2 cm within rock along fractures. **Unit A**.	Gl
	01.07 04:33 38°24.606S 111°04.559W 2259m	2: 11 x 5 cm **Unit A**, no glass and probably a pillow core.	Ts, Gc
		3: 9 x 3 cm dark grey aphyric basalt, well-developed 2-5 mm thick glass crust, 5% vesicles mostly in a band 2 cm below the crust, thin MnOx and orange Fe-staining along fractures. **Unit B**.	Gl
		4: 7 x 4 cm **Unit B**.	Gl
		5: 8 x 4 cm dark grey aphyric basalt, trace plagioclase, smooth glass crust up to 1 mm thick, 10% empty vesicles up to 2 mm across throughout, minor orange Fe-staining along fractures. **Unit C**.	Gl
		6: 6 x 3 cm very dark grey aphyric basalt, trace plagioclase, smooth glass crust 1 mm thick, 5% vesicles in band 2 cm below surface, MnOx layer 1 mm thick on fractures and	Gl

		lower surface. **Unit D**. One other piece sampled by Toronto.	
43 DS	01.07 06:50 38°30.001S 111°06.399W 2262m 01.07 07:33 38°29.509S 111°06.122W 2258m	Empty dredge.	
44 DS	01.07 09:04 38°29.580S 111°06.194W 2253m 01.07 09:58 38°29.01S 111°06.15W 2256m	1: 19 x 4 cm black aphyric basalt, trace plagioclase to 2 mm across, smooth but fractured glass crust up to 3 mm thick, lower side is also smooth and has drips indicating development of a large lava tube, 10% irregular vesicles to 3 mm long in central band, fresh. **Unit A**. 2: 8 x 7 cm dark grey aphyric basalt, poorly-developed glass crust to 1 mm thick, pillow fragment with 2 cm diameter hollow core, dense, yellow-orange Fe-staining on fractures. **Unit B**. 3: 11 x 4 cm **Unit A**. 4: 7 x 2 cm **Unit A**, mostly glass. 5: 8 x 5 cm **Unit B**. 6: 3 **Unit A** pieces up to 9 x 6 cm each sampled by Freiberg only for glass and display collections (6-FG). One other piece sampled by Toronto.	Gl, Ts Gl, Ts Gl, Ts Gl Ts, Gc
45 DS	01.07 12:08 38°35.10S 111°07.83W 2271m 01.07 13:18 38°34.64S 111°07.72W 2266m	1: 14 x 8 cm dense dark grey plagioclase basalt, 5% plagioclase phenocrysts up to 1 mm across, wrinkly glass crust to 3 mm thick, minor yellow-orange Fe-staining on fractures, pillow fragment. **Unit A**. Sub-sampled by Toronto. 2: 10 x 9 cm pillow sector, as for 1 but smooth glass crust up to 1 mm thick only. **Unit B**.	Gl, Ts Gl, Ts
46 DS	02.07 14:18 41°42.951S 111°14.983W 2505m 02.07 15:02 41°42.508S 111°15.424W 2495m	1: 9 x 6 cm dark grey plagioclase basalt, 5% plagioclase phenocrysts up to 2 mm across, thin smooth glass crust up to 1 mm thick, 10% small empty vesicles 1 mm across increasing to 15% up to 2 mm across in band 1.5 cm below crust. **Unit A**. Sub-sampled by Freiberg for glass (1-FG). 2: 6 x 5 cm dark grey plagioclase basalt, 10% small plagioclase phenocrysts up to 1 mm across, smooth glass crust up to 2 mm thick, 10% empty vesicles up to 3 mm across and throughout rock (but largest in band 1.5 cm below crust). **Unit B**.	Ts, Gc Gl, Ts
47 DS	02.07 18:34 41°29.26S 111°16.13W 2536m 02.07 19:11 41°29.48S 111°15.73W 2503m	Empty dredge.	
48 DS	02.07 21:26 41°29.25S 111°16.15W 2536m 02.07 23:38 41°29.26S 111°16.25W 2537m	1: 6 x 5 cm black aphyric lava (andesite?), glassy in patches but no real glass crust, 10% elongate vesicles up to 2 cm long and flow aligned, fresh. **Unit A**. 2: 4 x 3 cm **Unit A**, with traces of pyrite-marcasite in vesicles and smells of H_2S when cut. Bulk sample of 2 **Unit A** pieces, one 9 x 0.5 cm and the other 5 x 2 cm, taken by Kiel.	Gc Ts, Ms

49 DS	05.07 02:31 41°22.379S 111°23.226W 2210m	1: 16 x 5 cm black aphyric basalt, trace plagioclase phenocrysts up to 2 mm across, wrinkly glass crust up to 3 mm thick, trace xenoliths of baked sediment, 5% empty vesicles near crust only, fresh. **Unit A**.	Gl, Ts
	05.07 03:26 41°22.862S 111°22.910W 2225m	2: 13 x 5 cm **Unit A**. 3: 8 x 5 cm **Unit A**. 4: 11 x 6 cm black aphyric basalt, trace olivine and plagioclase phenocrysts both up to 1 mm across, glass crust up to 2 mm thick, 5% empty vesicles <1 mm across throughout, locally thin MnOx (<1mm thick) on glass. **Unit B**. 5: 11 x 6 cm **Unit B**. 6: 17 x 14 cm black aphyric basalt, trace olivine phenocrysts up to 1 mm across, glass crust 2 mm thick, up to 2 mm of MnOx on glass but interior fresh. **Unit C**. Sub-sampled by Freiberg for display collections (6-FG). 7: 13 x 7 cm **Unit C**. Sub-sampled by Freiberg for phenocrysts (7-FG). 8: 12 x 6 cm grey aphyric basalt, trace plagioclase and olivine phenocrysts both up to 1 mm across, 5% vesicles up to 5 mm long and elongate and with pyrite-marcasite specks, weathering rind 5 mm thick, locally shades of blue-grey around vesicles suggesting silicification. **Unit D**. 9: 11 x 5 cm **Unit D**. Sub-sampled by Toronto. 10: 9 x 4 cm grey aphyric basalt, one gabbroic clot 1 cm across (plagioclase + black pyroxene), 10% empty vesicles up to 5 mm long and elongate, weak flow banding, rather lightweight (devitrified glass?). **Unit E**. Sub-sampled by Freiberg for plagioclase and devitrification study (10-FG). 11: 16 x 6 cm dolerite, sub-equal plagioclase and black pyroxene with trace olivine (<1 mm across), trace plagioclase phenocrysts to 3 mm across, columnar jointed block, weathering rind 5 mm thick. **Unit F**. Sub-sampled by Freiberg for plagioclase (11-FG), and also Toronto. 12: 14 x 6 cm grey dolerite. As for Unit F, but finer-grained matrix and no olivine. **Unit G**. Sub-sampled by Freiberg for plagioclase (12-FG). 13: 12 x 4 cm grey dolerite. As for Unit G, but grain size intermediate between Units F and G. **Unit H**. Sub-sampled by Freiberg for plagioclase (13-FG). 14: 13 x 5 cm blue-grey plagioclase basalt, 20% large plagioclase phenocrysts up to 5 mm across, poorly-developed glass crust 3 mm thick, MnOx coating 1 mm thick, slightly weathered interior. **Unit I**. Sub-sampled by Freiberg for plagioclase (14-FG), and also Toronto. 15: Piece of **Unit E** sampled by Freiberg only for display collections (15-FG). 16: Piece of **Unit E** sampled by Freiberg only for display collections (16-FG). 17: Piece of **Unit E** sampled by Freiberg only for display collections (17-FG). 18: Piece of **Unit E** sampled by Freiberg only for display collections (18-FG). 19: Piece of **Unit A** sampled by Freiberg only for plagioclase (19-FG).	Gl, Ts Gl, Ts, Gc Gl, Ts Ts, Gc Ts, Gc Ms Ts, Gc Ts, Gc Ts, Gc Ts, Gc Ts, Gc
50 DS	05.07 06:22 41°23.153S	1: 12 x 5 cm pillow sector, dark grey plagioclase basalt, 15% plagioclase phenocrysts up to 1 mm across, 5%	Ts, Gc

	111°30.798W 2464m 05.07 07:18 41°23.608S 111°30.464W 2507m	empty vesicles to 1 mm across throughout, poorly developed glass crust <1 mm thick, MnOx up to 1 mm thick on top of glass. **Unit A**. 2: 8 x 5 cm pillow sector, **Unit A**. Sub-sampled (thin section piece) by Freiberg for plagioclase (2-FG). 3: 12 x 5 cm pillow sector, **Unit A**. 4: 14 x 7 cm pillow sector, **Unit A**. 5: Piece of **Unit A** only sampled by Toronto.	 Ts, Gc Gl, Ts
51 DS	05.07 10:16 41°18.733S 111°30.799W 2443m 05.07 11:13 41°19.237S 111°30.378W 2579m	1: 11 x 6 cm pillow sector, dark grey dense aphyric basalt, trace plagioclase phenocrysts to 2 mm across, 5% small empty vesicles <1 mm across throughout, poorly-developed glassy crust <1 mm thick, minor MnOx in patches to 1 mm thick and minor orange Fe-staining. **Unit A**. Sub-sampled (thin section piece) by Freiberg for plagioclase (1-FG). 2: 8 x 5 cm pillow sector, **Unit A**. 3: 8 x 4 cm pillow sector, dense dark grey aphyric basalt, trace plagioclase phenocrysts to 2 mm across, no vesicles, wrinkly glass crust 1 mm thick, MnOx patches to 1 mm thick. **Unit B**. 4: 6 x 3 cm small pillow, **Unit B**, soft orange sediment trapped in hollow core.	Ts, Gc Ts, Gc Gl, Ts Gl, Ts
52 DS	05.07 14:15 41°10.846S 111°33.201W 2525m 05.07 15:25 41°11.23S 111°33.375W 2537m	1: 17 x 7 cm pillow sector, dark grey olivine-plagioclase basalt, 5% olivine phenocrysts up to 1 mm across and 10% smaller plagioclase phenocrysts often in chains, 5% small empty vesicles throughout, glass crust to 1 mm thick, orange Fe-staining. **Unit A**. 2: 16 x 6 cm pillow sector, **Unit A**. 3: 11 x 4 cm pillow sector, **Unit A**, but more weathered with 1 mm MnOx layer over glass, also vesicles up to 1 mm across. 4: 8 x 7 cm black olivine-plagioclase basalt, 5% olivine phenocrysts up to 1 mm across, 5% small plagioclase phenocrysts, 5% vesicles up to 2 mm across and concentrated at the core, well-developed smooth glass crust up to 3 mm thick, fresher but still <1 mm MnOx on some surfaces. **Unit B**. 5: 7 x 5 cm **Unit B**. 6: Bulk sample of 2 small **Unit B** pieces, 7 x 4 and 7 x 3 cm, with the smaller being mostly glass. 7: Piece of **Unit A** sampled by Freiberg only for plagioclase and display collections (7-FG). 8: Piece of **Unit B** sampled by Freiberg only for glass (8-FG). 9: Piece of **Unit B** sampled by Freiberg only for glass (9-FG). One other piece sampled by Toronto.	Gl, Ts, Gc Ts, Gc Ts, Gc Gl, Ts Gl, Ts
53 DS	05.07 18:30 41°00.51S 111°32.27W 2492m 05.07 19:15 41°00.94S 111°32.05W 2455m	1: 13 x 5 cm sheet flow, black aphyric basalt, smooth glass crust 2 mm thick, 5% irregular empty vesicles to 2 mm across, fresh. **Unit A**. 2: 15 x 3 cm sheet flow, **Unit A**. 3: 9 x 7 cm pillow tube, olivine basalt with 5% olivine phenocrysts up to 1 mm across, glass crust to 1 mm thick, trace empty vesicles, minor orange Fe-staining along fractures. **Unit B**. 4: 12 x 3 cm sheet flow, black aphyric basalt, up to 5% vesicles <1 mm across along one side (only), wrinkly crust but no glass, orange Fe-staining, older sheet flow. **Unit C**. 5: 15 x 10 cm black aphyric basalt, trace olivine	Gl, Ts Gl, Ts Gl, Ts Ts, Gc Gl, Ts

		phenocrysts up to 1 mm across, wrinkly glass crust to 3 mm thick at pillow folds, 10% empty vesicles up to 2 mm across, orange Fe-staining. **Unit D**. 6: 7 x 4 cm black olivine basalt, 5% olivine phenocrysts up to 1 mm across, wrinkly glass crust 1-2 mm thick, 5% empty vesicles to 1 mm across, yellow-orange Fe-staining on fractures. **Unit E**. 7: 7 x 5 cm **Unit E**. 8: 11 x 8 cm black aphyric basalt, trace plagioclase phenocrysts up to 1 mm across, glass crust 1 mm thick, 5% empty vesicles up to 1 mm across. **Unit F**. 9: Piece of **Unit A** sampled by Freiberg only for display collections (9-FG). 10: Piece of **Unit A** sampled by Freiberg only for display collections (10-FG).	Gl, Ts Gl, Ts Gl, Ts
54 DS	05.07 22:46 40°46.21S 111°28.47W 2429m 05.07 23:33 40°46.63S 111°28.26W 2442m	1: 26 x 8 cm sheet flow, black aphyric basalt, wrinkly glass crust 2 mm thick, smooth lower surface to sheets, dense (no vesicles), very fresh lava with patches of blue silica and minor Fe-staining on some fractures. **Unit A**. 2: 12 x 6 cm sheet flow, **Unit A**. 3: 12 x 5 cm sheet flow, **Unit A**, trace plagioclase and olivine phenocrysts up to 1 mm across. 4: 11 x 1.5 cm sheet flow, **Unit A**, very thin and essentially pure glass. 5: Piece of **Unit A** sampled by Freiberg only for glass (5-FG). One other **Unit A** piece sampled by Toronto.	Gl, Ts Gl, Ts Gl, Ts Gl
55 DS	06.07 02:56 40°34.848S 111°28.458W 2433m 06.07 03:54 40°34.529S 111°28.035W 2410m	1: 8 x 4 cm pillow sector, grey aphyric basalt with trace plagioclase phenocrysts up to 2 mm across, smooth glass crust up to 2 mm thick, small pillow forms, minor yellow-orange Fe-staining along some fractures but quite fresh. **Unit A**. 2: 6 x 4 cm pillow sector, **Unit A**. 3: 5 x 4 cm pillow sector, **Unit A**. 4: Piece of **Unit A** sampled by Freiberg only for plagioclase (4-FG).	Gl, Ts Ts Ts
56 DS	06.07 06:59 40°23.278S 111°27.588W 2325m 06.07 07:52 40°22.953S 111°27.118W 2342m	1: 16 x 9 cm pillow sector, dark grey aphyric basalt, very rare traces of plagioclase phenocrysts up to 1 mm across, 5% empty vesicles mostly <1 mm across but some to 5 mm long, smooth glass crust 1 mm thick, much yellow-orange Fe-staining along fractures, MnOx coating up to 1 mm thick. **Unit A**. 2: 15 x 10 cm pillow sector, **Unit A**. 3: 26 x 22 cm pillow sector, **Unit A**. 4: Four small and one large piece of **Unit A** glass crust sampled by Freiberg only for glass and plagioclase (4-FG). One other **Unit A** piece sampled by Toronto.	Gl, Ts Gl, Ts Gl, Ts
57 DS	06.07 11:01 40°11.345S 111°25.240W 2358m 06.07 13:29 40°11.512S 111°25.333W 2360m	Safety cable broke- empty dredge.	
58 DS	06.07 16:09 40°11.312S 111°25.250W 2366m	Safety cable broke- empty dredge.	

	06.07 17:10 40°10.809S 111°25.336W 2360m		
59 DS	06.07 19:19 40°08.32S 111°27.75W 2354m 06.07 20:02 40°07.88S 111°27.76W 2343m	Empty dredge.	
60 DS	06.07 21:53 40°08.31S 111°27.88W 2373m 06.07 22:50 40°07.80S 111°27.83W 2356m	1: 6 x 5 cm small pillow sector, grey aphyric basalt, trace plagioclase phenocrysts up to 3 mm across, smooth glass crust 1 mm thick welded into groundmass, 5% small empty vesicles <1 mm across throughout, yellow-orange Fe-staining on fractures. **Unit A**.	Gl, Ts
61 DS	07.07 01:00 40°07.40S 111°24.98W 2442m 07.07 01:58 40°07.81S 111°25.04W 2402m	1: 16 x 5 cm sheet flow, grey plagioclase basalt with 15% small plagioclase phenocrysts <1mm across and traces of both olivine and plagioclase phenocrysts up to 1 mm across, smooth glass crust 2 mm thick, 5% small empty vesicles throughout, slight yellow-orange Fe-staining but essentially fresh, pull-aparts at base of flow. **Unit A**. 2: 18 x 13 cm pillow sector, **Unit A**. 3: 10 x 8 cm pillow sector, **Unit A**, but more weathered with yellow-orange Fe-staining and patchy thin MnOx (<1 mm) on some fractures. 4: Piece of **Unit A** sampled by Freiberg only for display collections (4-FG). 5: Piece of **Unit A** sampled by Freiberg only for display collections (5-FG). 6: Piece of **Unit A** sampled by Freiberg only for display collections (6-FG). One other **Unit A** piece sampled by Toronto.	Ts, Gc Gl, Ts Ts, Gc
62 DS	07.07 04:35 40°00.013S 111°26.691W 2307m 07.07 06:08 40°00.004S 111°26.741W 2311m	Empty dredge.	
63 DS	07.07 08:50 39°48.226S 111°25.608W 2253m 07.07 09:42 39°47.760S 111°25.398W 2260m	1: 13 x 7 cm sheet flow, black aphyric lava (andesite?), complex petrography with traces of dark green olivine and plagioclase up to 1 mm across, also trace skeletal needles up to 1 cm long by <0.5 mm across (plagioclase or pyroxene), also subrounded fine-grained xenoliths of earlier lavas up to 2 mm across and resorbed by present lava, wrinkly thick glass crust up to 3 cm thick, 5% vesicles up to 5 cm long and often elongate with vesicles at the interface between glass and the solid flow containing pyrite or cubanite, slight orange Fe-staining but essentially fresh. **Unit A**. Sub-sampled by Toronto. 2: 13 x 8 cm sheet flow, **Unit A**. 3: 18 x 11 cm block lacking glass crust and with patchy thin MnOx (<1 mm thick) on some surfaces. Petrography is identical to **Unit A**. Sub-sampled by Freiberg for	Gl, Ts, Ms Gl, Ts Ts*3, Gc

		plagioclase (3-FG), and also Toronto. 4: 8 x 6 cm **Unit A**, solid glass. 5: 6 x 4 cm **Unit A**, with pyrite-cubanite in some vesicles. 6: Piece of **Unit A** sampled by Freiberg only for phenocrysts and glass (6-FG). 7: 5 small **Unit A** glass pieces sampled by Freiberg only for glass. Two extra pieces of **Unit A** taken for Kiel.	Gl Ms
64 DS	07.07 12:27 39°38.500S 111°23.475W 2295m 07.07 13:47 39°38.516S 111°23.484W 2290m	Empty dredge.	
65 DS	07.07 17:18 39°30.271S 111°20.585W 2203m 07.07 19:54 39°29.68S 111°20.48W 2189m	1: 13 x 8 cm sheet flow, fresh black aphyric lava (andesite?), trace plagioclase phenocrysts <1 mm across, highly vesicular with 20% empty elongate vesicles up to 8 mm long and flow aligned, wrinkly glass crust up to 5 mm thick. **Unit A**. Sub-sampled by Toronto. 2: 12 x 8 cm sheet flow, fresh black aphyric lava (andesite?), trace slender needles up to 3 mm long (plagioclase or pyroxene), 5% round vesicles up to 1 mm across with pyrite specks in most, wrinkly glass crust up to 5 mm thick, subparallel joints spaced 2-3 mm throughout. **Unit B**. 3: 15 x 6 cm block, black aphyric lava (andesite?), trace plagioclase phenocrysts up to 1 mm across and slender needles of plagioclase or pyroxene, 5% vesicles up to 2 mm across with pyrite specks in most, relatively dense, smooth glass crust <1 mm thick. **Unit C**. 4: 11 x 5 cm black wrinkly glass crust, **Unit B**. 5: Piece of **Unit B** sampled by Freiberg only for glass (5-FG). 6: Piece of **Unit B** sampled by Freiberg only for display collections (6-FG). 7: Two thin section pieces of **Unit B** sampled by Freiberg only for glass (7-FG). 8: Piece of **Unit B** with big pyrite specks in vesicles, sampled by Freiberg only for (a) pyrite and glass (8-FG), (b) glass and devitrification study (8-FG-RK), and (c) spherulites and devitrification study (8-FG-Sph). 9: 8 x 3 cm sheet flow, **Unit B**, with pyrite in vesicles and one large 5 mm across pyritic vesicle in the glass crust. 10: Bulk sample of 2 **Unit B** pieces with pyrite in vesicles. Extra piece of **Unit B** taken for Kiel. One other piece sampled by Toronto.	Gl, Ts Gl, Ts, Ms Gl, Ts*2 Gl, Ts Ms Ms

APPENDIX 3: OFOS AND TV-GRAB DESCRIPTIONS

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°38.7768 / 110°52.3950	0	14:59:32	Station is located at the northern axial high of the Pacific-Antarctic Ridge (37°40'S)
37°39.7482 / 110°52.5008	2040	16:01:23	Video cameras turned on
37°39.7543 / 110°52.5132	2187	16:06:05	Bottom contact
37°39.7544 / 110°52.5147	2192	16:06:17	Glassy material, brownish stain
37°39.7578 / 110°52.5256	2188	16:07:42	Sheet flow, glassy material
37°39.7585 / 110°52.5286	2191	16:08:05	Flock, holothurie
37°39.7582 / 110°52.5300	2193	16:08:24	Sheet flow
37°39.7543 / 110°52.5324	2190	16:09:15	Crack in flow
37°39.7417 / 110°52.5305	2191	16:10:31	Crack in flow
37°39.7367 / 110°52.5261	2193	16:11:02	Fish
37°39.7305 / 110°52.5205	2190	16:11:35	Still the same sheet flow
37°39.7172 / 110°52.5068	2192	16:12:48	Sheet flow
37°39.6992 / 110°52.4973	2188	16:14:06	Crack in sheet flow
37°39.6940 / 110°52.4951	2188	16:14:25	Flow lamination and crack in flow
37°39.6876 / 110°52.4934	2190	16:14:44	Crack in flow, flow lamination
37°39.6832 / 110°52.4913	2187	16:15:01	Scrambled sheet flow
37°39.6419 / 110°52.4675	2190	16:17:44	Pillows, no sediment
37°39.6394 / 110°52.4662	2188	16:17:56	Crack in flow, no sediment
37°39.6240 / 110°52.4620	2188	16:18:59	Flow structures and cracks in flow
37°39.5990 / 110°52.4536	2187	16:20:44	Flow structures, cracks, no sediment
37°39.5930 / 110°52.4522	2186	16:21:09	Asteroidae on sheet flow
37°39.5811 / 110°52.4491	2189	16:21:58	Sheet flow to pillow transition
37°39.5653 / 110°52.4445	2192	16:23:07	Sheet flow to pillow transition, pillow increasing, no sediment
37°39.5507 / 110°52.4420	2194	16:24:04	Pillows, very young
37°39.5420 / 110°52.4401	2193	16:24:41	Pillows, fish, no sediment
37°39.5304 / 110°52.4382	2191	16:25:30	Pillows, zoarcidae
37°39.5189 / 110°52.4353	2192	16:26:23	Fish on pillows, no sediment
37°39.5121 / 110°52.4360	2193	16:26:52	Small pillow lava
37°39.4938 / 110°52.4351	2195	16:28:22	Pillows on top of a sheet flow
37°39.4862 / 110°52.4347	2195	16:28:58	Pillows, fish, no sediment
37°39.4703 / 110°52.4349	2194	16:30:10	Pillows, ca. 40-50 cm in diameter
37°39.4566 / 110°52.4341	2199	16:31:12	Large old pillow ca. 1-2 m next to young pillow
37°39.4468 / 110°52.4329	2199	16:31:54	Munidopsis, pillow
37°39.4375 / 110°52.4303	2201	16:32:38	Glassy pillows, scattered old and larger pillows (1-1.5 m in size)
37°39.4289 / 110°52.4267	2203	16:33:28	Young glassy pillows over older material, old pillows larger
37°39.4210 / 110°52.4249	2201	16:34:16	Large old pillow next to smaller young and glassy material
37°39.4082 / 110°52.4222	2201	16:35:28	Larger pillow next to young glassy material, actinie large
37°39.3967 / 110°52.4187	2194	16:36:34	Large pillows increasing
37°39.3925 / 110°52.4179	2198	16:36:59	Glassy pillows, fish, crab, 100 m south of hydrothermal activities
37°39.3867 / 110°52.4157	2197	16:37:40	Glassy pillows and larger old pillows, no sediments
37°39.3787 / 110°52.4143	2195	16:38:27	Large old pillow next to younger material
37°39.3725 / 110°52.4136	2193	16:39:10	Old pillows, more Fe oxides
37°39.3669 / 110°52.4106	2193	16:39:51	Pillow size increases, more Fe oxides, fish
37°39.3590 / 110°52.4080	2191	16:40:39	Pillow lava, rat tails
37°39.3499 / 110°52.4022	2191	16:41:43	Abundant old pillows (1-2 m in size)
37°39.3463 / 110°52.4010	2190	16:42:08	Abundant crinoids
37°39.3378 / 110°52.3974	2193	16:43:08	Larger old pillows, small young, not as glassy as a few meters before
37°39.3304 / 110°52.3948	2193	16:43:58	Abundant crabs, pillows

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°39.3270 / 110°52.3939	2195	16:44:20	Temperature anomaly, conductivity anomaly
37°39.3213 / 110°52.3933	2195	16:45:02	Older pillows, covered with white material, rat tail
37°39.3166 / 110°52.3931	2194	16:45:38	Leaving the filed, scattered white material
37°39.3088 / 110°52.3918	2196	16:46:27	Glassy material, pillows
37°39.3033 / 110°52.3907	2196	16:47:01	Pillows, glassy material, no sediments, less Fe staining
37°39.2999 / 110°52.3906	2194	16:47:21	White material on pillows, fish, vent fish, temperature anomaly, conductivity anomaly
37°39.2965 / 110°52.3891	2193	16:47:55	Pillows
37°39.2874 / 110°52.3864	2197	16:49:11	Glassy pillows, no sediments
37°39.2776 / 110°52.3852	2198	16:50:16	Large pillows next to smaller pillows, Fe oxides in small cracks
37°39.2693 / 110°52.3822	2199	16:51:22	Glassy pillows, relatively small
37°39.2665 / 110°52.3820	2200	16:51:43	Glassy pillows, fish
37°39.2606 / 110°52.3793	2201	16:52:27	Large individual pillows within glassy small pillows
37°39.2547 / 110°52.3774	2205	16:53:12	Large young glassy pillows
37°39.2485 / 110°52.3751	2201	16:53:58	Large glassy pillows
37°39.2439 / 110°52.3732	2205	16:54:32	Large older pillows next to glassy material
37°39.2368 / 110°52.3708	2206	16:55:15	Large old pillows next to small glassy material, no sediments
37°39.2283 / 110°52.3677	2205	16:56:05	Large old pillow on top of glassy small pillows
37°39.2187 / 110°52.3619	2205	16:57:02	Glassy material, scattered older pillows
37°39.2108 / 110°52.3566	2204	16:57:53	Younger glassy pillows on top of larger old pillows
37°39.1994 / 110°52.3500	2204	16:58:53	Glassy pillows, no sediments
37°39.1854 / 110°52.3406	2201	17:00:08	Glassy material, actinies
37°39.1704 / 110°52.3294	2201	17:01:26	Pillows transitional to sheet flow
No data	2198	17:03:09	Glassy pillows
No data	2196	17:03:43	Pillow transitional to sheet flow
No data	2200	17:05:11	Extremely glassy material, small pillows
No data	2201	17:06:12	Larger old pillows next to very glassy material
No data	2202	17:06:35	Older large pillows (0.5-1 m in size) covered by glassy material
No data	2203	17:07:21	Very glassy young material
No data	2201	17:08:40	Large old pillows next to young and glassy material
No data	2203	17:09:26	Large old pillows covered by fresh material, glassy, no sedimentary cover
37°39.0660 / 110°52.2646	2206	17:10:15	Large old tubes surrounded by fresh glassy material, old pillows, possibly sulfide material
37°39.0549 / 110°52.2610	2211	17:11:11	Very old pillows covered by glassy material, increasing fresh material
37°39.0488 / 110°52.2587	2210	17:11:46	Surface of the basalt is altered, no flow lamination
37°39.0456 / 110°52.2574	2210	17:12:10	Old pillow material, talus
37°39.0410 / 110°52.2569	2211	17:12:42	Old pillow material
37°39.0395 / 110°52.2556	2212	17:13:01	Old pillow material, talus material
37°39.0333 / 110°52.2535	2212	17:13:51	Old pillows (1-2 m in size), no glassy material, brownish surfaces
37°39.0195 / 110°52.2479	2211	17:15:18	Large old pillows, pillows have sizes of up to several meters
37°39.0151 / 110°52.2458	2209	17:15:54	Old pillow talus, some sediment
37°39.0093 / 110°52.2417	2213	17:16:55	Large old pillows
37°39.0022 / 110°52.2413	2215	17:17:40	Very large old pillows, no glassy material
37°38.9992 / 110°52.2406	2216	17:18:04	Surface of the pillows is soft
37°38.9954 / 110°52.2412	2214	17:18:31	Fine green talus material, rubble
37°38.9930 / 110°52.2415	2213	17:18:50	Talus material, little sediment
37°38.9889 / 110°52.2420	2212	17:19:19	Large old pillow material
37°38.9854 / 110°52.2412	2208	17:19:59	Large old pillows
37°38.9820 / 110°52.2412	2203	17:20:21	Large old talus material, sponges
37°38.9774 / 110°52.2400	2203	17:20:53	Fish, old pillow material, sea star
37°38.9732 / 110°52.2399	2204	17:21:22	Talus material, large blocky material

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°38.9658 / 110°52.2376	2198	17:22:14	Talus material, large blocky material
37°38.9621 / 110°52.2365	2192	17:22:37	Large block
37°38.9564 / 110°52.2348	2187	17:23:05	Large talus material, sponges
37°38.9548 / 110°52.2338	2189	17:23:25	Old pillow material, surface slightly sediment covered
37°38.9496 / 110°52.2332	2197	17:24:08	Talus material, large old pillows
37°38.9445 / 110°52.2330	2198	17:24:37	Old pillow material, fish
37°38.9407 / 110°52.2338	2198	17:25:02	Large pillows, crinoids
37°38.9369 / 110°52.2343	2197	17:25:28	Large old pillows
37°38.9316 / 110°52.2363	2200	17:26:02	Old pillows material
37°38.9253 / 110°52.2375	2201	17:26:37	Large pillows, older material, surface is weathered
37°38.9223 / 110°52.2383	2202	17:27:08	Fe staining on old pillows
37°38.9191 / 110°52.2397	2205	17:27:29	Fe staining on top of old pillows
37°38.9145 / 110°52.2405	2201	17:28:10	Large old pillows (0.5 m in size)
37°38.9110 / 110°52.2437	2200	17:28:37	Old pillows, fish
37°38.9079 / 110°52.2457	2203	17:29:01	Talus material, slightly sedimented
37°38.9038 / 110°52.2481	2202	17:29:33	Larger old pillows, Fe staining
37°38.8973 / 110°52.2534	2195	17:30:34	Large pillow, slight sediment covered, shrimp
37°38.8828 / 110°52.2618	2194	17:31:49	Old pillows, talus material
37°38.8737 / 110°52.2616	2190	17:32:36	Large old pillows, slightly sediment covered, white material
37°38.8716 / 110°52.2643	2193	17:33:07	Old pillar
37°38.8668 / 110°52.2671	2195	17:33:44	Talus material
37°38.8606 / 110°52.2690	2196	17:34:14	Crinoids, old pillow material
37°38.8551 / 110°52.2667	2200	17:35:00	Old pillow, talus material
37°38.8438 / 110°52.2692	2202	17:35:57	Large old talus material, sediment cover of several centimeters, red staining
37°38.8369 / 110°52.2714	2196	17:36:43	Old pillow material
37°38.8336 / 110°52.2726	2200	17:37:03	Talus, thin sediment cover, steep slope
37°38.8298 / 110°52.2728	2196	17:37:34	Old pillow material, surface weathered
37°38.8260 / 110°52.2741	2196	17:37:57	Large old pillow talus, slightly sedimented
37°38.8195 / 110°52.2762	2194	17:38:38	Red staining on talus material
37°38.8117 / 110°52.2772	2190	17:39:18	Crinoids, talus, slightly sedimented
37°38.7989 / 110°52.2783	2192	17:40:24	Old talus material, red staining, talus pile
37°38.7894 / 110°52.2802	2191	17:41:15	Talus material, munidopsis
37°38.7838 / 110°52.2802	2194	17:41:49	Old talus material, pillows, sediment cover
37°38.7771 / 110°52.2810	2197	17:42:26	Talus material
37°38.7738 / 110°52.2818	2196	17:42:44	Small talus material, only several centimeters in size
37°38.7602 / 110°52.2835	2193	17:43:48	Talus material, fish
37°38.7529 / 110°52.2828	2194	17:44:32	Talus material, red staining, some sediment
37°38.7396 / 110°52.2845	2194	17:45:45	Talus material
37°38.7362 / 110°52.2846	2198	17:46:01	Talus material, sedimentary cover
37°38.7214 / 110°52.2842	2190	17:47:15	Talus material, crab, old pillows
37°38.7190 / 110°52.2839	2191	17:47:30	Old pillows, sediment cover
37°38.7043 / 110°52.2812	2193	17:48:43	Old pillows and sediment cover
37°38.7011 / 110°52.2809	2189	17:49:01	Crab, old pillows
37°38.6967 / 110°52.2805	2191	17:49:21	Old pillows, sedimentary cover, temperature and salinity are slowly rising
37°38.6863 / 110°52.2779	2194	17:50:07	Old pillows, rat tail
37°38.6793 / 110°52.2770	2196	17:50:39	Crinoid, old pillows, sediment
37°38.6755 / 110°52.2766	2197	17:50:55	Old pillows, gorgonarias
37°38.6705 / 110°52.2751	2198	17:51:17	Old pillow with cracks, sediment
37°38.6641 / 110°52.2742	2199	17:51:48	Old pillows with cracks, sedimented
37°38.6569 / 110°52.2724	2199	17:52:23	Free swimming crinoid
37°38.6546 / 110°52.2726	2195	17:52:33	Old pillows with sediment, sometimes cracked, crab, fish
37°38.6445 / 110°52.2710	2198	17:53:19	Old pillow with sediment, sometimes cracked
37°38.6381 / 110°52.2704	2194	17:53:54	Old pillow material, talus, some sediment cover, crinoids
37°38.6282 / 110°52.2697	2194	17:54:51	Talus material, steep slope
37°38.6221 / 110°52.2690	2187	17:55:30	Western talus

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°38.6188 / 110°52.2690	2187	17:55:53	Large pillows, old, no glassy surfaces
37°38.6086 / 110°52.2655	2184	17:56:54	Talus material, red staining
37°38.6014 / 110°52.2605	2179	17:57:50	Large blocks
37°38.5977 / 110°52.2582	2179	17:58:22	Large old pillows, thin sediment cover
37°38.5893 / 110°52.2525	2180	17:59:29	Large talus material
37°38.5864 / 110°52.2505	2180	17:59:54	Large old pillows
37°38.5785 / 110°52.2464	2182	18:00:47	Larger old pillows, no glassy material, thin sediment cover
37°38.5679 / 110°52.2420	2183	18:01:55	Old pillows, thin sediment cover
37°38.5616 / 110°52.2400	2181	18:02:34	Old pillows, fish
37°38.5544 / 110°52.2375	2183	18:03:19	Old pillow material, no talus, fish, thin sediment cover
37°38.5432 / 110°52.2325	2182	18:04:29	Large old pillows, talus material
37°38.5356 / 110°52.2304	2178	18:05:22	Talus material, old pillows, thin sediment cover, surfaces weathered
37°38.5279 / 110°52.2275	2169	18:06:15	Steep slope
37°38.5223 / 110°52.2272	2168	18:06:57	Old pillow material, surfaces weathered
37°38.5132 / 110°52.2250	2172	18:08:04	Talus material
37°38.5101 / 110°52.2254	2173	18:08:27	Old pillows
37°38.4989 / 110°52.2234	2179	18:09:57	Old pillow material, surface weathered
37°38.4921 / 110°52.2223	2186	18:10:49	Talus material, thin sediment cover
37°38.4882 / 110°52.2220	2187	18:11:15	Talus material, red staining
37°38.4854 / 110°52.2221	2186	18:11:34	Small talus material
37°38.4799 / 110°52.2207	2185	18:12:09	Talus material, red staining
37°38.4703 / 110°52.2188	2187	18:13:10	Talus material, red staining
37°38.4656 / 110°52.2189	2187	18:13:34	Large blocks of talus material, alteration of the talus material
37°38.4558 / 110°52.2174	2187	18:14:26	Large block of talus material
37°38.4492 / 110°52.2154	2190	18:15:04	Talus material on the western slope
37°38.4433 / 110°52.2142	2190	18:15:38	Talus material, fish, red staining
37°38.4369 / 110°52.2117	2190	18:16:17	Large blocks of talus material
37°38.4341 / 110°52.2103	2187	18:16:45	Large blocks of talus material, thin sediment cover
37°38.4278 / 110°52.2089	2183	18:17:33	Talus field, some scattered large blocks
37°38.4229 / 110°52.2083	2184	18:18:10	Pillow talus, red staining
37°38.4161 / 110°52.2030	2184	18:19:17	Large talus material, thin sediment cover
37°38.4136 / 110°52.1987	2187	18:19:52	Fresh talus, some alteration of the talus material
37°38.4106 / 110°52.1954	2188	18:20:24	Pillow talus material, no fresh material
37°38.4084 / 110°52.1908	2189	18:20:55	Fine material, possibly glassy
37°38.4043 / 110°52.1819	2185	18:21:52	Extremely large blocks, slightly rounded
37°38.3994 / 110°52.1682	2190	18:23:24	Talus material, dark, relatively small
37°38.3976 / 110°52.1628	2194	18:23:57	Fine grained talus
37°38.3976 / 110°52.1604	2195	18:24:30	Well sorted talus material (10-20 cm in size)
37°38.3976 / 110°52.1562	2197	18:25:06	Large block in medium grained talus
37°38.3970 / 110°52.1522	2201	18:25:35	Larger blocks in talus material (0.2-1 m in size)
37°38.3964 / 110°52.1488	2199	18:26:02	Talus material, size increasing
37°38.3964 / 110°52.1462	2201	18:26:19	Talus material, thin sediment cover
37°38.3941 / 110°52.1432	2198	18:26:52	Pillow material in talus, some scattered large blocks
37°38.3928 / 110°52.1401	2198	18:27:21	Altered talus, reddish stain
37°38.3895 / 110°52.1357	2197	18:28:04	Large talus material, blocks up to 1 m in size
37°38.3858 / 110°52.1332	2195	18:28:37	Pillow material in talus, up to more than 1 meter in size
37°38.3817 / 110°52.1307	2194	18:29:04	Pillows
37°38.3783 / 110°52.1281	2193	18:29:24	Old pillows
37°38.3726 / 110°52.1231	2191	18:30:01	Old large pillow (1 m in size), surface weathered
37°38.3683 / 110°52.1183	2193	18:30:32	Large old pillows, slightly sedimented
37°38.3610 / 110°52.1110	2195	18:31:32	Large old pillows, several meters in size, thin sediment cover
37°38.3435 / 110°52.0876	2207	18:33:44	Talus material, some scattered large blocks
37°38.3378 / 110°52.0799	2209	18:34:32	Talus material, slightly sedimented
37°38.3296 / 110°52.0735	2205	18:35:17	Talus material, relatively large blocks, sediment cover

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°38.3254 / 110°52.0670	2207	18:36:02	Talus material, thin sediment cover, some red staining, size of material below 50 cm
37°38.3227 / 110°52.0609	2208	18:36:39	Red staining on talus material
37°38.3210 / 110°52.0582	2209	18:37:01	Sediment covered, red staining, irregular material
37°38.3140 / 110°52.0527	2213	18:37:50	Abundant sediment on lava
37°38.3108 / 110°52.0496	2211	18:38:18	Sediment on the lava material, sulfides
37°38.3065 / 110°52.0458	2213	18:38:52	Lots of reddish brown material on lava
37°38.2991 / 110°52.0403	2211	18:39:48	Talus material
37°38.2955 / 110°52.0393	2212	18:40:07	Red staining on talus material
37°38.2909 / 110°52.0353	2212	18:40:43	Large blocks in talus, large pillow material, several centimeters
37°38.2841 / 110°52.0319	2209	18:41:33	Large pillows, old material, sediment covered
37°38.2763 / 110°52.0268	2207	18:42:34	Large pillow blocks, slightly sedimented
37°38.2703 / 110°52.0242	2206	18:43:13	Large blocky material in talus, OFOS brought up few hundred meter to change course
37°38.4360 / 110°52.1065	2182	19:01:11	Bottom sight again; steep slope, crinoids
37°38.4417 / 110°52.1068	2179	19:01:35	Large talus material, thin sediment cover
37°38.4512 / 110°52.1101	2176	19:02:12	Large pillow structure, fish
37°38.4534 / 110°52.1093	2179	19:02:30	Large old pillows (1 m in size)
37°38.4674 / 110°52.1139	2181	19:03:24	Talus material, some large blocks
37°38.4763 / 110°52.1165	2185	19:04:03	Large talus material, scattered pillows, sediment cover of several centimeters
37°38.4925 / 110°52.1240	2188	19:05:05	Large blocks of pillow material, old talus, sediment cover (2-5 cm)
37°38.5001 / 110°52.1281	2189	19:05:32	Large block in the old talus, sediment cover
37°38.5122 / 110°52.1365	2187	19:06:12	Some large talus block, crinoids
37°38.5199 / 110°52.1402	2192	19:06:42	Talus, well sorted (20-40 cm in size), thin sediment cover
37°38.5311 / 110°52.1446	2195	19:07:26	Well sorted talus material, scattered blocks of up to 1 m, sediment cover of several centimeters
37°38.5449 / 110°52.1493	2197	19:08:13	Talus material (20-40 cm in size), sediment cover
37°38.5517 / 110°52.1505	2198	19:08:36	Orange staining, several centimeters sediment between talus material
37°38.5622 / 110°52.1520	2198	19:09:16	Abundant orange material between the talus material
37°38.5690 / 110°52.1524	2204	19:09:39	Blocky talus material (20-40 cm in size), little sediment
37°38.5821 / 110°52.1530	2206	19:10:34	Well sorted talus material, thin sediment cover (< 1 cm)
37°38.5914 / 110°52.1562	2209	19:11:12	Well sorted talus material (20-60 cm in size), thin sediment cover
37°38.6019 / 110°52.1603	2213	19:11:55	Red staining on talus material, ca. 50 cm blocks
37°38.6125 / 110°52.1622	2210	19:12:37	Blocky talus material, well sorted (20-50 cm in size)
37°38.6248 / 110°52.1641	2207	19:13:22	Fe oxides in talus material, mixed, red material
37°38.6314 / 110°52.1646	2206	19:13:42	Possibly sulfide debris mixed into the talus material, talus well sorted, pillow fragments
37°38.6400 / 110°52.1632	2204	19:14:14	Altered talus material
37°38.6526 / 110°52.1616	2208	19:15:00	Some large blocks with red staining in the talus material, sediment cover is orange
37°38.6639 / 110°52.1651	2209	19:15:48	Red staining on larger blocks, typically well sorted (20-50 cm in size)
37°38.6714 / 110°52.1696	2208	19:16:24	Large blocks covered with several centimeters sediment
37°38.6778 / 110°52.1733	2207	19:16:56	Hydrothermal sediment, orange material between the talus blocks
37°38.6839 / 110°52.1844	2201	19:17:40	Orange to red material between the talus, talus well sorted (20-50 cm in size)
37°38.6847 / 110°52.2039	2194	19:18:52	Some larger blocks in the talus, small temperature anomaly
37°38.6934 / 110°52.2100	2192	19:19:47	Thin sediment cover
37°38.7011 / 110°52.2168	2198	19:20:15	Altered material at the edge of the lava, thin sediment cover of 1-3 cm

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°38.7105 / 110°52.2253	2203	19:21:12	Well sorted talus material, mostly below 20 cm
37°38.7132 / 110°52.2262	2202	19:21:35	Larger talus, some blocks exceeding 50 cm, pillow blocks, slightly sedimented
37°38.7183 / 110°52.2249	2207	19:22:24	Well sorted talus (40-80 cm in size), more pillow fragments
37°38.7239 / 110°52.2239	2207	19:23:11	Large pillows, slightly sedimented
37°38.7286 / 110°52.2239	2201	19:23:41	Large pillows (>1 meter in size)
37°38.7337 / 110°52.2245	2204	19:24:13	Large pillows, several centimeters sediment cover
37°38.7402 / 110°52.2246	2201	19:25:03	Large pillows, crinoids
37°38.7474 / 110°52.2229	2201	19:25:51	Large old pillows, sediment covered, ca 3-5 cm sediment, pillow sizes of several meters
37°38.7548 / 110°52.2227	2203	19:26:41	Large talus material of pillows
37°38.7602 / 110°52.2213	2204	19:27:18	Large pillows, thin sediment cover
37°38.7678 / 110°52.2181	2208	19:28:14	Large pillows, relatively old, thin sediment cover, scattered talus between pillows
37°38.7706 / 110°52.2165	2208	19:28:38	Talus material (20 to 40 cm in size), scattered larger blocks
37°38.7755 / 110°52.2143	2209	19:29:14	Talus material, large blocks
37°38.7803 / 110°52.2135	2208	19:29:41	Old pillows, scattered talus material
37°38.7828 / 110°52.2120	2209	19:30:04	Sediment cover of several centimeters on larger pillows
37°38.7877 / 110°52.2097	2206	19:30:37	Large talus material
37°38.7907 / 110°52.2064	2205	19:31:01	Large talus material, scattered pillow fragments, slightly sedimented (2-3 cm)
37°38.7998 / 110°52.2018	2201	19:32:00	Large talus material
37°38.8162 / 110°52.1962	2201	19:34:04	Large talus material, slightly sedimented
37°38.8187 / 110°52.1958	2201	19:34:22	Fe oxide staining on talus, sea star, large talus blocks of pillows
37°38.8254 / 110°52.1961	2194	19:35:07	Talus field, well sorted, red staining
37°38.8305 / 110°52.1976	2191	19:35:46	Large pillows in the talus field, slightly sedimented
37°38.8378 / 110°52.1991	2185	19:36:27	Slightly altered, steep slope, small ridge
37°38.8441 / 110°52.2011	2184	19:37:10	Large talus material, 20-60 cm, slightly sedimented
37°38.8562 / 110°52.2053	2188	19:38:35	Well sorted talus material
37°38.8585 / 110°52.2042	2187	19:39:06	Pillow fragments in talus, larger than 1 m, slight temperature increase
37°38.8687 / 110°52.2044	2191	19:40:53	Pillow fragments in talus, slightly sedimented
37°38.8789 / 110°52.2086	2192	19:42:31	Talus material (20-40 cm in size), slightly sedimented
37°38.8844 / 110°52.2111	2194	19:43:17	Talus field (40-60 cm in size), slightly sedimented
37°38.8921 / 110°52.2155	2195	19:44:34	Talus field, some large blocks, temperature anomaly
37°38.8945 / 110°52.2169	2198	19:45:00	Temperature and conductivity anomaly, talus field, thin sediment cover
37°38.8993 / 110°52.2196	2196	19:45:45	Temperature and conductivity increasing, talus field
37°38.9019 / 110°52.2222	2197	19:46:08	Hydrothermal sediment on talus, red staining
37°38.9041 / 110°52.2229	2198	19:46:35	Increasing thickness of hydrothermal sediment, red staining
37°38.9080 / 110°52.2260	2199	19:47:24	All talus material is covered by hydrothermal sediment
37°38.9110 / 110°52.2310	2197	19:48:26	Red staining on talus blocks
37°38.9122 / 110°52.2334	2196	19:49:02	Plume material on the talus blocks, very fine grained
37°38.9142 / 110°52.2382	2203	19:49:56	Large pillow blocks in talus, sedimented, possibly hydrothermal, background temperature still increasing
37°38.9117 / 110°52.2419	2207	19:51:44	Pockets between the talus are filled with red to orange sediment, temperature increasing
37°38.9140 / 110°52.2400	2208	19:52:38	Red material in the sediments, sea star, fish
37°38.9197 / 110°52.2363	2214	19:53:51	Red material on talus blocks
37°38.9242 / 110°52.2337	2210	19:54:50	Pockets between the talus material are entirely filled with hydrothermal sediment
37°38.9405 / 110°52.2397	2210	19:56:58	Talus material covered by sediments, red colors
37°38.9446 / 110°52.2422	2207	19:57:26	Large blocks in talus, temperature increases
37°38.9558 / 110°52.2525	2203	19:58:49	Large talus blocks (> 1 m)

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°38.9594 / 110°52.2558	2198	19:59:23	Lava pillar
37°38.9659 / 110°52.2630	2199	20:00:12	Talus material (20 to 60 cm in size), slightly sedimented
37°38.9764 / 110°52.2763	2201	20:01:39	Change of the video tapes
37°38.9791 / 110°52.2783	2195	20:02:04	Very large blocks in the talus, poorly sorted, slightly sedimented
37°38.9886 / 110°52.2930	2194	20:03:21	Large blocks in the talus
37°38.9893 / 110°52.3023	2194	20:04:32	Larger pillows in the talus
37°38.9940 / 110°52.3146	2193	20:05:54	Talus material, scattered larger blocks
37°39.0013 / 110°52.3113	2194	20:07:25	Talus material, well sorted
37°39.0139 / 110°52.3068	2203	20:08:45	Large talus blocks, slightly sedimented
37°39.0193 / 110°52.3053	2203	20:09:16	Talus material is relatively small
37°39.0268 / 110°52.3026	2199	20:10:11	Low temperature alteration on the talus material
37°39.0327 / 110°52.2966	2196	20:11:15	Talus material, covered by thin sediment
37°39.0399 / 110°52.2940	2194	20:12:43	Large talus blocks, pillow fragments, thin sediment cover
37°39.0473 / 110°52.2899	2191	20:13:54	Red staining on the talus material
37°39.0489 / 110°52.2874	2191	20:14:19	Large blocks in the talus
37°39.0671 / 110°52.2799	2188	20:16:13	Large blocks in the talus, pillow fragments
	2186	20:16:45	Large old pillows, fish
37°39.0802 / 110°52.2788	2185	20:17:09	Large old pillows, slightly sedimented
37°39.0907 / 110°52.2795	2185	20:17:56	Large pillows, rim of the axial valley, slightly sedimented
37°39.1086 / 110°52.2807	2188	20:19:22	Large old pillow lava
37°39.1351 / 110°52.2854	2197	20:21:26	Large blocky talus material, pillow fragments, slightly sedimented
37°39.1474 / 110°52.2877	2198	20:22:27	Large pillow fragments in talus
37°39.1550 / 110°52.2872	2196	20:22:59	Red staining on fragments in the talus
37°39.1629 / 110°52.2859	2196	20:23:35	Shrimp, talus material, large blocks
37°39.1748 / 110°52.2810	2198	20:24:43	Red staining, hydrothermal sediment on larger blocks
37°39.1893 / 110°52.2800	2201	20:25:50	Talus material, red staining
37°39.2036 / 110°52.2788	2205	20:26:56	Red staining on larger blocks
37°39.2236 / 110°52.2799	2198	20:28:11	Large pillow fragments
37°39.2443 / 110°52.2862	2195	20:29:52	Temperature increase
37°39.2512 / 110°52.2908	2199	20:30:28	Talus material, white spots on the talus material, angular talus blocks, patches of white material
37°39.2612 / 110°52.2963	2195	20:31:16	More white material in talus, only 2-3 m across
37°39.2698 / 110°52.3018	2197	20:32:03	Well sorted talus material, only scattered larger blocks
37°39.2761 / 110°52.3064	2200	20:32:43	Well sorted talus material (20-40 cm in size)
37°39.2872 / 110°52.3136	2199	20:33:47	Medium sized talus material, only slightly sedimented
37°39.2978 / 110°52.3206	2200	20:34:39	Fracture parallel to rift axis, talus material
37°39.3011 / 110°52.3239	2201	20:35:01	Larger old pillow blocks, several meters in size
37°39.3138 / 110°52.3365	2206	20:36:08	Octopus, large pillow fragments in talus
37°39.3211 / 110°52.3440	2207	20:36:50	Talus field, medium sized 20 to 80 cm
37°39.3376 / 110°52.3531	2209	20:38:01	Large talus material, 80 cm to several meters
37°39.3520 / 110°52.3591	2207	20:39:01	Large blocks in talus
37°39.3581 / 110°52.3623	2207	20:39:27	Possibly glassy material in the pockets, slightly sedimented, smaller sized pillow fragments
37°39.3834 / 110°52.3698	2208	20:41:06	Older fragments in talus, slightly sedimented
37°39.3973 / 110°52.3695	2207	20:42:01	Blocky talus material, relatively large, several meters in size
37°39.4144 / 110°52.3698	2205	20:43:06	Altered talus material, fine grained material in pockets, red staining
37°39.4264 / 110°52.3729	2207	20:43:57	Fresh glassy lava
37°39.4324 / 110°52.3751	2205	20:44:16	Fresh glassy pillows
37°39.4415 / 110°52.3823	2207	20:44:59	Fresh glassy material, no sediments
37°39.4465 / 110°52.3850	2207	20:45:18	Scattered larger pillows covered by the younger pillows, younger pillows very glassy
37°39.4571 / 110°52.3871	2206	20:46:16	Large old pillows covered by the small young pillows
37°39.4653 / 110°52.3892	2207	20:46:53	Small young pillows, glassy

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°39.4694 / 110°52.3898	2205	20:47:17	Scattered larger old pillows covered by the small young pillows
37°39.4788 / 110°52.3907	2207	20:48:01	Large older pillows surrounded by glassy pillows
37°39.4855 / 110°52.3933	2205	20:48:30	Lots of the old pillows scattered in the glassy material
37°39.4964 / 110°52.3938	2208	20:49:25	Glassy fresh pillows
37°39.5061 / 110°52.3951	2207	20:50:10	Scattered old pillows in the glassy young pillows
37°39.5156 / 110°52.3976	2206	20:50:59	Talus blocks in the fresh lava
37°39.5195 / 110°52.3991	2206	20:51:17	Two lava generations, oldest is not glassy
37°39.5260 / 110°52.4022	2207	20:51:58	Two lava generations surrounding old talus material
37°39.5402 / 110°52.4054	2206	20:52:47	Out of the fresh lava, back in talus
37°39.5459 / 110°52.4078	2210	20:53:15	Fresh lava on top of the talus
37°39.5507 / 110°52.4077	2209	20:53:42	Fresh lava on top of the talus
37°39.5569 / 110°52.4067	2212	20:54:11	Fresh lava down slope over the talus material
37°39.5600 / 110°52.4065	2211	20:54:27	Weathered blocks with Fe oxide staining
37°39.5656 / 110°52.4067	2211	20:54:52	Red staining on talus material, possibly hydrothermal, large irregular blocks
37°39.5704 / 110°52.4069	2213	20:55:25	Sulfide blocks, second generations of lava, back into fresh lava
37°39.5754 / 110°52.4090	2214	20:56:00	Talus has iron staining, covered by lava
37°39.5796 / 110°52.4103	2210	20:56:29	Talus in depressions covered by fresh lava
37°39.5828 / 110°52.4127	2212	20:56:48	Both lava generations occur in depressions
37°39.5885 / 110°52.4160	2209	20:57:22	Two lava generations on top of the talus material, glassy lava dominates
37°39.5924 / 110°52.4191	2207	20:57:46	Few larger older pillows surrounded by younger generation
37°39.6031 / 110°52.4250	2204	20:58:47	Fresh material, no sediments
37°39.6097 / 110°52.4289	2201	20:59:28	50 percent old pillows, 50 percent smaller young lava
37°39.6209 / 110°52.4325	2199	21:00:30	Glassy young material
37°39.6316 / 110°52.4378	2201	21:01:30	Larger older pillow
37°39.6375 / 110°52.4400	2196	21:01:56	Temperature anomaly, thin sediment cover, Fe oxide staining on top of the new lava
37°39.6497 / 110°52.4461	2195	21:02:55	Old lava tubes and new pillows surrounded by the glassy material
37°39.6668 / 110°52.4525	2194	21:04:27	Temperature anomaly, some Fe staining
37°39.6704 / 110°52.4515	2194	21:04:45	Temperature increases further
37°39.6744 / 110°52.4506	2198	21:05:08	Staining on the fresh glassy material
37°39.6850 / 110°52.4485	2193	21:05:59	Still two lava generations, temperature decreases, some staining on the glassy material
37°39.6927 / 110°52.4480	2198	21:06:43	Temperature increases again
37°39.7068 / 110°52.4492	2197	21:07:44	Still both lava generations
37°39.7220 / 110°52.4529	2194	21:08:58	Very young lava, very likely covering the sulfides
37°39.7384 / 110°52.4605	2191	21:10:17	Sheet flows
37°39.7416 / 110°52.4625	2192	21:10:31	Transition from pillow to sheet flow
37°39.7528 / 110°52.4696	2193	21:11:21	Fresh glassy sheet flow
37°39.7644 / 110°52.4779	2198	21:12:27	Two generations of pillows
37°39.7926 / 110°52.4916	2200	21:14:43	Two generations of pillows
37°39.7977 / 110°52.4938	2202	21:15:06	Young pillows flowing over talus material
37°39.8037 / 110°52.4959	2199	21:15:31	Larger blocks in old talus
37°39.8243 / 110°52.5028	2203	21:16:54	Western wall with larger talus material, thin sediment cover
37°39.8308 / 110°52.5061	2203	21:17:23	Talus material, some large blocks
37°39.8409 / 110°52.5119	2199	21:18:07	Fresh glassy lava
37°39.8432 / 110°52.5128	2201	21:18:17	Two generations of lava, older surrounded by young glassy pillows
37°39.8649 / 110°52.5221	2198	21:20:21	Fresh glassy material on top of the older generation
37°39.8795 / 110°52.5299	2193	21:21:36	Two generations of pillow lava
37°39.8946 / 110°52.5420	2193	21:23:10	Glassy pillow material
37°39.8983 / 110°52.5451	2193	21:23:34	Fish on top of the fresh pillow lava

STATION 01-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°39.9057 / 110°52.5509	2192	21:24:25	Sheet flow
37°39.9090 / 110°52.5535	2192	21:24:52	Fresh glassy sheet flow
37°39.9130 / 110°52.5566	2194	21:25:25	Collapse pit in the sheet flow of the glassy material
37°39.9186 / 110°52.5631	2194	21:26:17	Collapse feature in the sheet flow
37°39.9322 / 110°52.5908	2196	21:29:15	Pillow structures
37°39.9370 / 110°52.6042	2195	21:30:23	Pillow structures
37°39.9420 / 110°52.6187	2191	21:31:38	Temperature rises slightly
37°39.9437 / 110°52.6209	2192	21:31:54	Talus material of sulfides covered by lava
37°39.9453 / 110°52.6272	2190	21:32:29	Altered lava
37°39.9455 / 110°52.6286	2188	21:32:40	Talus material
37°39.9465 / 110°52.6305	2187	21:32:50	Well sorted talus material (20-30 cm in size)
37°39.9554 / 110°52.6491	2179	21:34:10	Animals, altered lava
37°39.9572 / 110°52.6519	2177	21:34:33	Talus material, some scattered large blocks, crinoids
37°39.9640 / 110°52.6611	2183	21:35:19	Fresh lava overriding the talus material
37°39.9750 / 110°52.6692	2176	21:36:15	Possible sulfide debris underneath the fresh and glassy lava
37°39.9867 / 110°52.6736	2179	21:37:13	Fresh and glassy material
37°39.9922 / 110°52.6764	2178	21:37:40	Pillows on sheets, abundant crabs, some older talus material beneath
37°39.9988 / 110°52.6794	2180	21:38:12	Lots of animals, yellow material, temperature anomaly
37°40.0084 / 110°52.6810	2185	21:38:56	Medium sized talus material
37°40.0120 / 110°52.6823	2184	21:39:06	Well sorted talus, Fe staining, crinoid, crap, altered talus material, temperature increases slightly
37°40.0207 / 110°52.6846	2183	21:39:41	Talus size increasing
37°40.0222 / 110°52.6849	2187	21:39:51	Fe and silica staining on talus, some large pillow
37°40.0399 / 110°52.6889	2193	21:41:10	Fresh glassy material, tubes and sheets
37°40.0483 / 110°52.6885	2194	21:41:40	Glassy pillow lava
37°40.0624 / 110°52.6827	2196	21:42:34	Tubes of glassy lava, yellow staining
37°40.0760 / 110°52.6759	2196	21:43:36	Large pillows and glassy tube lava
37°40.0922 / 110°52.6689	2193	21:45:04	Glassy tube lava
37°40.1027 / 110°52.6687	2195	21:46:12	Glassy tube and pillow lava, crab
37°40.1092 / 110°52.6670	2195	21:46:41	Two generations of pillows, iron staining between the pillows
37°40.1245 / 110°52.6647	2198	21:47:44	Large older pillows and tubes surrounded by younger and glassy pillows
37°40.1448 / 110°52.6552	2201	21:49:27	Larger old pillows surrounded by the young generation
37°40.1592 / 110°52.6477	2203	21:50:46	Older generation of pillows
37°40.1637 / 110°52.6470	2204	21:51:12	Still two generations of pillows
37°40.1713 / 110°52.6471	2205	21:51:58	Fresh glassy material
37°40.1809 / 110°52.6471	2205	21:53:10	Young pillows overriding the older generation
37°40.1862 / 110°52.6445	2203	21:54:01	Fresh glassy material
37°40.1928 / 110°52.6470	2206	21:55:35	Large older pillows surrounded by the younger glassy material
37°40.2009 / 110°52.6510	2212	21:57:32	Two generations of pillows
37°40.2110 / 110°52.6548	2217	21:59:31	Still two generations of pillow lava
37°40.2231 / 110°52.6648	2220	22:01:49	Two generations of pillow lava
37°40.2265 / 110°52.6672	2221	22:02:45	Two generations of lava
37°40.2349 / 110°52.6652	2223	22:04:40	Glassy fresh lava surrounding the older generation of pillow lava
37°40.2459 / 110°52.6619	2220	22:06:41	Two generations of lava
37°40.2492 / 110°52.6611	2218	22:07:05	Bottom contact lost and end of station

Station 08-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°42.5023 / 111°07.0239	0	17:51:43	Station is located at an off-axis seamount (37°42’S)
37°42.3254 / 111°07.2732	1368	18:24:27	Video cameras turned on

Station 08-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°42.2646 / 111°07.3272	1637	18:32:57	Bottom contact
37°42.2626 / 111°07.3289	1643	18:33:22	Pillow lava, slightly sedimented, not very glassy
37°42.2548 / 111°07.3316	1646	18:34:06	Pillow basalt, slightly sedimented
37°42.2528 / 111°07.3354	1648	18:34:29	Pockets between the pillows are filled with sediment
37°42.2439 / 111°07.3413	1647	18:35:54	Old pillow stacks, pockets between the pillows are sedimented, very steep scarp
37°42.2398 / 111°07.3423	1637	18:36:38	Very steep slope (15-20 m), covered by pillows
37°42.2360 / 111°07.3506	1633	18:38:03	Old pillows, sediment in pockets
37°42.2366 / 111°07.3654	1640	18:39:29	Cracks between the pillows are sedimented
37°42.2367 / 111°07.3716	1634	18:40:30	Old pillows, pillows well preserved, no glassy surfaces, sediments in cracks and pockets
37°42.2368 / 111°07.3802	1619	18:43:18	Old pillows, no glassy rims, sediment cover, shrimps
37°42.2344 / 111°07.3837	1618	18:44:08	Sediment filled pockets
37°42.2354 / 111°07.3872	1617	18:44:28	Overall slight slope
37°42.2325 / 111°07.3923	1610	18:45:09	Old pillows on steep slope, sediment filling in pockets between individual pillows
37°42.2214 / 111°07.4570	1578	18:49:00	Large pillows, sediment in pockets between the pillows
37°42.2184 / 111°07.4854	1583	18:51:11	Old pillows (1 m in size), pockets filled with sediment
37°42.2154 / 111°07.5053	1567	18:53:34	Elongated pillows and tubes
37°42.2145 / 111°07.5217	1564	18:54:54	Large pillows and some tubes, sediment filling in the pockets
37°42.2072 / 111°07.5586	1564	18:57:17	Transition of tube lava and pillows towards sheets, collapse pits
37°42.2037 / 111°07.5652	1566	18:57:56	Old pillows, sediment in pockets, no glassy material
37°42.1998 / 111°07.5732	1564	18:59:10	Tube lava
37°42.1973 / 111°07.5770	1569	19:00:04	Old pillows and some tube lava, slightly sedimented, no glassy material
37°42.1925 / 111°07.5876	1569	19:02:24	Old pillows, sediments in pockets is several centimeters thick
37°42.1966 / 111°07.6035	1567	19:03:43	Sheet flow and collapse feature
37°42.1992 / 111°07.6077	1566	19:04:10	Old pillows, sediment in pockets, no glassy material
37°42.2081 / 111°07.6183	1569	19:05:09	Large old pillows (>1 m in size)
37°42.2168 / 111°07.6393	1572	19:06:43	Large pillows, relatively flat topography
37°42.2171 / 111°07.6611	1577	19:08:36	Old pillows, quite intensely sedimented
37°42.2172 / 111°07.6715	1579	19:09:39	Pillows are slightly darker here, possibly some glassy material
37°42.2206 / 111°07.6818	1580	19:10:35	Two different sizes of the pillows
37°42.2256 / 111°07.6956	1585	19:12:15	Starting to go down hill, pillows, already 20 m deeper than the highest points
37°42.2298 / 111°07.7086	1593	19:13:43	Some tube lava, large pillows, sediment in pockets
37°42.2303 / 111°07.7251	1599	19:15:36	Two different pillow types
37°42.2272 / 111°07.7291	1602	19:17:05	Some large pillows, quite a lot of sediment, probably several centimeters
37°42.2272 / 111°07.7310	1601	19:17:38	Staining, orange Fe oxides
37°42.2284 / 111°07.7312	1598	19:17:55	Yellowish sediment
37°42.2291 / 111°07.7342	1597	19:18:54	Morphology changing, no pillows, yellowish, fine grained
37°42.2313 / 111°07.7366	1599	19:19:24	Small rubble, orange red, hydrothermal sediment, 30 cm deep, some rubble in it, very soft
37°42.2354 / 111°07.7443	1593	19:20:47	Only hydrothermal sediment, no pillows any more
37°42.2355 / 111°07.7474	1595	19:21:37	Pillows beneath the sediment, hydrothermal sediment is several tenth of centimeters, Fe oxides
37°42.2333 / 111°07.7486	1596	19:22:13	More hydrothermal sediment, rubble, orange material
37°42.2274 / 111°07.7472	1597	19:23:22	Some lava rubble in the hydrothermal sediment
37°42.2231 / 111°07.7456	1597	19:24:02	Some large pillows in the hydrothermal sediment
37°42.2209 / 111°07.7435	1596	19:24:39	Fe oxides in the sediment, some lava rubble
37°42.2143 / 111°07.7371	1590	19:26:10	Chimney structure, reddish brown material
37°42.2148 / 111°07.7345	1608	19:26:53	Closing the TV grab, bottom contact lost and end of

Station 08-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°42.2975 / 111°07.5258	1218	19:47:22	station Video cameras turned off

Station 9-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°42.1730 / 111°07.4322	0	21:19:13	Station is located at an off-axis seamount (37°42'S)
37°42.2287 / 111°07.7182	1403	21:51:49	Video cameras turned on
37°42.2260 / 111°07.7649	1589	21:57:53	Bottom contact
37°42.2272 / 111°07.7667	1592	21:58:15	Thick sediments, reddish brown color
37°42.2285 / 111°07.7690	1591	21:59:02	Edifices at least 1 to 2 m high
37°42.2290 / 111°07.7697	1592	21:59:27	Some biology on edifices
37°42.2324 / 111°07.7715	1595	22:01:22	Fish
37°42.2342 / 111°07.7738	1595	22:01:50	Slightly greenish looking edifice, surrounded by reddish sediment
37°42.2366 / 111°07.7839	1597	22:03:17	Soft sediments and chimneys
37°42.2366 / 111°07.7967	1596	22:04:30	More soft chimneys
37°42.2294 / 111°07.8150	1614	22:06:45	Bottom, now about 8m deeper, has blotchy appearance, probably pillows, covered by some sediment
37°42.2276 / 111°07.8244	1623	22:08:01	Still going down, pillows mounds
37°42.2259 / 111°07.8295	1632	22:08:59	More pillows, some sediments
37°42.2236 / 111°07.8364	1645	22:10:21	Old pillows
37°42.2239 / 111°07.8379	1649	22:10:46	Iron oxides in depressions between individual pillows
37°42.2237 / 111°07.8434	1654	22:12:05	Sedimentation seems to become more pronounced
37°42.2286 / 111°07.8518	1656	22:13:31	Now about 50% sediments
37°42.2318 / 111°07.8566	1656	22:14:32	Holothurie on pillow
37°42.2323 / 111°07.8579	1656	22:15:01	Holothurie
37°42.2334 / 111°07.8572	1656	22:15:56	Still about 50% sediments, pillows
37°42.2336 / 111°07.8527	1655	22:17:16	Sediment is brownish to beige in color
37°42.2364 / 111°07.8439	1654	22:18:58	Sediments and pillows, no more biology
37°42.2359 / 111°07.8322	1655	22:20:17	Sediments now more prominent
37°42.2322 / 111°07.7995	1655	22:22:45	Going uphill, only few sediments on pillows
37°42.2264 / 111°07.7657	1644	22:24:53	Steep wall consisting of pillows, going uphill
37°42.2262 / 111°07.7523	1629	22:26:13	Start of blotchy, mottled sediment, still going uphill
37°42.2275 / 111°07.7455	1614	22:27:17	No more pillows visible
37°42.2289 / 111°07.7435	1608	22:27:46	Holothurie
37°42.2240 / 111°07.7372	1591	22:30:49	Fe oxides
37°42.2253 / 111°07.7395	1591	22:32:25	Dark fish, top of dome is reached
37°42.2261 / 111°07.7324	1594	22:34:15	Soft iron oxide sediment
37°42.2260 / 111°07.7193	1594	22:35:44	Fe oxide crusts
37°42.2296 / 111°07.6996	1596	22:38:08	Pillows
37°42.2363 / 111°07.6989	1596	22:39:37	About 30% sediment cover
37°42.2434 / 111°07.6931	1603	22:41:57	Slightly less sediment
37°42.2454 / 111°07.6877	1606	22:42:58	Pillows and some sediment
37°42.2457 / 111°07.6729	1609	22:44:43	Pillows, little sediment
37°42.2547 / 111°07.6722	1615	22:46:30	Starting another E-W traverse about 50m S of first one
37°42.2509 / 111°07.6880	1617	22:48:45	Still pillows, little sediment
37°42.2514 / 111°07.6984	1619	22:50:39	Sea star on pillow
37°42.2527 / 111°07.7025	1620	22:51:24	Small fish on old sedimented pillows
37°42.2537 / 111°07.7066	1620	22:51:57	Gorgonaria
37°42.2540 / 111°07.7170	1620	22:53:20	Pillows, little sediments, minor Fe oxides on pillows
37°42.2521 / 111°07.7181	1615	22:54:34	Increase in abundance of iron oxides, obscures surface textures of pillows
37°42.2519 / 111°07.7322	1613	22:56:54	Holothurie
37°42.2551 / 111°07.7516	1600	22:58:55	Shrimps
37°42.2552 / 111°07.7607	1604	23:00:09	Thick sediments
37°42.2548 / 111°07.7649	1605	23:01:21	Gorgonaria, small deep sea lobster, Fe oxide sediments

Station 9-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°42.2548 / 111°07.7644	1605	23:02:21	White tubes
37°42.2542 / 111°07.7624	1602	23:03:21	Tube worm sticking out of sediment
37°42.2550 / 111°07.7614	1602	23:04:48	Little (ca. 20 cm) spires sticking out of sediment
37°42.2595 / 111°07.7675	1605	23:06:30	Very soft material, disintegrates due to weak water current
37°42.2568 / 111°07.7941	1608	23:08:16	Pillows visible in sediment
37°42.2565 / 111°07.8146	1613	23:09:42	Thick iron oxides
37°42.2476 / 111°07.8274	1649	23:14:00	Sediment seems to consist of chimney fragments
37°42.2466 / 111°07.8211	1648	23:14:35	More pillows, less sediment
37°42.2439 / 111°07.8170	1648	23:15:23	Holothurie on pillow
37°42.2533 / 111°07.8278	1648	23:17:16	Mostly pillows, little sediment
37°42.2590 / 111°07.8359	1654	23:20:53	Sheeted flow, lightly sedimented
37°42.2555 / 111°07.8124	1654	23:22:27	Slightly more sediments, brownish to beige in color
37°42.2543 / 111°07.8022	1654	23:23:05	Back into pillows, still sediments
37°42.2507 / 111°07.7817	1651	23:24:17	Sediments now predominant
37°42.2468 / 111°07.7667	1642	23:25:19	Pillows sticking out of hydrothermal sediments (climbed another 10m)
37°42.2362 / 111°07.7430	1621	23:27:09	Hydrothermal sediments, some pillows visible
37°42.2329 / 111°07.7416	1598	23:28:38	Area of large chimneys
37°42.2327 / 111°07.7422	1594	23:28:54	Fish
37°42.2317 / 111°07.7452	1598	23:30:37	Grab attempt, bottom contact lost and end of station
37°42.2192 / 111°07.7418	1442	23:39:17	Video cameras turned off

Station 10-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°42.3421 / 111°08.2903	0	01:17:53	Station is located at an off-axis seamount (37°42’S)
37°42.3866 / 111°08.4034	1385	02:07:53	Video cameras turned on
37°42.3958 / 111°08.4021	1478	02:10:36	Bottom contact
37°42.3962 / 111°08.4018	1481	02:10:46	Pillow lava, slightly sedimented
37°42.4040 / 111°08.3976	1492	02:12:26	Rope length + 40 m is the real water depth
37°42.4055 / 111°08.3939	1493	02:12:48	Pillow lava, intensely sedimented
37°42.4077 / 111°08.3818	1494	02:13:43	Wavy lava structures
37°42.4089 / 111°08.3728	1494	02:14:26	Hyaloclastite next to two large pillows
37°42.4093 / 111°08.3628	1493	02:15:13	Abundant pillows and tubes, intensely sedimented
37°42.4104 / 111°08.3529	1491	02:15:58	Rhodalid, pillow structures, sedimented, some Fe oxide
37°42.4121 / 111°08.3427	1489	02:16:48	Rat tail, pillow lava, slightly sedimented
37°42.4131 / 111°08.3345	1489	02:17:25	Collapse pit and chimney structure (30 cm high)
37°42.4148 / 111°08.3275	1488	02:18:02	Quite intensely sedimented, white in color, small fish, mottled sediment texture
37°42.4148 / 111°08.3187	1488	02:18:44	More Fe oxide on top of the pillow lava, intensely sedimented
37°42.4161 / 111°08.3106	1489	02:19:19	Large pillow structures and a tube, starting to go down slope
37°42.4186 / 111°08.2979	1492	02:20:24	Pillows, quite intensely sedimented, mottled sediment
37°42.4195 / 111°08.2938	1494	02:20:52	Sediment is very light in color, no hydrothermal input
37°42.4202 / 111°08.2857	1496	02:21:43	Hyaloclastite debris surrounding a pillow
37°42.4197 / 111°08.2821	1496	02:22:06	Pillow ridge
37°42.4194 / 111°08.2757	1493	02:23:08	Little Fe-oxide next to the pillows
37°42.4185 / 111°08.2696	1488	02:24:10	Resedimented hyaloclastite around pillows
37°42.4175 / 111°08.2652	1488	02:24:44	Fe oxide and pillows, quite intensely sedimented
37°42.4181 / 111°08.2606	1488	02:25:16	Fe oxide and little chimney
37°42.4167 / 111°08.2532	1492	02:26:08	More Fe chimneys
37°42.4166 / 111°08.2505	1494	02:26:27	Going down slope
37°42.4161 / 111°08.2467	1498	02:26:56	Fe-oxide material next to pillows, surrounded by sediment
37°42.4142 / 111°08.2353	1495	02:28:08	Old pillows, glassy bits are broken of and resedimented,

Station 10-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
			lots of sediment
37°42.4133 / 111°08.2282	1496	02:28:42	Abundant sediment, resedimented hyaloclastite surrounding the pillows
37°42.4139 / 111°08.2228	1494	02:29:16	Crinoids abundant on pillows
37°42.4106 / 111°08.2104	1488	02:30:44	Fish, pillow lava with gorgonarias, slightly sedimented
37°42.3983 / 111°08.1984	1486	02:32:27	Pillows covered by sediment, no hydrothermal input, gorgonaria
37°42.3966 / 111°08.1942	1486	02:32:58	Little Fe chimney
37°42.3954 / 111°08.1911	1486	02:33:23	Little Fe chimney
37°42.3944 / 111°08.1882	1487	02:33:51	More Fe oxides
37°42.3943 / 111°08.1868	1489	02:34:14	Larger chimneys, pillows intensely sedimented
37°42.3939 / 111°08.1824	1493	02:34:59	Abundant sediment
37°42.3952 / 111°08.1760	1495	02:35:38	Larger chimney structures, several large chimneys
37°42.4011 / 111°08.1572	1495	02:37:15	Only very little sediment on the pillow tops, but abundant in the pockets suggesting some current
37°42.4001 / 111°08.1477	1495	02:38:01	Fe oxide, two gorgonarias
37°42.3993 / 111°08.1415	1496	02:38:37	More Fe oxide chimneys, some of it standing on top of a pillow, several chimney like structures
37°42.3982 / 111°08.1325	1495	02:39:33	Collapsed pillow
37°42.3962 / 111°08.1254	1492	02:40:25	Fe oxide, some tubes and gorgonarias
37°42.3940 / 111°08.1238	1491	02:40:46	Large Fe oxide chimney
37°42.3886 / 111°08.1221	1490	02:41:18	More Fe oxide chimneys, hyaloclastite abundant
37°42.3769 / 111°08.1203	1486	02:42:48	Large pillows, gorgonaria, sedimented pockets
37°42.3726 / 111°08.1040	1493	02:45:00	Fe oxide and pillows
37°42.3726 / 111°08.1027	1494	02:45:16	Small Fe oxide chimneys
37°42.3723 / 111°08.0978	1500	02:46:26	Getting steeper, cliff
37°42.3705 / 111°08.0949	1503	02:46:45	Cliff is covered with orange material
37°42.3695 / 111°08.0898	1507	02:47:56	Scarp (10 m down)
37°42.3671 / 111°08.0744	1511	02:49:48	Abundant sediments
37°42.3667 / 111°08.0694	1511	02:50:16	Pillows surrounded by sediments
37°42.3648 / 111°08.0651	1512	02:50:41	Big pillows surrounded by sediment, relatively steep slope
37°42.3630 / 111°08.0601	1513	02:51:29	Crack, possibly fault
37°42.3625 / 111°08.0574	1514	02:51:57	Abundant pillows, some sediment
37°42.3613 / 111°08.0501	1518	02:53:12	Perpendicular wall (1516 m upper limit and 1644 m at bottom)
37°42.3575 / 111°08.0225	1655	02:56:56	Rat tail
37°42.3573 / 111°08.0201	1656	02:57:09	Hyaloclastite surrounding a pillow
37°42.3447 / 111°07.9973	1655	02:59:38	Pillows surrounded by sediments
37°42.3415 / 111°07.9924	1654	03:02:31	Abundant pillows surrounded by sediments
37°42.3445 / 111°07.9867	1654	03:05:10	Pillows surrounded by sediment, pockets intensely sedimented
37°42.3453 / 111°07.9845	1652	03:07:07	Abundant hyaloclastite
37°42.3485 / 111°07.9717	1653	03:08:50	Pillows surrounded by sediment, some resedimented hyaloclastite
37°42.3435 / 111°07.9384	1653	03:11:47	Pillows, some white sediment, fish
37°42.3340 / 111°07.9323	1652	03:13:46	Sheet flows
37°42.3321 / 111°07.9289	1653	03:14:30	Flow lamination very well developed
No data	1650	03:15:46	Crack in the sheet flow
No data	1649	03:15:57	Sheet flow is sedimented, flow lamination
37°42.3345 / 111°07.9207	1651	03:17:01	Wavy features on the sheet flow
37°42.3364 / 111°07.9203	1652	03:17:49	Sheet flows with wavy surfaces, quite well covered with sediments, fish
37°42.3414 / 111°07.9134	1652	03:20:07	Sheet flows, some scattered tubes, quite intensely sedimented
37°42.3460 / 111°07.9148	1649	03:21:16	Large sheet flow
37°42.3503 / 111°07.9183	1650	03:22:38	Sheet flow, lots of sediment cover, no hydrothermal input
37°42.3539 / 111°07.9145	1652	03:23:46	Tube flows

Station 10-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°42.3539 / 111°07.9121	1652	03:24:04	Tubes are only located between the sheet flows
37°42.3567 / 111°07.8970	1652	03:25:38	Tube lava
37°42.3620 / 111°07.8853	1653	03:27:12	Abundant tubes, slightly sedimented
37°42.3654 / 111°07.8821	1652	03:28:12	Sheet flows
37°42.3578 / 111°07.8649	1652	03:32:01	Fish over tube lava, slightly sedimented
37°42.3476 / 111°07.8679	1654	03:33:07	Large tubes surrounded by sediments
37°42.3397 / 111°07.8776	1654	03:35:15	Tube lava surrounded by sediment
37°42.3372 / 111°07.8744	1655	03:36:42	Tube lava, very few scattered pillows
37°42.3454 / 111°07.8796	1656	03:38:48	Tube lava
37°42.3505 / 111°07.8786	1653	03:40:40	Tube lava surrounded by sediment
37°42.3524 / 111°07.8755	1654	03:42:16	Tube lava
37°42.3541 / 111°07.8568	1654	03:45:28	Two separated pillows at the tip of a tube lava
37°42.3522 / 111°07.8444	1655	03:46:53	Tube lava surrounded by sediment
37°42.3545 / 111°07.8286	1653	03:48:53	Sheet flow surrounded by sediment
37°42.3558 / 111°07.8216	1654	03:50:01	Tube lava, heavily sedimented
37°42.3568 / 111°07.8182	1654	03:50:22	Rat tail next to the tube lava, sedimented pockets
37°42.3600 / 111°07.8102	1652	03:51:41	Lava appears to be slightly older than on top of the cliff because the resedimented hyaloclastite is now covered by sediments
37°42.3657 / 111°07.8019	1653	03:53:41	Tube lava, sheet lava
37°42.3670 / 111°07.7971	1653	03:54:56	Sheet flows transitional to tubes
37°42.3699 / 111°07.7951	1653	03:55:52	Sheet flow
37°42.3723 / 111°07.7933	1654	03:56:53	Tube lava, Fe oxide in collapse pit
37°42.3731 / 111°07.7911	1653	03:57:51	Rat tail, intensely sedimented
37°42.3742 / 111°07.7894	1653	03:58:59	Shrimp
37°42.3752 / 111°07.7908	1654	03:59:46	Two pillows, tube lava, intensely sedimented
37°42.3783 / 111°07.7876	1652	04:01:14	Tube lava surrounded by sediment, no hydrothermal activities
37°42.3813 / 111°07.7762	1651	04:05:10	Tube lava surrounded by sediment
37°42.3830 / 111°07.7692	1652	04:07:17	Sheet flow
37°42.3764 / 111°07.7561	1652	04:10:01	Sheet flow, no hyaloclastite, relatively thick sediment cover
37°42.3769 / 111°07.7479	1653	04:11:52	Tube lava
37°42.3800 / 111°07.7370	1652	04:15:11	Tube lava covered by sediment
37°42.3800 / 111°07.7042	1654	04:23:37	Tube lava surrounded by sediments
37°42.3815 / 111°07.6804	1655	04:26:19	Video turned off
37°42.3886 / 111°07.6640	1653	04:30:13	Video turned on
37°42.3860 / 111°07.6492	1651	04:32:46	Pillows forming the mound on top of the sheet flows and the tube lava
37°42.3853 / 111°07.6357	1650	04:34:06	Dome consists of pillows, the pillows are less sedimented than the sheet flows and the tubes in the valley
37°42.3916 / 111°07.6120	1648	04:36:34	Pillow mound covered with some sediments in the cracks in the pillows
37°42.3851 / 111°07.5842	1633	04:39:37	Relatively steep slope, pillow covered, no glassy material, but also not as much sediment as down in the valley
37°42.3830 / 111°07.5767	1628	04:40:33	Talus material, broken pillows
37°42.3825 / 111°07.5714	1621	04:41:30	Talus material consists of broken pillows
37°42.3826 / 111°07.5580	1604	04:43:49	White sediment close to the top
37°42.3821 / 111°07.5541	1594	04:44:26	Very steep scarp
37°42.3813 / 111°07.5432	1573	04:46:25	Still going up slope of the mound, pillows change to tube like morphology
37°42.3855 / 111°07.5389	1568	04:47:44	Bottom contact lost and end of station
37°42.3851 / 111°07.5323	1554	04:48:34	Video cameras turned off

Station 13-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.3064 / 110°51.8613	0	14:06:57	Station is located at the northern axial high of the Pacific-Antarctic Ridge (37°40'S)
37°38.3138 / 110°51.9979	1949	14:47:04	Video cameras turned on
37°38.3131 / 110°52.0288	2150	14:52:14	Bottom contact
37°38.3175 / 110°52.0160	2172	14:53:46	Talus, well sorted
37°38.3282 / 110°52.0172	2162	14:55:53	Crinoids
37°38.3265 / 110°52.0163	2161	14:56:21	Talus and pillows
37°38.3197 / 110°52.0128	2159	14:57:08	Pillows
37°38.3160 / 110°52.0148	2161	14:58:02	No sediments between pillows
37°38.3142 / 110°52.0383	2163	15:00:09	White spots on pillows, pillows are not glassy, no sediments
37°38.3072 / 110°52.0529	2174	15:01:50	Two crinoids
37°38.3068 / 110°52.0542	2178	15:02:06	Talus material
37°38.3038 / 110°52.0590	2181	15:03:47	Still talus with some black material (glassy basalt), pillows
37°38.3038 / 110°52.0595	2184	15:04:16	Talus not sorted
37°38.3033 / 110°52.0567	2185	15:04:56	Crinoid on pillow
37°38.3023 / 110°52.0539	2190	15:05:25	Pillows
37°38.3018 / 110°52.0504	2190	15:06:20	Crinoids on pillow flows, gorgonaria
37°38.3016 / 110°52.0511	2187	15:06:55	Reddish sediment in pillow pockets
37°38.3043 / 110°52.0555	2187	15:07:51	Holothurie
37°38.3069 / 110°52.0592	2188	15:08:23	Massive pillow flows, no talus
37°38.3071 / 110°52.0632	2187	15:08:47	Pillow tubes
37°38.3092 / 110°52.0739	2187	15:09:38	Gorgonaria on pillow tube
37°38.3107 / 110°52.0802	2189	15:10:01	Steep step downwards (3-4 m), some more animals on cliff
37°38.3138 / 110°52.1077	2198	15:12:02	Sponge on pillow
37°38.3131 / 110°52.1161	2203	15:12:51	Still nearly no sediment
37°38.3125 / 110°52.1184	2205	15:13:10	Small scarp, talus
37°38.3124 / 110°52.1189	2208	15:13:39	Rat tail
37°38.3107 / 110°52.1207	2214	15:14:09	Talus, no sediment
37°38.3100 / 110°52.1213	2214	15:14:35	Crab, actinie, large pillows
37°38.3100 / 110°52.1218	2211	15:15:15	Munidopsis
37°38.3071 / 110°52.1179	2209	15:16:04	Climbing a few meters, large pillows
37°38.3055 / 110°52.1173	2205	15:16:32	Autobrecciated pillow
37°38.3009 / 110°52.1147	2215	15:17:43	Talus material
37°38.2999 / 110°52.1175	2213	15:18:23	Talus unsorted
37°38.3041 / 110°52.1281	2212	15:19:41	Medium sized pillows, talus
37°38.3020 / 110°52.1332	2215	15:20:35	Large gorgonaria
37°38.3020 / 110°52.1383	2211	15:21:05	Small gorgonarias
37°38.3042 / 110°52.1411	2210	15:21:28	Silica stained talus
37°38.3080 / 110°52.1430	2208	15:21:42	Crinoid
37°38.3115 / 110°52.1537	2206	15:22:50	Pillows partly slightly stained with light material
37°38.3138 / 110°52.1619	2211	15:23:48	Medium sized talus material, thin sediment cover
37°38.3142 / 110°52.1702	2209	15:24:45	Talus, pillows, actinie
37°38.3140 / 110°52.1829	2206	15:26:03	Talus material lightly stained
37°38.3124 / 110°52.1867	2203	15:26:35	Staining of talus
37°38.3116 / 110°52.1900	2202	15:26:59	Mn staining on talus
37°38.3108 / 110°52.1947	2201	15:27:45	Old talus
37°38.3103 / 110°52.1971	2199	15:28:06	Yellow staining of talus
37°38.3098 / 110°52.2019	2176	15:29:15	Crinoids on pillows of the wall
37°38.3109 / 110°52.1985	2173	15:30:35	Old sedimented pillows and tubes
37°38.3118 / 110°52.1918	2176	15:31:35	Actinie
37°38.3132 / 110°52.1891	2179	15:32:02	Big pillow slightly sedimented and sediments between pillows
37°38.3211 / 110°52.1759	2179	15:33:45	Slightly sedimented pillows
37°38.3342 / 110°52.1591	2175	15:35:37	Larger pillow tubes
37°38.3388 / 110°52.1537	2176	15:36:17	Some sponges on pillows

Station 13-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.3425 / 110°52.1504	2175	15:36:42	Pillows and tubes
37°38.3494 / 110°52.1529	2174	15:37:49	Gorgonaria and fish
37°38.3506 / 110°52.1541	2169	15:38:19	Crinoid
37°38.3505 / 110°52.1528	2171	15:38:43	Crossing a small ridge, rat tail
37°38.3495 / 110°52.1500	2182	15:39:20	Stained talus
37°38.3469 / 110°52.1473	2194	15:39:50	Medium sized talus some tubes
37°38.3426 / 110°52.1418	2199	15:40:44	Crinoid
37°38.3408 / 110°52.1419	2203	15:41:26	Gorgonaria on talus
37°38.3390 / 110°52.1427	2204	15:42:03	Talus
37°38.3398 / 110°52.1406	2209	15:42:42	Talus not sorted
37°38.3423 / 110°52.1372	2211	15:43:21	Some orange staining on talus
37°38.3428 / 110°52.1348	2209	15:43:41	Crinoid unstalked
37°38.3471 / 110°52.1317	2212	15:44:26	Crinoid and actinie, orange-red staining of talus, slightly sedimented
37°38.3516 / 110°52.1328	2207	15:45:23	Gravel
37°38.3513 / 110°52.1332	2208	15:46:02	Crinoid, sedimented pillows
37°38.3517 / 110°52.1321	2209	15:46:16	Fish
37°38.3519 / 110°52.1297	2209	15:46:48	Increasing sediment
37°38.3510 / 110°52.1247	2207	15:47:26	Sediment, large hydrozoa
37°38.3491 / 110°52.1192	2203	15:48:05	Some staining on old pillows
37°38.3478 / 110°52.1134	2204	15:48:48	East wall, staining on pillows, crab
37°38.3456 / 110°52.1081	2206	15:49:32	Bythograea crab
37°38.3451 / 110°52.0992	2209	15:50:25	Passed a small ridge
37°38.3435 / 110°52.0947	2212	15:50:54	Actinie, pillows sedimented
37°38.3420 / 110°52.0899	2212	15:51:21	Sediment ponds between pillows
37°38.3423 / 110°52.0874	2213	15:51:36	Sea star, huge pillows
37°38.3416 / 110°52.0820	2208	15:52:26	Talus and pillows
37°38.3420 / 110°52.0665	2208	15:54:09	Crinoid, talus material
37°38.3417 / 110°52.0600	2210	15:55:05	Crossing a small ridge (2-3 m high)
37°38.3433 / 110°52.0572	2208	15:55:35	Silica staining on talus material
37°38.3436 / 110°52.0541	2209	15:56:05	Fine talus
37°38.3535 / 110°52.0488	2190	15:58:43	Well sorted medium sized talus
37°38.3576 / 110°52.0504	2188	15:59:23	Actinie
37°38.3617 / 110°52.0503	2185	15:59:53	Larger pillows
37°38.3647 / 110°52.0502	2186	16:00:11	Pillows and talus
37°38.3693 / 110°52.0481	2188	16:00:48	Sponges and white spots on pillows
37°38.3755 / 110°52.0465	2188	16:01:20	Talus material
37°38.3796 / 110°52.0501	2191	16:02:57	Still talus
37°38.3764 / 110°52.0530	2188	16:03:46	Steep step upwards, nearly vertical wall, several crinoids
37°38.3691 / 110°52.0581	2179	16:05:00	Talus
37°38.3597 / 110°52.0701	2182	16:06:55	Fine and well sorted talus
37°38.3590 / 110°52.0775	2187	16:08:02	Slightly more sediments in pockets between talus
37°38.3598 / 110°52.0771	2192	16:09:07	Crinoid
37°38.3644 / 110°52.0757	2188	16:10:04	Talus, fish
37°38.3679 / 110°52.0758	2189	16:10:37	Some pillows between talus, sponges on pillows
37°38.3784 / 110°52.0776	2185	16:11:34	Crinoids
37°38.3854 / 110°52.0810	2185	16:12:15	Large pillow talus
37°38.3873 / 110°52.0835	2185	16:12:36	Gorgonaria
37°38.3891 / 110°52.0871	2183	16:12:58	Small step up, talus and pillows
37°38.3878 / 110°52.0933	2180	16:13:42	Sponge
37°38.3872 / 110°52.0957	2181	16:14:05	Small ridge surrounded by talus
37°38.3861 / 110°52.0978	2185	16:14:42	Actinie, gorgonaria
37°38.3858 / 110°52.0991	2186	16:15:01	Talus
37°38.3846 / 110°52.1039	2187	16:15:36	Gorgonaria
37°38.3837 / 110°52.1122	2189	16:16:13	Munidopsis
37°38.3854 / 110°52.1281	2192	16:17:01	Sponge
37°38.3900 / 110°52.1494	2200	16:18:16	Crab
37°38.3917 / 110°52.1553	2202	16:18:41	Talus

Station 13-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.3938 / 110°52.1638	2205	16:19:11	Crinoid, talus
37°38.3969 / 110°52.1763	2210	16:19:49	Slightly sedimented talus
37°38.3986 / 110°52.1872	2214	16:20:20	Some more sediment on broken pillows
37°38.4021 / 110°52.2105	2218	16:21:33	Talus, crab, crinoids, material slightly sedimented
37°38.4054 / 110°52.2201	2220	16:22:22	More sediment on talus material
37°38.4093 / 110°52.2241	2213	16:23:32	Fine grained talus
37°38.4103 / 110°52.2244	2213	16:23:46	Sharp ridge some meters high surrounded by talus
37°38.4129 / 110°52.2227	2214	16:24:43	Larger talus, white spots on a pillar, more sediment
37°38.4146 / 110°52.2223	2218	16:25:14	Chimney or pillar
37°38.4155 / 110°52.2249	2215	16:25:35	Step wall
37°38.4163 / 110°52.2307	2202	16:26:08	Chimney structure, stained
37°38.4158 / 110°52.2525	2196	16:27:17	Pillows sedimented
37°38.4156 / 110°52.2600	2199	16:27:50	Two different pillow generations
37°38.4155 / 110°52.2628	2202	16:28:02	Medium sized talus, slightly sedimented
37°38.4161 / 110°52.2682	2199	16:28:29	Talus material
37°38.4160 / 110°52.2718	2196	16:28:46	Gorgonaria
37°38.4155 / 110°52.2751	2194	16:29:00	Talus
37°38.4150 / 110°52.2852	2188	16:29:40	Crinoid
37°38.4146 / 110°52.2921	2182	16:30:24	Sedimented pillows
37°38.4129 / 110°52.3054	2179	16:31:36	Larger pillows in talus field
37°38.4126 / 110°52.3096	2177	16:31:59	Small talus, crinoids
37°38.4134 / 110°52.3120	2174	16:32:17	Stained talus, silica
37°38.4140 / 110°52.3144	2174	16:32:33	Steep wall with fine talus
37°38.4191 / 110°52.3179	2130	16:33:34	Very steep wall, nearly vertical, about 50 m high
No data	2136	16:36:31	Talus material, sponge
37°38.4462 / 110°52.3116	2132	16:37:03	Pillow tubes, large pillows, sponges
37°38.4482 / 110°52.3009	2131	16:37:56	Little sediment on pillows
37°38.4499 / 110°52.2847	2131	16:38:52	Crinoid
37°38.4499 / 110°52.2799	2133	16:39:07	Large pillows and talus
37°38.4478 / 110°52.2584	2131	16:40:16	Broken pillows and tubes, thin sediment cover
37°38.4495 / 110°52.2468	2133	16:41:01	Pillows and tubes
37°38.4498 / 110°52.2401	2132	16:41:31	Large pillows and tubes
37°38.4559 / 110°52.2187	2137	16:43:16	Pillows and talus
37°38.4599 / 110°52.2106	2140	16:43:51	Small cliff, crinoid on pillow, tilted blocks
37°38.4644 / 110°52.1999	2133	16:44:31	Still large pillows and tubes
37°38.4701 / 110°52.1908	2137	16:45:15	Still large pillows and tubes, crinoid
37°38.4716 / 110°52.1854	2138	16:45:36	Talus
37°38.4723 / 110°52.1813	2138	16:45:51	Crinoid and sponge
37°38.4735 / 110°52.1514	2181	16:47:41	Talus, silica staining, probably low temperature fluids emanate at the foot of the cliff
37°38.4734 / 110°52.1388	2189	16:48:24	Fine talus
37°38.4735 / 110°52.1302	2191	16:48:51	Pillows
37°38.4736 / 110°52.1244	2193	16:49:17	Large pillows and tubes
37°38.4749 / 110°52.1160	2192	16:49:59	Broken tubes
37°38.4751 / 110°52.0942	2206	16:51:21	Pillows and tubes
37°38.4826 / 110°52.0673	2205	16:53:29	Scarp (about 2 m deep), still pillows, slightly sedimented
No data	2220	16:55:05	Talus material
No data	2219	16:55:36	Pillows and tubes, sediment on the pillows and in pockets
37°38.4969 / 110°52.0182	2224	16:56:47	Talus
37°38.4995 / 110°52.0116	2220	16:57:15	Sediment in talus pockets
37°38.5026 / 110°52.0078	2214	16:57:38	Sediments in talus pockets, gorgonaria
37°38.5025 / 110°52.0011	2211	16:58:03	Fine talus, sediments, reddish-orange color
37°38.5052 / 110°51.9939	2209	16:58:30	Pillow block stained with orange material
37°38.5066 / 110°51.9868	2203	16:59:05	Talus material, no sediments
37°38.5090 / 110°51.9828	2206	16:59:24	Pillows
37°38.5109 / 110°51.9793	2202	16:59:42	Actinie
37°38.5112 / 110°51.9758	2202	16:59:54	Shrimp, talus

Station 13-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.5168 / 110°51.9658	2201	17:00:48	Talus
37°38.5177 / 110°51.9633	2202	17:01:01	Pillows
37°38.5259 / 110°51.9374	2193	17:02:50	Pillow talus
37°38.5274 / 110°51.9318	2186	17:03:18	Pillows and tubes
37°38.5299 / 110°51.9085	2181	17:04:32	Pillows
37°38.5330 / 110°51.9042	2178	17:05:02	Talus
37°38.5351 / 110°51.8957	2170	17:05:35	Talus, well sorted, actinie
37°38.5380 / 110°51.8866	2162	17:06:10	Gorgonaria talus
37°38.5394 / 110°51.8797	2150	17:06:36	Step upwards (2 m), crinoids
37°38.5398 / 110°51.8657	2136	17:07:25	Pillows
37°38.5403 / 110°51.8506	2139	17:08:20	Rat tail
37°38.5412 / 110°51.8472	2130	17:08:31	Steep step up (2-3m)
37°38.5469 / 110°51.8243	2146	17:11:55	Pillows and tubes
37°38.5478 / 110°51.8179	2148	17:12:44	Pillows
37°38.5456 / 110°51.8119	2154	17:13:11	Pillows and tubes slightly sedimented
37°38.5457 / 110°51.8029	2154	17:13:56	Some sponges
37°38.5470 / 110°51.7928	2143	17:14:42	Talus
37°38.5487 / 110°51.7867	2138	17:15:15	Steep wall, sponges and gorgonarias
37°38.5491 / 110°51.7733	2128	17:16:01	Pillows, partly broken, slightly sedimented, crinoids
37°38.5597 / 110°51.7768	2122	17:16:58	Crinoids
37°38.5657 / 110°51.7788	2124	17:17:35	Bottom contact lost and end of station
37°38.5705 / 110°51.7761	2105	17:18:38	Video cameras turned off

Station 14-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.1292 / 110°52.0965	0	18:44:06	Station is located at the northern axial high of the Pacific-Antarctic Ridge (37°40'S)
37°38.1688 / 110°52.1040	2011	19:25:48	Video cameras turned on
37°38.1387 / 110°52.0785	2184	19:31:18	Bottom contact
37°38.1385 / 110°52.0786	2188	19:31:27	Old pillows, octopus
37°38.1396 / 110°52.0795	2189	19:31:41	Cirroteuthis
37°38.1442 / 110°52.0853	2191	19:32:24	Big broken pillows
37°38.1486 / 110°52.0918	2189	19:33:20	Pillows slightly sedimented
37°38.1502 / 110°52.0931	2188	19:33:47	Crinoid
37°38.1515 / 110°52.0936	2189	19:34:00	Light staining on pillow
37°38.1552 / 110°52.0936	2191	19:35:20	Old pillows, slightly sedimented partly broken
37°38.1924 / 110°52.0923	2183	19:39:43	Pillows covered by sediment
37°38.1965 / 110°52.0964	2185	19:40:09	Crinoid
37°38.2028 / 110°52.1007	2185	19:40:40	Large pillows
37°38.2065 / 110°52.1031	2185	19:41:16	Large pillows
37°38.2117 / 110°52.1033	2185	19:42:04	Large pillows
37°38.2156 / 110°52.1052	2185	19:42:31	Pillows and tubes
37°38.2222 / 110°52.1068	2181	19:43:53	Crinoid
37°38.2237 / 110°52.1060	2181	19:44:05	Pillow tubes
37°38.2251 / 110°52.1034	2180	19:44:28	Two crinoids
37°38.2279 / 110°52.0970	2178	19:44:56	Large pillows and tubes, crinoids on the edge
37°38.2420 / 110°52.0819	2193	19:47:12	Talus material
37°38.2465 / 110°52.0864	2197	19:47:49	Crinoids
37°38.2537 / 110°52.0987	2197	19:48:35	Talus
37°38.2589 / 110°52.1068	2203	19:49:24	Fine grained talus, silica staining
37°38.2635 / 110°52.1087	2207	19:50:09	Pillows partly broken
37°38.2674 / 110°52.1075	2204	19:50:38	Broken tubes
37°38.2696 / 110°52.1062	2204	19:50:52	Vent crabs
37°38.2700 / 110°52.1036	2204	19:51:10	Large broken tubes
37°38.2724 / 110°52.0994	2202	19:51:37	Material slightly sedimented
37°38.2744 / 110°52.0977	2202	19:52:00	Vent crab

Station 14-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.2768 / 110°52.0964	2202	19:52:20	Talus and broken pillows
37°38.2819 / 110°52.0988	2204	19:52:57	Rhodalid
37°38.2856 / 110°52.1023	2203	19:53:19	Actinie
37°38.2862 / 110°52.1047	2203	19:53:30	Crinoids on talus, munidopsis
37°38.2905 / 110°52.1110	2204	19:54:06	Still talus getting finer, more crabs
37°38.2917 / 110°52.1128	2204	19:54:31	Still more animals
37°38.2932 / 110°52.1125	2205	19:54:55	Crinoids and crabs on talus
37°38.2936 / 110°52.1104	2206	19:55:40	Talus coarser
37°38.2942 / 110°52.1086	2206	19:55:58	Crabs again, some staining on sediments
No data	2206	19:56:18	Lots of animals
37°38.2984 / 110°52.1030	2206	19:57:14	Coarse talus
37°38.3023 / 110°52.1046	2209	19:57:59	Fish, talus, slightly sedimented
37°38.3046 / 110°52.1060	2210	19:58:16	Crinoids
37°38.3060 / 110°52.1079	2211	19:58:30	Large pillows
37°38.3126 / 110°52.1117	2212	19:59:21	Sea star and crinoids, pillows
37°38.3158 / 110°52.1137	2213	19:59:45	Pillows slightly sedimented, no staining
No data	2214	20:00:14	Vent crab, rat tail, coarse talus
37°38.3186 / 110°52.1113	2213	20:00:41	Rat tail
No data	2213	20:01:04	Broken pillows with thin sediment cover
37°38.3216 / 110°52.1089	2212	20:01:18	Crab and crinoids, larger talus pieces, fish
37°38.3238 / 110°52.1090	2212	20:01:45	Fish over sedimented talus
37°38.3299 / 110°52.1117	2211	20:02:27	Coarse talus
37°38.3332 / 110°52.1160	2209	20:02:58	Holothurie
37°38.3340 / 110°52.1170	2209	20:03:08	Large broken pillow
37°38.3359 / 110°52.1183	2206	20:03:25	Slight sediment cover of pillow without distinct staining
37°38.3388 / 110°52.1177	2206	20:04:38	Slightly sedimented talus
37°38.3396 / 110°52.1153	2206	20:05:13	Talus material rather coarse
37°38.3419 / 110°52.1143	2204	20:05:53	Large old pillow between talus
37°38.3450 / 110°52.1133	2204	20:06:26	Gorgonaria on talus
37°38.3483 / 110°52.1143	2202	20:06:52	Small cliff consisting of talus
37°38.3584 / 110°52.1230	2203	20:08:04	Talus, gorgonaria
37°38.3628 / 110°52.1253	2202	20:08:33	Large talus unsorted
37°38.3644 / 110°52.1227	2202	20:09:12	Crinoid on talus, sea star
37°38.3733 / 110°52.1064	2205	20:10:46	Pillows and talus
37°38.3755 / 110°52.1052	2205	20:11:20	Only talus, some sediment, crinoid
37°38.3761 / 110°52.1070	2202	20:11:53	Large pillows, fish
37°38.3747 / 110°52.1067	2197	20:12:41	Talus, pillows, crinoids
37°38.3703 / 110°52.1069	2196	20:13:47	Pillows and talus, crinoid
37°38.3639 / 110°52.1170	2197	20:14:41	Still mostly talus, rather coarse
37°38.3448 / 110°52.1265	2200	20:16:38	Sponge on old pillow surrounded by talus
37°38.3374 / 110°52.1182	2201	20:17:28	Talus with only a very thin sediment cover
37°38.3061 / 110°52.0953	2200	20:19:36	Pillar structure with crinoids
37°38.2970 / 110°52.0897	2201	20:20:11	Blocky basalt
37°38.2945 / 110°52.0895	2201	20:20:23	Vent-specific animals
37°38.2827 / 110°52.0823	2205	20:21:46	Large pillows
37°38.2785 / 110°52.0818	2206	20:22:11	Large talus material and some large pillows
37°38.2739 / 110°52.0806	2206	20:23:17	Sponge on large talus blocks
37°38.2725 / 110°52.0828	2204	20:23:35	Small step up, large pillows
37°38.2695 / 110°52.0845	2203	20:23:53	Crinoid, free swimming, typical fauna of nearby vent
37°38.2530 / 110°52.0961	2206	20:25:23	Large pillows and tubes
37°38.2526 / 110°52.0992	2203	20:25:42	Pillows slightly sedimented
37°38.2383 / 110°52.1096	2206	20:26:49	Talus material
37°38.2363 / 110°52.1122	2206	20:27:04	Free swimming crinoid
37°38.2336 / 110°52.1143	2206	20:27:18	Two vent crabs over pillows
37°38.2239 / 110°52.1172	2208	20:28:01	Pillows
37°38.2226 / 110°52.1171	2209	20:28:15	Sponge
37°38.2209 / 110°52.1166	2211	20:28:30	Some more sediment on talus
37°38.2201 / 110°52.1154	2213	20:28:44	Broken pillow tubes, crinoids, vent crabs

Station 14-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.2180 / 110°52.1118	2214	20:29:15	Free swimming crinoids, vent crab, talus
37°38.2178 / 110°52.1096	2213	20:29:33	Free swimming crinoids over talus
37°38.2183 / 110°52.1034	2215	20:30:01	Crinoids and crabs over talus
37°38.2180 / 110°52.0997	2215	20:30:18	Rat tail, talus, crinoids, fish
37°38.2179 / 110°52.0932	2210	20:30:45	Crinoids over talus
37°38.2179 / 110°52.0909	2209	20:30:58	Vent crab, fish, vent lobster
37°38.2182 / 110°52.0856	2208	20:31:17	Barnacles, lots of crabs, red staining
37°38.2171 / 110°52.0798	2208	20:31:42	Probable vent, light staining (silica)
37°38.2196 / 110°52.0739	2208	20:32:04	Much more crabs, lobster, more crabs
37°38.2201 / 110°52.0704	2207	20:32:25	Abundant crabs, venting
37°38.2200 / 110°52.0685	2208	20:32:49	Medium sized talus, no Fe staining, still lots of animals
37°38.2189 / 110°52.0718	2207	20:33:47	Large pillows
37°38.2159 / 110°52.0717	2206	20:34:32	Vent crab
37°38.2163 / 110°52.0709	2206	20:34:44	Staining of talus, crab
37°38.2146 / 110°52.0674	2207	20:35:03	Crab, crinoid, talus
37°38.2138 / 110°52.0629	2207	20:35:34	Crab
37°38.2121 / 110°52.0567	2208	20:36:02	Pillows and talus, no staining
37°38.2041 / 110°52.0466	2210	20:36:39	Medium to small sized talus with silica staining
37°38.1979 / 110°52.0480	2209	20:37:15	Large broken tubes, slightly covered by sediments, no staining
37°38.1909 / 110°52.0577	2206	20:37:53	Large partly broken pillows
37°38.1853 / 110°52.0627	2207	20:38:19	Sponge on talus
37°38.1866 / 110°52.0642	2206	20:38:28	Small actinie
37°38.1819 / 110°52.0671	2205	20:39:06	Talus
37°38.1774 / 110°52.0681	2204	20:39:26	Crinoid on talus
37°38.1760 / 110°52.0694	2204	20:39:37	Gorgonaria
37°38.1685 / 110°52.0664	2203	20:40:51	Munidopsis on talus
37°38.1643 / 110°52.0610	2203	20:41:19	Staining on sediment
37°38.1637 / 110°52.0576	2204	20:41:39	Fish
37°38.1621 / 110°52.0543	2204	20:41:52	Distinct yellow staining of sediments and pillows
37°38.1559 / 110°52.0467	2204	20:42:29	Video cameras stopped several minutes ago
37°38.1521 / 110°52.0405	2205	20:42:55	Vent crab, pillows and talus
37°38.1490 / 110°52.0380	2205	20:43:25	Small pillar and talus
37°38.1451 / 110°52.0333	2206	20:43:58	Color video camera turned on
37°38.1442 / 110°52.0338	2205	20:44:34	Still large talus, vent crab
37°38.1448 / 110°52.0379	2203	20:44:54	Black and white video camera turned on
37°38.1452 / 110°52.0414	2203	20:45:09	Larger pillows and talus
37°38.1414 / 110°52.0582	2207	20:46:32	Actinies, orange staining on talus
37°38.1425 / 110°52.0580	2206	20:47:12	Large pillows and talus
37°38.1420 / 110°52.0493	2206	20:48:05	Rat tail, crinoid
37°38.1436 / 110°52.0466	2203	20:48:28	Staining of talus
37°38.1415 / 110°52.0447	2202	20:48:58	Silica stained talus at the foot of a small cliff
37°38.1412 / 110°52.0425	2201	20:49:33	Orange staining
37°38.1431 / 110°52.0424	2202	20:50:00	Finer grained talus between larger pillar structures
37°38.1464 / 110°52.0428	2201	20:50:25	Light stained talus material
37°38.1483 / 110°52.0423	2201	20:50:40	Orange sediment
37°38.1508 / 110°52.0411	2201	20:50:59	Silica staining on small wall
37°38.1541 / 110°52.0417	2201	20:51:27	Small, steep wall
37°38.1628 / 110°52.0423	2205	20:52:33	Silica stained talus
37°38.1643 / 110°52.0415	2205	20:52:48	Small, steep wall, part of it is stained
No data	2205	20:54:00	Fine sized talus, partly silica stained
No data	2205	20:54:34	Old pillows next to silica stained talus
No data	2202	20:54:56	Pillows
37°38.1835 / 110°52.0588	2203	20:55:22	Silica stained talus and pillows
37°38.1865 / 110°52.0618	2201	20:55:43	Pillows
37°38.2062 / 110°52.0590	2204	20:58:50	Talus material
37°38.2076 / 110°52.0578	2205	20:59:05	Yellow staining of the talus
37°38.2175 / 110°52.0556	2204	21:00:19	Talus with a thin sediment cover

Station 14-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.2227 / 110°52.0587	2204	21:00:57	Silica stained talus
37°38.2328 / 110°52.0697	2201	21:02:29	Talus
37°38.2340 / 110°52.0702	2201	21:02:47	Crinoid
37°38.2353 / 110°52.0702	2199	21:02:58	Vent crabs
37°38.2370 / 110°52.0682	2201	21:04:15	Fine grained and well sorted talus
37°38.2396 / 110°52.0687	2201	21:04:40	Staining of talus
37°38.2404 / 110°52.0685	2201	21:05:00	Sponge, actinies, two yellow spots
37°38.2422 / 110°52.0677	2201	21:05:30	Yellow staining of talus
37°38.2425 / 110°52.0679	2203	21:06:44	Sediment between talus
37°38.2454 / 110°52.0676	2206	21:08:24	Vent crab
37°38.2474 / 110°52.0679	2206	21:08:41	Swimming polychaet
37°38.2480 / 110°52.0673	2206	21:08:53	Yellow staining of talus
37°38.2508 / 110°52.0677	2204	21:09:04	3 fishes
37°38.2590 / 110°52.0626	2206	21:10:14	Medium to large sized talus
37°38.2651 / 110°52.0586	2206	21:10:57	Rat tail
37°38.2824 / 110°52.0923	2189	21:15:18	Two crinoids on the steep wall
37°38.2782 / 110°52.0937	2187	21:15:38	Silica stained talus close to the top of the wall
37°38.2722 / 110°52.0906	2197	21:17:22	Fine grained talus, silica stained
37°38.2659 / 110°52.0867	2206	21:18:58	Stained talus
37°38.2443 / 110°52.0783	2208	21:22:19	Coarser talus, no staining
37°38.2421 / 110°52.0819	2207	21:23:05	Broken pillows
37°38.2423 / 110°52.0829	2207	21:23:16	Gorgonarias
37°38.2437 / 110°52.0840	2207	21:24:30	Medium sized talus, no staining
37°38.2452 / 110°52.0791	2206	21:26:04	Rat tail
37°38.2309 / 110°52.0870	2201	21:29:48	Pillows
37°38.2232 / 110°52.0799	2202	21:31:06	Crinoid
37°38.2102 / 110°52.0771	2203	21:32:39	Sponge, big pillow and talus
37°38.2072 / 110°52.0763	2203	21:32:55	Holothurie
37°38.2014 / 110°52.0750	2203	21:33:26	Medium sized talus, nothing interesting
37°38.1958 / 110°52.0740	2203	21:34:00	Gorgonaria, crinoid on talus
37°38.1751 / 110°52.0677	2204	21:35:59	Crinoid, talus and some pillows
37°38.1706 / 110°52.0659	2202	21:36:39	Sediment, yellow and white staining
37°38.1653 / 110°52.0681	2203	21:37:46	Larger blocks and pillows between talus, sponge
37°38.1585 / 110°52.0669	2203	21:39:25	Talus
37°38.1545 / 110°52.0588	2204	21:39:56	Vent crab
37°38.1541 / 110°52.0568	2205	21:40:11	Coarse talus
37°38.1506 / 110°52.0525	2205	21:40:41	Free swimming crinoids
37°38.1497 / 110°52.0563	2204	21:41:09	Old large pillows
37°38.1439 / 110°52.0569	2205	21:41:34	Gorgonaria on broken flows
37°38.1408 / 110°52.0590	2205	21:42:00	Mainly talus, some pillows
37°38.1365 / 110°52.0629	2205	21:42:38	Broken pillows
37°38.1350 / 110°52.0622	2204	21:42:47	Crinoid
37°38.1342 / 110°52.0622	2203	21:42:54	Actinie
37°38.1344 / 110°52.0639	2204	21:43:04	Slightly sedimented large pillows
37°38.1310 / 110°52.0638	2204	21:43:17	Talus, some pillows, fish
37°38.1074 / 110°52.0554	2204	21:45:54	Large pillows, slightly sedimented
37°38.0936 / 110°52.0460	2206	21:47:55	Medium to large sized talus
37°38.0910 / 110°52.0492	2206	21:48:38	Altered talus
37°38.0892 / 110°52.0501	2206	21:48:51	Munidopsis on talus
37°38.0868 / 110°52.0521	2205	21:49:10	Yellow stained talus
37°38.0861 / 110°52.0526	2206	21:49:38	Large lava blocks partly yellow stained
37°38.0805 / 110°52.0486	2198	21:56:37	Large pillows, munidopsis
37°38.0809 / 110°52.0499	2198	21:57:28	Large pillows
37°38.0851 / 110°52.0507	2198	21:58:32	Large old pillows
37°38.0947 / 110°52.0462	2196	22:00:17	Large talus blocks
37°38.1024 / 110°52.0400	2198	22:01:20	Broken pillows, gorgonaria
37°38.1153 / 110°52.0322	2200	22:03:01	Pillows and tubes slightly sedimented
37°38.1216 / 110°52.0381	2200	22:03:41	Gorgonaria on large pillow

Station 14-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.1250 / 110°52.0429	2201	22:04:06	Talus
37°38.1288 / 110°52.0463	2203	22:04:36	Silica staining of talus
37°38.1327 / 110°52.0478	2204	22:05:11	Large pillow and talus, vent crab
37°38.1379 / 110°52.0451	2205	22:06:01	Pillows and talus
37°38.1439 / 110°52.0419	2208	22:06:47	Talus of old pillows
37°38.1458 / 110°52.0405	2208	22:07:04	Talus
37°38.1522 / 110°52.0421	2209	22:07:53	Fine grained talus
37°38.1563 / 110°52.0581	2211	22:09:05	Large pillows covered by sediment, holothurie
37°38.1564 / 110°52.0664	2210	22:10:05	Large pillows and smaller talus litter the seafloor
37°38.1557 / 110°52.0649	2210	22:10:46	Talus of variable sizes
37°38.1569 / 110°52.0618	2209	22:11:13	Sediments on talus and in pockets
37°38.1597 / 110°52.0556	2208	22:11:57	Broken pillows
37°38.1610 / 110°52.0552	2207	22:12:14	Sponges
37°38.1665 / 110°52.0581	2206	22:13:20	Still medium to large sized talus
37°38.1821 / 110°52.0690	2199	22:16:29	Still talus of medium to large size, shrimp
37°38.1877 / 110°52.0870	2201	22:18:05	Crinoids, free swimming
37°38.1881 / 110°52.0861	2199	22:18:19	Vent crab
37°38.1942 / 110°52.0762	2198	22:19:34	Crinoids on old pillow
37°38.2007 / 110°52.0806	2201	22:20:16	Free swimming crinoid
37°38.2060 / 110°52.0887	2202	22:21:05	Altered fine sized talus
37°38.2089 / 110°52.0912	2202	22:21:37	Pillow fragments
37°38.2128 / 110°52.0928	2203	22:22:30	Talus of variable sizes
37°38.2147 / 110°52.0934	2203	22:22:45	Crinoid
37°38.2169 / 110°52.0929	2201	22:23:17	Free swim crinoid
37°38.2220 / 110°52.0903	2199	22:24:30	Broken pillows
37°38.2237 / 110°52.0893	2200	22:24:55	Crinoid on pillow
37°38.2244 / 110°52.0867	2200	22:25:18	Gorgonaria
37°38.2280 / 110°52.0847	2201	22:25:52	Rat tail, crinoid
37°38.2330 / 110°52.0795	2204	22:27:07	Old pillows
37°38.2375 / 110°52.0761	2205	22:27:38	Gorgonaria, swimming crinoids, talus
37°38.2421 / 110°52.0756	2206	22:28:05	Talus silica stained
37°38.2516 / 110°52.0918	2204	22:30:36	Silica stained talus
37°38.2522 / 110°52.0925	2205	22:30:52	Small talus ridge, talus silica stained
37°38.2554 / 110°52.0909	2202	22:31:12	Fe oxide structure, vent lobster
37°38.2579 / 110°52.0869	2202	22:32:01	Stained talus on a small ridge
37°38.2604 / 110°52.0857	2199	22:32:38	Vent crabs on the ridge
37°38.2646 / 110°52.0871	2204	22:33:33	Fine grained talus, partly silica stained
37°38.2657 / 110°52.0890	2206	22:34:03	Talus gets a bit larger
37°38.2695 / 110°52.0921	2211	22:34:56	Large talus blocks
37°38.2662 / 110°52.0991	2206	22:35:53	Talus ridge
37°38.2639 / 110°52.0995	2206	22:36:04	Crinoids
37°38.2605 / 110°52.1016	2205	22:37:10	Vent crab, pillows, swimming crinoids
37°38.2571 / 110°52.0958	2208	22:38:10	Free swimming crinoids, talus, variable sizes
37°38.2602 / 110°52.0906	2205	22:38:52	Fine grained talus, silica stained
37°38.2629 / 110°52.0952	2210	22:40:41	Talus of variable sizes covered by a thin sediment cover
37°38.2685 / 110°52.1016	2209	22:42:56	Vent crab on talus, swimming crinoids
37°38.2699 / 110°52.1011	2208	22:43:23	More vent crabs on talus
37°38.2679 / 110°52.0995	2206	22:43:59	White dots on talus
37°38.2679 / 110°52.0983	2205	22:44:14	Crabs
37°38.2677 / 110°52.0974	2204	22:44:26	Talus material of variable sizes
37°38.2661 / 110°52.1005	2205	22:45:11	Attempt to grab, no material recovered, batteries low
37°38.2632 / 110°52.1139	2203	22:47:56	Free swimming crinoids
37°38.2594 / 110°52.1035	2204	22:51:56	Stained talus
37°38.2543 / 110°52.0959	2202	22:54:13	Free swimming crinoid, talus
37°38.2528 / 110°52.0997	2201	22:54:33	Gorgonaria
37°38.2504 / 110°52.1027	2202	22:54:49	Sponge
37°38.2229 / 110°52.1024	2202	22:57:27	Pillows, partly broken
37°38.1812 / 110°52.1096	2206	23:00:22	Fine grained talus

Station 14-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.1791 / 110°52.1085	2205	23:00:41	Altered talus
37°38.1657 / 110°52.0881	2201	23:02:18	Large talus
37°38.1638 / 110°52.0804	2202	23:02:46	Lobster, actinie, crinoid, fish
37°38.1587 / 110°52.0703	2199	23:03:22	Fish, crinoid on talus material
37°38.1583 / 110°52.0625	2199	23:03:44	Crinoids, free swimming
37°38.1532 / 110°52.0431	2199	23:04:40	Gorgonaria
37°38.1516 / 110°52.0413	2200	23:04:48	Altered talus beneath east wall
37°38.1511 / 110°52.0347	2194	23:05:16	Large pillows or pillars
37°38.1479 / 110°52.0286	2196	23:05:50	Talus material
37°38.1451 / 110°52.0262	2199	23:06:20	Silica stained talus
37°38.1425 / 110°52.0232	2195	23:06:49	Steep wall with silica stained talus
37°38.1369 / 110°52.0114	2205	23:07:45	Pillows
37°38.1316 / 110°52.0007	2203	23:08:50	Talus of variable sizes
37°38.1317 / 110°52.0010	2201	23:09:18	Cliff with silica stained talus
37°38.1395 / 110°52.0099	2202	23:10:47	Steep wall with talus
37°38.1413 / 110°52.0097	2199	23:11:11	Large pillow
37°38.1411 / 110°52.0094	2197	23:11:18	Bottom contact lost and end of station

Station 19-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.1601 / 110°52.0139	47	14:18:08	Station is located at the northern axial high of the Pacific-Antarctic Ridge (37°40’S)
37°38.2163 / 110°52.0609	2051	14:57:28	Video cameras turned on
37°38.2271 / 110°52.0617	2199	15:02:13	Bottom contact
37°38.2273 / 110°52.0614	2201	15:02:25	Pillow talus
37°38.2263 / 110°52.0597	2205	15:03:47	Scattered tube lava
37°38.2276 / 110°52.0643	2208	15:06:27	Silica stained talus
37°38.2267 / 110°52.0652	2209	15:06:47	Yellowish sediment scattered throughout the matrix
37°38.2223 / 110°52.0654	2207	15:08:15	Orange to yellowish staining on the talus material
37°38.2134 / 110°52.0608	2210	15:10:25	Relatively well sorted talus material, thin sediment cover
37°38.2107 / 110°52.0644	2210	15:11:39	Talus contains some large blocks
37°38.2100 / 110°52.0676	2207	15:12:12	Large gorgonaria
37°38.2120 / 110°52.0734	2205	15:12:51	Silica staining increasing
37°38.2099 / 110°52.0776	2205	15:13:39	Actinie
37°38.2095 / 110°52.0789	2204	15:13:54	Large talus material with sediment
37°38.2096 / 110°52.0809	2206	15:15:10	Some large blocky material contained in the talus
37°38.2064 / 110°52.0778	2210	15:16:21	Possible Fe oxide material
37°38.2058 / 110°52.0760	2208	15:17:02	Floating crinoids
37°38.2078 / 110°52.0723	2209	15:17:44	Increasing amount of sediment on the talus
37°38.2099 / 110°52.0683	2208	15:18:29	Vent crab
37°38.2088 / 110°52.0657	2208	15:19:07	Large talus block
37°38.2181 / 110°52.0564	2207	15:21:02	Talus material, some scattered large blocks
37°38.2226 / 110°52.0562	2207	15:22:05	Gorgonaria
37°38.2225 / 110°52.0601	2206	15:22:32	Vent crab
37°38.2280 / 110°52.0760	2206	15:24:50	Some large rounded blocks contained in the talus material, sponge
37°38.2273 / 110°52.0740	2207	15:25:56	Red lobster, large talus material, tubes
37°38.2256 / 110°52.0613	2207	15:27:32	Large pillows contained in the talus
37°38.2262 / 110°52.0574	2209	15:27:59	Munidopsis
37°38.2259 / 110°52.0555	2206	15:28:26	Polychaet
37°38.2314 / 110°52.0564	2209	15:29:54	Talus material, some silica staining
37°38.2381 / 110°52.0565	2209	15:31:38	Actinie
37°38.2392 / 110°52.0567	2208	15:32:16	Well sorted talus material
37°38.2369 / 110°52.0637	2200	15:33:43	Several tubes at the slope
37°38.2366 / 110°52.0659	2201	15:34:02	Crinoids at the talus material
37°38.2300 / 110°52.0756	2207	15:36:00	Vent crab in the talus material

Station 19-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°38.2286 / 110°52.0775	2207	15:36:41	Swimming crinoids
37°38.2295 / 110°52.0779	2207	15:36:52	Medium grained talus material, little sediment, sponge
37°38.2293 / 110°52.0777	2208	15:37:11	Silica staining on the talus
37°38.2278 / 110°52.0769	2210	15:37:37	Pillow fragments in the talus
37°38.2277 / 110°52.0714	2208	15:38:33	Vent crab
37°38.2237 / 110°52.0705	2207	15:39:49	Medium sized talus, vent crab
37°38.2198 / 110°52.0748	2207	15:40:41	Gorgonaria on talus material
37°38.2170 / 110°52.0758	2207	15:40:58	Crinoid
37°38.2134 / 110°52.0767	2208	15:41:28	Vent crab, gorgonaria
37°38.2110 / 110°52.0791	2208	15:42:04	Large tube fragments
37°38.2041 / 110°52.0819	2210	15:43:26	Several large boulders
37°38.1920 / 110°52.0606	2209	15:46:04	Sedimented talus material
37°38.2021 / 110°52.0573	2206	15:48:45	Well sorted talus material
37°38.2256 / 110°52.0694	2208	15:51:38	Swimming crinoids
37°38.2320 / 110°52.0660	2209	15:53:04	Talus containing quite angular material
37°38.2318 / 110°52.0580	2211	15:54:03	Fe oxide material
37°38.2305 / 110°52.0495	2207	15:55:29	Medium sized talus material
37°38.2282 / 110°52.0458	2207	15:56:41	Silica staining on the talus material
37°38.2247 / 110°52.0616	2206	16:06:34	Talus material contains some larger blocks
37°38.2169 / 110°52.0669	2210	16:10:42	Well sorted talus material, rat tail
37°38.2120 / 110°52.0642	2213	16:12:23	Sample location reached
37°38.2100 / 110°52.0635	2222	16:12:41	Attempt to sample, GTV did not close
37°38.2197 / 110°52.0660	2206	16:15:08	Vent crab, silica staining
37°38.2338 / 110°52.0693	2223	16:17:54	Attempt to sample, GTV has fallen over, bottom contact lost
37°38.2327 / 110°52.0798	2166	16:33:25	Changing position to 37°38.3 and 110° 52.09
37°38.2356 / 110°52.0834	2205	16:34:36	Bottom contact
37°38.2410 / 110°52.0768	2208	16:37:53	Large pillows on steep wall
37°38.2601 / 110°52.0756	2213	16:40:29	Video tapes changed
37°38.2615 / 110°52.0758	2212	16:40:48	Silica staining on talus material
37°38.2656 / 110°52.0739	2211	16:41:29	Large pillows
37°38.2864 / 110°52.0753	2213	16:44:53	Vent crab
37°38.2860 / 110°52.0752	2213	16:44:59	Evenly sized talus, quite angular material
37°38.2883 / 110°52.0750	2214	16:45:19	Some scattered pillow fragments
37°38.2922 / 110°52.0770	2215	16:45:54	Two vent crabs, silica staining on the talus material
37°38.2945 / 110°52.0916	2210	16:48:43	Large pillows
37°38.2948 / 110°52.0913	2212	16:48:52	Tubes on the steep slope
37°38.2920 / 110°52.0867	2212	16:50:13	Crinoids
37°38.2921 / 110°52.0863	2212	16:50:21	Large tube and pillow fragments
37°38.2861 / 110°52.0899	2210	16:52:04	Sponges, large talus material
37°38.2916 / 110°52.0956	2208	16:54:48	Talus material containing large pillows and several tube lava fragments, fracture zone
37°38.3011 / 110°52.0915	2214	16:57:03	Large pillow fragments contained in the talus
37°38.3021 / 110°52.0885	2214	16:57:29	Pillow fragments are slightly sedimented and do not contain glass, crinoids
37°38.3031 / 110°52.0903	2213	16:59:26	Swimming crinoids, pillow talus
37°38.3007 / 110°52.0937	2215	17:00:26	Vent crabs
37°38.2866 / 110°52.0856	2213	17:04:38	Large pillow fragments
37°38.2815 / 110°52.0804	2211	17:06:20	Pillow fragments in talus, only slightly sedimented
37°38.2814 / 110°52.0849	2209	17:06:51	Swimming crinoids
37°38.2925 / 110°52.0871	2209	17:09:09	Large tube lava
37°38.3183 / 110°52.0910	2212	17:12:21	Large pillow and tube lava
37°38.3306 / 110°52.1054	2216	17:14:47	Large pillows only slightly sediment covered
37°38.3347 / 110°52.1000	2209	17:15:49	Vent crab, sponges, large broken talus material
37°38.3483 / 110°52.1052	2207	17:17:39	Shrimp
37°38.3562 / 110°52.1113	2207	17:19:03	Vent crab, large talus material
37°38.3636 / 110°52.0942	2209	17:21:42	Large pillow fragments
37°38.3648 / 110°52.0952	2208	17:22:02	Small talus material with scattered larger material, some

Station 19-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
			silica staining
37°38.3700 / 110°52.0976	2208	17:23:01	Bottom contact lost and end of station
37°38.3738 / 110°52.1032	2203	17:23:37	Video cameras turned off

Station 20-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°39.1618 / 110°52.3897	867	19:20:47	Station is located at the northern axial high of the Pacific-Antarctic Ridge (37°40'S), laser points have a distance of 21 cm, all three spots are on a straight line at a distance of 3 m to the seafloor
37°39.2404 / 110°52.4081	2189	19:50:23	Bottom contact
37°39.2419 / 110°52.4053	2194	19:50:55	Large blocks scattered through the talus material, sediment between individual blocks
37°39.2430 / 110°52.3977	2192	19:51:53	Blocks in the talus material are typically quite angular (30-60 cm in size), some of the blocks have brownish staining, shrimp
37°39.2526 / 110°52.4039	2196	19:53:48	Very little sediment on the blocky and angular talus material, some silica staining and Fe oxides, the talus material is well sorted (30-60 cm in size)
37°39.2608 / 110°52.4040	2193	19:55:04	Large block in the talus material, several meters in size
37°39.2648 / 110°52.4013	2194	19:55:41	Rat tail in the talus field
37°39.2696 / 110°52.3977	2190	19:56:22	Rat tail in the talus field
37°39.2768 / 110°52.3978	2194	19:57:14	Well sorted, relatively small talus material, blocky and angular, no pillow fragments, no glassy material
37°39.2857 / 110°52.4013	2197	19:58:26	Fresh lava in the valley, fresh lava flow on top of the talus, glassy pillows, no sediments
37°39.2931 / 110°52.3948	2200	19:59:42	Older generation of pillows without glassy rims covered by the younger generation lava, no sediments
37°39.3080 / 110°52.3981	2200	20:01:07	Fish on the younger generation pillow lava
37°39.3105 / 110°52.3965	2200	20:01:34	The older generation pillows are much larger than the young glassy material
37°39.3152 / 110°52.3960	2197	20:02:15	Transition to sheet flow, lobate lava
37°39.3241 / 110°52.3997	2196	20:03:34	The young lava generation is relatively thin
37°39.3270 / 110°52.3985	2199	20:04:23	Sea star on the younger lava generation
37°39.3367 / 110°52.4014	2199	20:05:54	Old generation pillows surrounded by young glassy material, the younger generation pillow contain water escape features
37°39.3585 / 110°52.4036	2197	20:09:16	Water escape features are surrounded by Fe oxide material
37°39.3611 / 110°52.4035	2197	20:09:41	Lobate lava
37°39.3722 / 110°52.3991	2195	20:11:50	Young generation of lobate lava, glassy, no sediments
37°39.3864 / 110°52.4065	2200	20:14:01	Rat tail, two generations of lava, old lava is not glassy
37°39.3927 / 110°52.4027	2201	20:15:26	Hyaloclastite on top of a large pillow, the glass was not able to fall from the flat top of the pillow
37°39.3951 / 110°52.3993	2203	20:16:20	Older pillow content increasing
37°39.3969 / 110°52.3968	2204	20:17:01	Talus covered by the younger generation lava, the young lava is very thin, large old pillows beneath the young generation, the thickness of the younger generation does not exceed ca. 50 cm
37°39.4015 / 110°52.3933	2201	20:18:08	Patches of young generation lava
37°39.4046 / 110°52.3923	2205	20:18:47	Young generation lava on top of the old large pillows that are much larger
37°39.4083 / 110°52.3910	2202	20:19:18	Old generation lava are not covered by sediment, vent crab, fractures in the pillows
37°39.4227 / 110°52.3997	2201	20:21:14	Sea star on the two lava generations
37°39.4250 / 110°52.4024	2205	20:21:38	Most of the old generation lava and pillows are broken,

Station 20-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
			small cliff
37°39.4276 / 110°52.4028	2202	20:22:13	Gorgonaria on the two lava generations
37°39.4340 / 110°52.3995	2203	20:23:18	Two rat tails, younger lava generation
37°39.4379 / 110°52.3958	2202	20:24:05	Only younger lava generation
37°39.4429 / 110°52.3917	2205	20:25:03	Two lava generations, the old generation forms much larger pillows
37°39.4599 / 110°52.3893	2201	20:27:25	Two generation lava, the younger material is glassy
37°39.4628 / 110°52.3920	2202	20:27:51	Video cameras switched on
37°39.4683 / 110°52.3974	2201	20:28:26	Two lava generations
37°39.4759 / 110°52.4039	2198	20:29:41	Shrimp, younger lava generation
37°39.4796 / 110°52.4080	2197	20:31:08	Shrimp on younger lava generation, only scattered old generation pillows, fish
37°39.4830 / 110°52.4028	2194	20:32:32	Lava pillar of the old generation lava within the field of younger lava
37°39.4876 / 110°52.3972	2193	20:33:35	Free swimming crinoid, lots of water escape structure
37°39.4900 / 110°52.3975	2194	20:34:06	Rat tail, abundant water escape structures, younger generation lava, small temperature anomaly
37°39.4940 / 110°52.3989	2190	20:34:38	Temperature increases
37°39.4968 / 110°52.4040	2194	20:35:16	Younger generation lava, water escape structures
37°39.5024 / 110°52.4097	2190	20:36:28	Temperature is elevated, younger generation lava
37°39.5039 / 110°52.4095	2191	20:37:08	Temperature increase
37°39.5055 / 110°52.4070	2194	20:37:43	Free swimming crinoid, younger lava generation
37°39.5078 / 110°52.4038	2194	20:38:43	Crinoid
37°39.5126 / 110°52.3995	2195	20:40:02	Temperature back to background level, only younger generation lava, lobate and small pillows
37°39.5272 / 110°52.4021	2194	20:41:54	Abundant free swimming crinoids, scattered old lava pillows surrounded by the young generation lava
37°39.5362 / 110°52.4012	2195	20:43:00	Lobate lava flows, glassy material, no sediment cover, water escape structures
37°39.5565 / 110°52.3972	2194	20:45:41	Younger generation lava, glassy, no sedimentary cover, some water escape structures
37°39.5653 / 110°52.4059	2193	20:47:04	Large old pillow, surface cracks
37°39.5785 / 110°52.4035	2194	20:49:02	Collapsed pillows, only the outer rims are preserved, munidopsis
37°39.5852 / 110°52.3977	2193	20:50:14	Abundant old generation pillows
37°39.5982 / 110°52.4048	2194	20:51:44	Lobate flows of the young generation lava, glassy rims, some water escape structure
37°39.6094 / 110°52.4079	2193	20:52:58	Large old generation lava
37°39.6100 / 110°52.4076	2195	20:53:07	Shrimp on young generation lava, glassy rims
No data	2194	20:54:05	Old generation pillows sticking through the young generation lava
37°39.6317 / 110°52.3974	2194	20:55:59	Contact to talus material that underlies the young lava, shrimp
37°39.6361 / 110°52.3978	2192	20:56:37	Steep slope
37°39.6383 / 110°52.3980	2190	20:56:54	Steep slope with blocky fragments, only rarely pillow fragments, white staining
37°39.6577 / 110°52.4028	2179	20:59:09	Large talus material, large pillow fragments
37°39.6655 / 110°52.4022	2183	21:00:15	Massive sulfides, large blocks of extinct material
37°39.6739 / 110°52.4011	2188	21:01:12	Sediment in the pockets between the talus material
37°39.6802 / 110°52.4029	2190	21:02:04	Increasing amount of sediment
37°39.6869 / 110°52.4103	2186	21:02:57	Abundant sediment within the talus, talus material is blocky and angular
37°39.6934 / 110°52.4177	2183	21:04:21	Sedimented talus, the color of the sediment ranges from greenish to brownish
37°39.6970 / 110°52.4140	2178	21:04:57	Well sorted talus material, red staining on the sediment, vent crabs
37°39.7004 / 110°52.4097	2175	21:05:43	More vent crabs, silica staining on the talus
37°39.7045 / 110°52.4025	2172	21:06:20	Steep cliff, staining on the talus material

Station 20-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°39.7086 / 110°52.3938	2171	21:07:31	Abundant crabs facing to the east
37°39.7135 / 110°52.3884	2179	21:08:22	Medium sized and quite well sorted talus, thin sediment cover, sponge
37°39.7185 / 110°52.3904	2185	21:09:22	Old talus with irregular surfaces, sponge
37°39.7283 / 110°52.4014	2185	21:11:10	Sponge, medium sized talus, quite rounded material
37°39.7379 / 110°52.4070	2194	21:12:44	Fine to medium sized talus material, only slightly covered by sediments, crinoids
37°39.7436 / 110°52.4091	2198	21:13:40	Slightly sedimented talus
37°39.7471 / 110°52.4065	2198	21:14:00	Talus material is quite angular, up to 50 cm, munidopsis, almost no sedimentary cover
37°39.7560 / 110°52.4046	2201	21:15:12	Relatively well sorted talus material, blocky and angular, no sediment cover
37°39.7631 / 110°52.3981	2201	21:16:06	Gorgonaria, talus material, sponge
37°39.7710 / 110°52.3927	2201	21:17:05	Large blocks of pillow lava close to a scarp
37°39.7767 / 110°52.3874	2201	21:18:01	Large pile of old pillow fragments, sponges
37°39.7872 / 110°52.3841	2201	21:18:59	Large tubes of lava, several meters in size, only slightly sedimented
37°39.7981 / 110°52.3829	2199	21:19:52	Large old pillows, vent crab, sea star
37°39.8083 / 110°52.3851	2201	21:20:41	Large pillows, shrimp, only slightly sedimented
37°39.8215 / 110°52.3991	2201	21:21:57	Talus on top of up to 2 m large old pillow lava
37°39.8266 / 110°52.4035	2200	21:22:34	Munidopsis on old large pillow material, largely talus material of the large pillows
37°39.8432 / 110°52.4005	2191	21:25:02	Vent crab, little slope
37°39.8531 / 110°52.4000	2191	21:26:28	Large in situ pillow basalt, some of the pillows have sizes of up to 2 m
37°39.8674 / 110°52.4015	2191	21:28:07	Hyaloclastite on the large 2 m pillows
37°39.8882 / 110°52.4044	2185	21:30:15	Some large cracks in the pillow mound
37°39.9010 / 110°52.4063	2185	21:31:33	Large pillows with hyaloclastite on the surfaces
37°39.9077 / 110°52.4054	2183	21:32:22	Rat tail and large old pillow blocks, this forms part of the large pillow mound
37°39.9158 / 110°52.4013	2181	21:33:32	Shrimp
37°39.9287 / 110°52.3889	2182	21:35:25	Large talus blocks of pillow material
37°39.9359 / 110°52.3843	2184	21:36:08	Large talus blocks
37°39.9439 / 110°52.3843	2184	21:36:48	Some large pillows
37°39.9640 / 110°52.3963	2186	21:38:58	Talus material, quite angular and angular, munidopsis
37°39.9762 / 110°52.4017	2188	21:40:32	Talus, pillow fragments (0.5-1 m in size)
37°39.9777 / 110°52.4035	2191	21:41:00	Thin sediment cover on the pillow fragments
37°39.9827 / 110°52.4131	2189	21:42:18	Blocky and angular talus material, quite well sorted
37°39.9853 / 110°52.4182	2187	21:42:43	Actinie
37°39.9850 / 110°52.4208	2189	21:42:53	Talus material quite well sorted, scattered larger blocks
37°39.9905 / 110°52.4411	2183	21:44:08	Well sorted talus material, angular blocks
37°39.9967 / 110°52.4697	2186	21:45:45	Well sorted talus material
37°39.9987 / 110°52.4758	2186	21:46:17	Vent crab
37°40.0017 / 110°52.4782	2184	21:47:34	Well sorted talus material, medium sized (30 -50 cm)
37°40.0088 / 110°52.4636	2190	21:49:16	Medium sized talus, some larger pillow fragments
37°40.0160 / 110°52.4489	2191	21:50:44	Thin sediment cover on the talus material, munidopsis
37°40.0244 / 110°52.4513	2192	21:51:53	Angular fragments, two large pillows
37°40.0377 / 110°52.5005	2190	21:54:42	Large pillow fragments on the talus
37°40.0408 / 110°52.5356	2191	21:56:26	Increasing sediment at the bottom of the talus
37°40.0424 / 110°52.5387	2193	21:56:48	Back into talus
37°40.0429 / 110°52.5405	2194	21:57:02	Young generation lava flowing over the debris
37°40.0491 / 110°52.5493	2194	21:58:00	Fresh glassy material, no sediment cover, water escape structures, lobate flows
37°40.0574 / 110°52.5595	2194	21:59:24	Shrimp, lobate lava
37°40.0637 / 110°52.5612	2195	22:00:17	Shrimp, glassy young generation lava, the lava is not covered by sediments, water escape structures
37°40.0710 / 110°52.5592	2193	22:01:10	Only one generation lava, no large old pillows
37°40.0811 / 110°52.5609	2195	22:02:26	Sheet flow, glassy surface, water escape structures

Station 20-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°40.0907 / 110°52.5637	2194	22:03:25	Transition sheet flow towards lobate and tubes
37°40.1055 / 110°52.5708	2197	22:05:03	Transition sheet flow to lobate lava
37°40.1090 / 110°52.5727	2197	22:05:29	Small glassy pillows, first sight of the older generation lava since the contact to the talus at the eastern wall
37°40.1203 / 110°52.5686	2198	22:07:15	Pillow to lobate young generation lava, glassy, almost no sediment cover, abundant water escape features, increasing abundance of the older generation
37°40.1288 / 110°52.5536	2199	22:08:38	Collapsed old generation pillows
37°40.1427 / 110°52.5421	2207	22:10:17	Two lava generations, the older generation forms some loops ending in individual pillows
37°40.1640 / 110°52.5384	2209	22:12:11	Old pillows have multiple crusts, young lava generation is glassy, no sediment cover
37°40.1940 / 110°52.5298	2220	22:14:55	Two lava generations, the young generation is glassy, some water escape feature
37°40.2186 / 110°52.5403	2223	22:17:08	Munidopsis, two lava generations
37°40.2351 / 110°52.5457	2225	22:18:38	Increasing abundance of the young generation glassy pillows, contact to the talus, no evidence here for the old generation lava
37°40.2501 / 110°52.5388	2223	22:20:08	Relatively well sorted talus material, some scattered larger blocks of the 2 m sized pillows derived from the pillow mound on the eastern wall
37°40.2611 / 110°52.5337	2221	22:21:08	Little sediment cover on the talus material, sponge
37°40.2672 / 110°52.5346	2224	22:21:33	Talus material is commonly angular and blocky, scattered larger pillow fragments
37°40.2798 / 110°52.5436	2225	22:22:20	Contact of the talus to the two generations of the lava, both lava types can be seen
37°40.2948 / 110°52.5650	2222	22:23:40	Well sorted talus material (ca. 30 cm in size), blocky and angular
37°40.2987 / 110°52.5739	2220	22:24:20	Large pillow blocks, sponges
37°40.2995 / 110°52.5810	2221	22:25:13	Abundant large pillow talus, scattered sponges
37°40.3008 / 110°52.5835	2222	22:25:39	Very little sediment cover on the talus
37°40.3054 / 110°52.5963	2221	22:26:42	Well sorted, relatively large debris (30-60 cm in size), rare larger pillow fragments
37°40.3069 / 110°52.6037	2223	22:27:10	Contact of the older generation to the talus
37°40.3172 / 110°52.6585	2229	22:30:43	Some large old lava pillows and tube like features
37°40.3253 / 110°52.6723	2232	22:32:44	Canyon, 2 m wide, N-S striking
37°40.3294 / 110°52.6697	2231	22:33:28	Thin fissure
37°40.3380 / 110°52.6677	2229	22:34:54	50 cm wide fissure, quite deep, older generation of lava, no glassy material
37°40.3724 / 110°52.6666	2230	22:38:45	Temperature anomaly
37°40.3982 / 110°52.6678	2228	22:40:59	Fissure in the old pillow lavas
37°40.4068 / 110°52.6710	2230	22:42:01	Large temperature anomaly next to the fissure
37°40.4234 / 110°52.6689	2230	22:43:56	Swimming crinoids
37°40.4370 / 110°52.6739	2226	22:45:10	The large pillows are glassy, another fissure
37°40.4476 / 110°52.6923	2224	22:46:34	Large fissure, several meters wide, some crinoids
37°40.4492 / 110°52.7068	2225	22:47:32	Fissure
37°40.4471 / 110°52.7222	2225	22:48:29	This older generation pillow lava is slightly glassy
37°40.4447 / 110°52.7410	2224	22:50:04	Large fissure, lots of animals
37°40.4440 / 110°52.7538	2228	22:51:41	Swimming crinoids, white spots on the older lava generation
37°40.4424 / 110°52.7556	2229	22:52:17	Vent crabs, temperature increase
37°40.4453 / 110°52.7632	2228	22:53:20	Lobster, temperature is elevated
37°40.4471 / 110°52.7759	2227	22:54:16	Temperature anomaly
37°40.4516 / 110°52.7942	2227	22:55:17	Several large collapse features in the sheet flow
37°40.4570 / 110°52.8238	2227	22:56:36	Transition from the older generation sheet flow to older generation lobate lava, some sediments between individual lobes
37°40.4630 / 110°52.8674	2227	22:58:45	Contact of the older lava to the second generation glassy

Station 20-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
			lava
37°40.4628 / 110°52.8769	2228	22:59:32	Large pillows and some tubes of the older generation lava, surrounded by small pillows of the very glassy material, no sediments, water escape features
37°40.4599 / 110°52.8944	2216	23:01:27	Two lava generations, glassy younger material dominates, thin sediment cover
37°40.4628 / 110°52.9114	2213	23:03:00	Mainly younger generation lava
37°40.4674 / 110°52.9214	2214	23:04:12	Mainly younger generation lava, lava is very fresh and glassy, no sediments
37°40.4746 / 110°52.9244	2212	23:05:12	Contact of the lava to the underlying talus material, silica staining on talus
37°40.4822 / 110°52.9330	2203	23:06:05	Some large talus material (30 to 60 cm in size)
37°40.4871 / 110°52.9379	2194	23:06:59	Well sorted talus material, angular and blocky material, scattered pillow fragments, silica staining on talus material
37°40.4927 / 110°52.9263	2179	23:08:27	Well sorted talus material (<30 cm in size), steep wall (30 m)
37°40.5026 / 110°52.9111	2140	23:11:12	Large old pillows at the top of the 60 m high hill, the western wall of the valley is formed by this pillow mound
37°40.5062 / 110°52.8999	2145	23:12:09	The old pillows are in the range of two meters, similar to the eastern pillow mound
37°40.5090 / 110°52.8855	2155	23:13:02	The large pillows are slightly sedimented
37°40.5155 / 110°52.8594	2157	23:14:43	Large pillows, ca. 2 m in size, slightly sedimented, some sponges
37°40.5596 / 110°52.8181	2150	23:20:12	Approaching the cliff
37°40.5666 / 110°52.8036	2163	23:21:25	Talus on the first terrace, irregular to angular, blocky talus
37°40.5826 / 110°52.7709	2195	23:23:56	35 m cliff, lots of sediment close to the wall, the talus is silica and Fe stained, the talus is quite well sorted
37°40.5887 / 110°52.7526	2211	23:25:11	Fish, the talus is partly covered by sediment
37°40.5944 / 110°52.7414	2215	23:26:04	Well sorted talus containing angular to blocky material, thin sediment cover
37°40.5987 / 110°52.7385	2213	23:26:33	Contact of the talus material to the younger glassy lava
37°40.6059 / 110°52.7291	2216	23:27:36	Dominantly younger glassy material with some scattered larger pillows and tubes of the first generation
37°40.6153 / 110°52.7149	2213	23:28:43	Older generation lavas surrounded by younger generation pillow lava
37°40.6289 / 110°52.6924	2215	23:30:37	Two lava generations, younger generation is lobate lava and glassy, local water escape features
37°40.6567 / 110°52.6623	2217	23:33:27	Younger generation lava is fresh and glassy, scattered older generation tubes and pillows.
37°40.6675 / 110°52.6522	2221	23:34:34	Contact of the fresh lava to the older generation
37°40.6782 / 110°52.6494	2220	23:35:24	Older generation lava is lobate to sheet like
37°40.6826 / 110°52.6473	2221	23:35:47	Fissure, relatively small
37°40.6887 / 110°52.6417	2216	23:36:25	Fissure
37°40.6924 / 110°52.6372	2223	23:36:57	Sheet flow to lobate flow of the older generation lava, large fissure
37°40.7025 / 110°52.6188	2222	23:38:18	Fissure
37°40.7110 / 110°52.6045	2227	23:39:28	15 m wide canyon
37°40.7142 / 110°52.6002	2230	23:39:46	Pillows of the older generation lava
37°40.7258 / 110°52.5857	2230	23:41:14	Fissure in the lobate older generation material
37°40.7318 / 110°52.5830	2230	23:41:50	Black fresh lava on top of the older generation lava
37°40.7398 / 110°52.5744	2232	23:42:44	Two pillow generations
37°40.7469 / 110°52.5616	2233	23:43:42	Two lava generations, large older generation material surrounded by the glassy younger generation lava
37°40.7643 / 110°52.5527	2232	23:45:44	Increasing older generation lava
37°40.7706 / 110°52.5519	2232	23:46:18	Small pillows of the young generation surrounding

Station 20-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
			scattered larger old pillows
37°40.7808 / 110°52.5295	2238	23:48:33	Lobate flows of the glassy material, almost sheet like
37°40.7834 / 110°52.5223	2236	23:49:04	Sheet flow of the older generation lava
37°40.7859 / 110°52.5170	2236	23:49:33	Sheet flows
37°40.7897 / 110°52.5129	2233	23:50:02	Fissure in older generation sheet flow
37°40.7920 / 110°52.5104	2236	23:50:19	Older generation sheet flow
37°40.7953 / 110°52.5068	2232	23:50:47	Video tapes changed
37°40.7998 / 110°52.5017	2232	23:51:17	Older generation sheet flow, relatively fresh, shrimp
37°40.8111 / 110°52.4895	2227	23:52:25	Talus material
37°40.8130 / 110°52.4868	2226	23:52:39	Well sorted talus material containing some blocky material
37°40.8198 / 110°52.4762	2215	23:53:31	Well sorted talus material
37°40.8206 / 110°52.4757	2212	23:53:39	Bottom contact lost and end of station
37°40.8393 / 110°52.4581	2171	23:55:23	Video cameras turned off

Station 25-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°46.0398 / 110°54.4497	0	15:49:11	Station is located at the central axial high of the Pacific-Antarctic Ridge (37°47.5'S)
37°46.1800 / 110°54.4810	2096	16:34:28	Video cameras turned on
37°46.2023 / 110°54.5161	2210	16:37:24	Bottom contact
37°46.2049 / 110°54.5155	2212	16:37:39	Large pillows, younger pillows, sediment in pockets
37°46.2119 / 110°54.5128	2216	16:38:27	Sponge
37°46.2179 / 110°54.5106	2216	16:39:05	Large pillow partly broken
37°46.2196 / 110°54.5099	2217	16:39:17	Sedimented lobate flow
37°46.2230 / 110°54.5092	2215	16:39:44	Few large pillows
37°46.2263 / 110°54.5075	2218	16:40:07	Crack
37°46.2291 / 110°54.5069	2217	16:40:22	Fissure parallel to track
37°46.2320 / 110°54.5041	2220	16:40:54	Sponge
37°46.2355 / 110°54.5021	2220	16:41:17	Fissure, large pillows
37°46.2391 / 110°54.5030	2216	16:41:35	gorgonaria, actinie, slightly sedimented pillows
37°46.2438 / 110°54.5067	2221	16:41:57	fissure splits into two
37°46.2552 / 110°54.5227	2221	16:42:53	Large pillows along the fissure, sediment in-between them, swimming crinoid, gorgonaria
37°46.2598 / 110°54.5248	2223	16:43:23	Sedimented pillows and tubes, sponge
37°46.2679 / 110°54.5198	2223	16:44:06	Fissure, large pillows slightly sedimented
37°46.2713 / 110°54.5151	2225	16:44:33	Probably two generation of pillows or two different sizes
37°46.2856 / 110°54.5080	2223	16:45:44	Young pillows are not as fresh as those in the north, actinies
37°46.2931 / 110°54.5061	2223	16:46:35	Large old pillow on younger pillows, younger ones are more tube like
37°46.2972 / 110°54.5060	2224	16:46:56	Small young pillows
No data	2223	16:47:33	Large tubes of old pillows on younger pillows
37°46.3107 / 110°54.5223	2219	16:48:37	Sponge
37°46.3124 / 110°54.5234	2220	16:48:46	Large old pillows and younger glassy pillows
37°46.3186 / 110°54.5248	2219	16:49:26	Only a few old pillows, mostly young pillows
37°46.3226 / 110°54.5257	2216	16:49:47	Fish
37°46.3247 / 110°54.5244	2218	16:50:01	Lobate young flow
37°46.3280 / 110°54.5240	2218	16:50:17	Pillow and tube like young pillows
37°46.3401 / 110°54.5253	2218	16:51:12	Large old pillow structure surrounded by younger pillows
37°46.3421 / 110°54.5257	2216	16:51:30	Sponges
37°46.3472 / 110°54.5254	2218	16:51:57	Vent crab
37°46.3511 / 110°54.5246	2218	16:52:16	Only young generation pillows with glassy surface
37°46.3554 / 110°54.5238	2216	16:52:47	Gorgonarias on younger pillow
No data	2218	16:53:09	Young pillows and tubes, large sponge

Station 25-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°46.3675 / 110°54.5265	2218	16:54:04	Large pillows of young generation, very few old ones
37°46.3753 / 110°54.5367	2215	16:54:57	Old pillow surrounding young pillows
37°46.3784 / 110°54.5430	2215	16:55:20	Tube like, sometimes sheet like young flows
37°46.3811 / 110°54.5483	2216	16:55:39	Sheets of young flow, sponge
37°46.3837 / 110°54.5519	2215	16:55:56	Sponge on sheets, only young generation
37°46.3857 / 110°54.5546	2216	16:56:15	Lobate flows
37°46.3860 / 110°54.5552	2216	16:56:24	Crinoid on young pillow
37°46.3888 / 110°54.5557	2216	16:56:39	Very thin sediment cover, more older generation, shrimps, young flow is back to smaller pillows
37°46.3931 / 110°54.5545	2217	16:57:27	Tubes of young lava generation, some sheets, crinoid
37°46.3952 / 110°54.5545	2216	16:57:49	Sheets and lobate flow
37°46.3972 / 110°54.5547	2210	16:58:19	Sheet flow of the younger generation
37°46.4000 / 110°54.5544	2216	16:58:34	Sponge
37°46.4052 / 110°54.5556	2216	16:59:08	Lobate flow, actinie
37°46.4073 / 110°54.5555	2216	16:59:20	Pillows and tubes of the younger generation
37°46.4108 / 110°54.5576	2216	16:59:44	Lobate and sheet flows, sedimented pockets
37°46.4147 / 110°54.5607	2216	17:00:06	Sheet flow and lobate flows
37°46.4168 / 110°54.5622	2216	17:00:18	Pillows of the older generation, crinoid
37°46.4217 / 110°54.5635	2215	17:00:44	Old pillows
37°46.4250 / 110°54.5650	2215	17:01:05	Only young pillows, lobate flows
37°46.4296 / 110°54.5641	2216	17:01:30	Gorgonarias, mostly younger lava generation with a few old large pillows
37°46.4342 / 110°54.5643	2217	17:01:57	Gorgonarias on lobate flows
37°46.4346 / 110°54.5654	2213	17:02:27	Crinoid and sponge on pillows of younger generation
37°46.4375 / 110°54.5670	2217	17:02:51	Transition from lobate and pillows to small sheet flows
37°46.4390 / 110°54.5677	2214	17:03:20	Holothurie
37°46.4425 / 110°54.5662	2216	17:03:52	Tube lava and small pillows overlying sheet flows
37°46.4449 / 110°54.5678	2216	17:04:30	Large pillows of younger generation
37°46.4450 / 110°54.5689	2214	17:04:40	Sheet flows
37°46.4454 / 110°54.5699	2216	17:04:56	Sheets, cracked
37°46.4468 / 110°54.5701	2216	17:05:12	Lobate flows
37°46.4458 / 110°54.5713	2216	17:05:26	Pillows overlying sheets
37°46.4469 / 110°54.5719	2216	17:05:59	Lobate lava and pillows
37°46.4505 / 110°54.5701	2216	17:06:33	Pillows and tubes over sheets
37°46.4523 / 110°54.5698	2214	17:06:50	Sheet flows
37°46.4532 / 110°54.5697	2216	17:06:57	Lobate
37°46.4534 / 110°54.5695	2216	17:07:04	Crinoid on sheets
37°46.4546 / 110°54.5694	2216	17:07:14	Scrambled sheets
37°46.4559 / 110°54.5694	2216	17:07:25	Sheets
37°46.4591 / 110°54.5703	2216	17:07:49	Crinoid on pillows
37°46.4613 / 110°54.5716	2216	17:08:06	Stalked sponge on pillows, only younger lava generation
37°46.4653 / 110°54.5716	2216	17:09:01	Pillows and lobate lava
37°46.4661 / 110°54.5730	2216	17:09:13	Sheets, actinie
37°46.4678 / 110°54.5748	2216	17:09:27	Pillows and lobate lava overlying sheets
37°46.4715 / 110°54.5775	2215	17:09:51	Very few sediments in pockets between pillows
37°46.4721 / 110°54.5793	2216	17:10:04	Sheets
37°46.4751 / 110°54.5798	2216	17:10:15	Old pillow on sheets
37°46.4771 / 110°54.5827	2216	17:10:39	Sheets are overlain by pillows
37°46.4814 / 110°54.5844	2216	17:10:58	Pillows and lobate lava
37°46.4819 / 110°54.5851	2217	17:11:07	Sponge on pillow
37°46.4834 / 110°54.5856	2216	17:11:14	Pillows overlying sheets
37°46.4867 / 110°54.5875	2214	17:11:40	Large old pillows and young pillows
37°46.4893 / 110°54.5895	2215	17:12:04	Crinoid
37°46.4921 / 110°54.5906	2216	17:12:22	Lobate flow, small sheets
37°46.4958 / 110°54.5909	2216	17:12:40	Sheets are overlain by pillows
37°46.4995 / 110°54.5912	2217	17:13:06	Pillows
37°46.5016 / 110°54.5902	2213	17:13:21	Some old pillows, two crinoids
37°46.5058 / 110°54.5896	2216	17:13:44	Small old pillows sticking through younger ones

Station 25-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°46.5097 / 110°54.5900	2216	17:14:05	Young pillows and tubes
37°46.5118 / 110°54.5913	2216	17:14:19	Sponge
37°46.5151 / 110°54.5922	2216	17:14:39	Crinoid on young pillow
37°46.5187 / 110°54.5946	2215	17:14:57	Fissure, about 10 cm wide, gorgonaria
37°46.5256 / 110°54.5978	2215	17:15:34	Sponge
37°46.5275 / 110°54.5992	2212	17:15:48	Sponge on young pillows
37°46.5292 / 110°54.6007	2214	17:16:02	Lobate lava and pillows
37°46.5321 / 110°54.6025	2214	17:16:28	Old pillows
37°46.5352 / 110°54.6018	2213	17:16:58	Small fissure, gorgonaria, crinoid
37°46.5383 / 110°54.6009	2214	17:17:17	Large pillows, young generation
37°46.5396 / 110°54.6002	2213	17:17:32	Gorgonaria
37°46.5431 / 110°54.6007	2214	17:17:48	Actinie, old pillow, increasing sediment
37°46.5455 / 110°54.6011	2212	17:18:16	Swimming animal, sheets, pillows, lobate lava
37°46.5529 / 110°54.6048	2216	17:19:07	Sedimented sheet lava
37°46.5545 / 110°54.6064	2216	17:19:19	Sponge
37°46.5558 / 110°54.6078	2216	17:19:26	Crinoid, gorgonaria on young pillow
No data	2217	17:20:05	Lobate lava of the younger generation
37°46.5606 / 110°54.6143	2216	17:20:19	Large sponge
37°46.5618 / 110°54.6155	2214	17:20:30	Lobate lava to sheet flow
37°46.5625 / 110°54.6166	2215	17:20:41	Sponge on pillow
37°46.5638 / 110°54.6174	2215	17:20:56	Lobate lava and pillows
37°46.5648 / 110°54.6163	2212	17:21:12	Fissure, 50 cm wide
37°46.5650 / 110°54.6148	2215	17:21:25	Actinie
37°46.5658 / 110°54.6121	2216	17:21:51	Fish
37°46.5670 / 110°54.6115	2215	17:21:58	Lobate lava
37°46.5673 / 110°54.6074	2215	17:22:23	Crinoids on pillow
37°46.5687 / 110°54.6069	2215	17:22:35	Gorgonaria on pillow
37°46.5694 / 110°54.6045	2216	17:23:06	Pillows and lobate lava
37°46.5693 / 110°54.6043	2217	17:23:19	Fish over lobate lava
37°46.5705 / 110°54.6055	2217	17:23:34	Sponge on pillow
No data	2217	17:23:49	Pillows
37°46.5721 / 110°54.6088	2217	17:24:02	Small temperature anomaly
37°46.5722 / 110°54.6184	2218	17:24:41	Small white dots on pillows
37°46.5720 / 110°54.6245	2220	17:24:58	Larger pillows and lobate lava
37°46.5693 / 110°54.6374	2219	17:25:41	Old pillow tube and younger pillows
37°46.5709 / 110°54.6425	2211	17:26:48	Older material, heavily sedimented, crinoid
37°46.5707 / 110°54.6363	2215	17:27:56	Talus, staining
37°46.5712 / 110°54.6355	2210	17:28:08	Lava pillar
37°46.5734 / 110°54.6343	2212	17:28:51	Talus and large blocks of older material, rough seafloor
37°46.5779 / 110°54.6352	2213	17:29:24	Fissure, ragged seafloor
37°46.5906 / 110°54.6342	2212	17:30:41	Fe oxide staining, more sediments, yellowish sediment, red-brown stuff, really red, sulfides
37°46.5987 / 110°54.6318	2215	17:31:16	Sulfides
37°46.6013 / 110°54.6309	2212	17:31:36	More sulfides, wall stained red
37°46.6082 / 110°54.6304	2212	17:32:14	Sulfides
37°46.6127 / 110°54.6297	2212	17:32:36	Sulfide chimney, several meters high
37°46.6213 / 110°54.6376	2209	17:33:19	Talus and young pillows
37°46.6222 / 110°54.6416	2211	17:33:32	Back to young lobate lava
37°46.6253 / 110°54.6456	2215	17:33:46	Sponge on pillows
37°46.6316 / 110°54.6479	2210	17:34:16	Big old pillows with sponges
37°46.6353 / 110°54.6446	2211	17:34:48	Big old pillow surrounded by young small pillows
37°46.6427 / 110°54.6416	2212	17:35:31	Large old pillows surrounded by younger lava, crinoid
37°46.6489 / 110°54.6411	2210	17:36:22	Large old pillows sticking through smaller younger ones in a more ragged terrain
37°46.6522 / 110°54.6381	2208	17:37:17	Actinie
37°46.6536 / 110°54.6397	2209	17:37:37	Holothurie on young flows
37°46.6542 / 110°54.6416	2208	17:37:54	Rat tail
37°46.6554 / 110°54.6429	2208	17:38:02	Back to young flows of pillows and lobate lava

Station 25-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°46.6584 / 110°54.6487	2208	17:38:40	Sponge on old pillow surrounded by younger ones, more fauna on old pillows
37°46.6600 / 110°54.6528	2204	17:39:07	Large pillows and sheets of younger generation
37°46.6628 / 110°54.6558	2208	17:39:35	Sheets under pillows
37°46.6657 / 110°54.6579	2208	17:40:00	Only very few sediments
37°46.6660 / 110°54.6596	2208	17:40:14	Lobate lava over sheets, some pillows
37°46.6709 / 110°54.6633	2207	17:40:55	Sheets of young generation
37°46.6721 / 110°54.6642	2208	17:41:07	More sheets than pillows
37°46.6739 / 110°54.6653	2207	17:41:32	Sheets and lobate lava
37°46.6767 / 110°54.6658	2208	17:41:55	Sheets
37°46.6788 / 110°54.6648	2207	17:42:08	Sponge on sheets
37°46.6812 / 110°54.6641	2208	17:42:21	Crinoid on sheets
37°46.6820 / 110°54.6618	2205	17:42:35	Sheets, sponge, lobate lava
37°46.6852 / 110°54.6585	2208	17:42:57	Sponge on lobate lava
37°46.6873 / 110°54.6559	2207	17:43:11	Sheet lava
37°46.6924 / 110°54.6480	2207	17:43:42	Sheet lava
37°46.6983 / 110°54.6427	2205	17:44:10	Sheet and lobate lava, crinoid
37°46.7036 / 110°54.6383	2208	17:44:44	Sheet lava
37°46.7110 / 110°54.6397	2206	17:45:28	Sheet lava
37°46.7140 / 110°54.6379	2205	17:45:45	Crinoid on sheets
37°46.7179 / 110°54.6369	2207	17:46:12	Sheets
37°46.7218 / 110°54.6372	2206	17:46:29	Holothurie and crinoid on sheets
37°46.7264 / 110°54.6384	2206	17:46:52	Sponge on sheet flow
37°46.7287 / 110°54.6393	2208	17:47:06	Collapse structure in sheets
37°46.7331 / 110°54.6435	2208	17:47:35	Sheets
37°46.7399 / 110°54.6465	2207	17:48:04	Crinoid on sheets
37°46.7419 / 110°54.6482	2203	17:48:23	Some more biology
37°46.7511 / 110°54.6538	2208	17:49:15	Silica stained cracks, tubes, two lava generations, more sediment
37°46.7585 / 110°54.6546	2205	17:49:56	Very old blocky material (heavily sedimented) on top of new stuff, actinie, collapse structure
37°46.7621 / 110°54.6575	2208	17:50:42	Old material, distinctly sedimented
37°46.7655 / 110°54.6593	2207	17:51:04	Tubes of old material, sedimented
37°46.7661 / 110°54.6597	2208	17:51:23	Reddish sediment on old pillows and tubes
37°46.7698 / 110°54.6591	2205	17:51:47	Sponges, crinoid on old pillows
37°46.7734 / 110°54.6587	2205	17:52:13	Collapse structures, old large sheet, sedimented
37°46.7760 / 110°54.6598	2207	17:52:40	Fissure, Fe oxide staining, talus
37°46.7777 / 110°54.6613	2205	17:52:53	Crinoid, sponge on old material
37°46.7783 / 110°54.6629	2205	17:53:06	Reddish sediment
37°46.7801 / 110°54.6702	2205	17:53:37	Crinoid and holothurie on old material
37°46.7869 / 110°54.6789	2205	17:54:25	Holothurie on old sedimented material
37°46.7885 / 110°54.6811	2207	17:54:44	Small fissure, 10 cm wide, sedimented, Fe staining
37°46.7933 / 110°54.6838	2206	17:55:07	Sheet like old material
37°46.7949 / 110°54.6839	2201	17:55:19	Gorgonaria on old basalt
37°46.7952 / 110°54.6837	2205	17:55:35	Crinoid
37°46.7981 / 110°54.6818	2207	17:56:00	Fishes, old sheets, tubes, sediments with Fe oxide staining
37°46.8023 / 110°54.6819	2207	17:56:36	Rat tail, old material
37°46.8051 / 110°54.6817	2205	17:56:51	White dots on sediments, crinoids
37°46.8125 / 110°54.6807	2203	17:57:29	Collapse structure
37°46.8158 / 110°54.6807	2207	17:57:49	Collapse structure filled by younger material
37°46.8183 / 110°54.6812	2207	17:58:11	Back in young material, young pillows on sheets, glassy surface
37°46.8250 / 110°54.6875	2206	17:58:43	Large old pillows surrounded by young pillows, no red staining, sponges
37°46.8287 / 110°54.6973	2208	17:59:07	Munidopsis, fish, sponge on young sheets and lobate lava
37°46.8315 / 110°54.7113	2207	17:59:33	Lobate lava of the younger generation
37°46.8319 / 110°54.7223	2206	18:00:04	Stalked sponge, smaller pillows

Station 25-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°46.8334 / 110°54.7260	2206	18:00:32	Young pillows to lobate lava, sheet flows
37°46.8340 / 110°54.7270	2205	18:00:45	Actinie on sheets, sponge
37°46.8342 / 110°54.7268	2207	18:01:00	Red lobster, munidopsis, young flows
37°46.8362 / 110°54.7248	2205	18:01:23	Tube and lobate flows, sheets
37°46.8362 / 110°54.7236	2206	18:01:35	Fish over sheets, gorgonarias
37°46.8381 / 110°54.7176	2206	18:02:09	Collapse structure with young talus inside
37°46.8396 / 110°54.7114	2207	18:02:34	Young lobate lava
37°46.8396 / 110°54.7099	2207	18:02:43	Gorgonaria, sponge on sheets
37°46.8400 / 110°54.7087	2208	18:02:59	Young pillows over sheets, some older large pillows
37°46.8361 / 110°54.7079	2208	18:03:37	Large old pillow sticking through young flows
37°46.8364 / 110°54.7090	2207	18:03:57	Sheets, vent crab
37°46.8369 / 110°54.7087	2206	18:04:15	Sheets and large pillows
37°46.8346 / 110°54.7065	2207	18:04:44	Young pillows
37°46.8345 / 110°54.7032	2206	18:05:05	Crinoid on old pillow
37°46.8343 / 110°54.6978	2207	18:05:29	Young tubes and pillows over older material
37°46.8342 / 110°54.6863	2208	18:06:03	Sheets, lobate lava
37°46.8350 / 110°54.6727	2207	18:06:46	Stalked sponge on young sheets and lobate lava
37°46.8343 / 110°54.6679	2207	18:07:23	Lobate lava and sheets
37°46.8331 / 110°54.6724	2209	18:07:51	Stalked sponge on sheets
37°46.8350 / 110°54.6762	2206	18:08:12	Sheet flow
37°46.8363 / 110°54.6793	2206	18:08:43	Fish over sheets
37°46.8382 / 110°54.6794	2206	18:09:04	Sheets
37°46.8430 / 110°54.6766	2207	18:09:52	Swimming crinoid, stalked sponge on sheets
37°46.8452 / 110°54.6745	2208	18:10:19	Sheet flow
37°46.8499 / 110°54.6731	2206	18:10:46	Holothurie on sheets
37°46.8504 / 110°54.6726	2208	18:10:57	Sponge on sheets
37°46.8541 / 110°54.6703	2205	18:11:16	Swimming holothurie over sheet flow
37°46.8597 / 110°54.6676	2207	18:11:44	Sheets, gorgonaria, crinoids, holothurie
37°46.8640 / 110°54.6673	2208	18:12:04	Sheets
37°46.8716 / 110°54.6675	2206	18:12:38	Stalked sponge on sheets
37°46.8949 / 110°54.6802	2210	18:14:09	Sponge, munidopsis on young pillows
37°46.9034 / 110°54.6834	2208	18:14:57	Large older pillows surrounded by younger material
37°46.9071 / 110°54.6835	2205	18:15:34	Increasing sediment
37°46.9100 / 110°54.6838	2208	18:15:48	Gorgonaria
37°46.9128 / 110°54.6858	2208	18:16:03	Crinoid, holothurie on older pillow
37°46.9152 / 110°54.6916	2205	18:16:22	More older large pillows, slightly sedimented
37°46.9175 / 110°54.6996	2206	18:16:47	Sponge on old pillow
37°46.9196 / 110°54.7068	2207	18:17:07	Old pillow
37°46.9216 / 110°54.7157	2208	18:17:44	Red staining in a small hole
37°46.9283 / 110°54.7200	2207	18:18:48	Crinoid on old pillow, red staining
37°46.9330 / 110°54.7174	2207	18:19:16	Crinoid, actinie on old pillow
37°46.9361 / 110°54.7173	2206	18:19:29	Small fissure, about 1 m wide, crinoid
37°46.9408 / 110°54.7181	2207	18:20:04	White dots on old pillow, actinie
37°46.9494 / 110°54.7137	2207	18:21:01	Old material sedimented, fissure, actinie
37°46.9553 / 110°54.7064	2208	18:21:44	Fissure
37°46.9586 / 110°54.7006	2210	18:22:16	Big old pillows and some smaller younger pillows
37°46.9615 / 110°54.7003	2209	18:22:41	Old pillows covered by the young material
37°46.9646 / 110°54.7039	2210	18:23:00	Munidopsis on old material
37°46.9671 / 110°54.7067	2207	18:23:15	Large old pillows and structures sticking through younger material
37°46.9712 / 110°54.7091	2208	18:23:45	Young pillows now, lobate lava
37°46.9755 / 110°54.7072	2207	18:24:26	Sponge on young pillows and tubes, munidopsis
37°46.9807 / 110°54.7078	2207	18:24:56	Sponges on tube like flow
37°46.9816 / 110°54.7096	2207	18:25:13	Sponges
37°46.9833 / 110°54.7104	2208	18:25:25	Smaller young pillows
37°46.9857 / 110°54.7125	2208	18:25:38	Actinie on young lava
37°46.9909 / 110°54.7164	2208	18:25:59	Large old block with more sediment
37°46.9948 / 110°54.7185	2209	18:26:14	Fissure, back in old material, gorgonaria

Station 25-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°47.0003 / 110°54.7213	2207	18:26:40	Large pillows of second generation, slightly sedimented
37°47.0055 / 110°54.7240	2207	18:27:17	Young and old material
37°47.0098 / 110°54.7242	2207	18:27:44	Sponge on sheets
37°47.0109 / 110°54.7234	2208	18:27:56	Young pillows, sponges
37°47.0151 / 110°54.7234	2206	18:28:16	Old pillows sticking through young ones in a cluster
37°47.0183 / 110°54.7232	2207	18:28:41	More sponges
37°47.0196 / 110°54.7239	2208	18:28:56	Young tubes
37°47.0218 / 110°54.7258	2208	18:29:12	Sponge on young pillow
37°47.0251 / 110°54.7283	2205	18:29:32	Young sheets
37°47.0280 / 110°54.7367	2208	18:30:10	Sponge and crinoid on old pillow
37°47.0344 / 110°54.7417	2208	18:30:53	Crab on young pillows
37°47.0422 / 110°54.7379	2208	18:31:56	Sea star
37°47.0467 / 110°54.7363	2206	18:32:17	Actinie, crinoid
37°47.0514 / 110°54.7352	2204	18:32:41	Sponges
37°47.0519 / 110°54.7349	2207	18:32:50	Crinoid
37°47.0629 / 110°54.7327	2203	18:33:56	Old large pillows, slightly sedimented
37°47.0647 / 110°54.7335	2206	18:34:12	Young and old pillows, silica staining
37°47.0770 / 110°54.7425	2204	18:35:19	Young sheets
37°47.0815 / 110°54.7470	2206	18:35:58	Young pillows, munidopsis
37°47.0850 / 110°54.7497	2206	18:36:20	Lobate lava and sheets
37°47.0871 / 110°54.7511	2206	18:36:34	Sponge, sheets, gorgonaria
37°47.0901 / 110°54.7518	2206	18:36:57	Young pillows, stalked sponges
37°47.0934 / 110°54.7512	2206	18:37:18	Swimming crinoids
37°47.0952 / 110°54.7503	2207	18:37:33	Large old pillow surrounded by young lava
37°47.0979 / 110°54.7486	2207	18:37:53	Swimming crinoid, sheets
37°47.0995 / 110°54.7470	2205	18:38:04	Swimming crinoids
37°47.1027 / 110°54.7474	2207	18:38:31	Shrimp over sheets and lobate lava
37°47.1074 / 110°54.7515	2204	18:38:56	Sheet lava, swimming. crinoids
37°47.1129 / 110°54.7545	2206	18:39:30	Old pillow surrounded by young lava
37°47.1144 / 110°54.7557	2207	18:39:43	Sheet flow
37°47.1170 / 110°54.7555	2207	18:39:59	Lots of swimming crinoids
37°47.1254 / 110°54.7563	2205	18:40:52	Young pillows
37°47.1270 / 110°54.7582	2206	18:41:15	Increasing sediment on old pillows
37°47.1283 / 110°54.7634	2207	18:41:59	Old pillows and talus, some staining
37°47.1286 / 110°54.7652	2206	18:42:19	Crinoid
37°47.1316 / 110°54.7665	2201	18:42:26	Munidopsis over old material
37°47.1309 / 110°54.7681	2203	18:42:47	Fish
37°47.1301 / 110°54.7678	2204	18:42:55	Large old pillow, sedimented, mainly old material
37°47.1319 / 110°54.7682	2205	18:43:18	More sediments in pockets
37°47.1338 / 110°54.7660	2202	18:44:02	Collapse pit
37°47.1340 / 110°54.7559	2203	18:45:17	Second generation sheet flows, fissure, actinie
37°47.1337 / 110°54.7540	2201	18:46:13	Crinoid, second generation sheet flow
37°47.1343 / 110°54.7543	2202	18:47:03	Small fissure
37°47.1376 / 110°54.7602	2202	18:47:54	Rat tail, sheet flow of the second generation, some lobate lava
37°47.1451 / 110°54.7596	2204	18:48:46	Small fishes, lobate second generation
37°47.1532 / 110°54.7530	2201	18:49:36	Sheet flow to lobate lava of the second generation
37°47.1664 / 110°54.7625	2201	18:50:50	Slightly sedimented sheet flow
37°47.1710 / 110°54.7723	2201	18:51:26	Stalked sponge
37°47.1714 / 110°54.7784	2205	18:52:13	Swimming crinoid, some reddish staining on the sediments
37°47.1774 / 110°54.7780	2203	18:53:11	Rat tail, sponge, pillows
37°47.1794 / 110°54.7773	2203	18:53:37	Sponge, gorgonaria
37°47.1814 / 110°54.7722	2202	18:54:27	Large fissure, second generation pillows
37°47.1806 / 110°54.7728	2202	18:55:24	Second generation sheet flow
37°47.1832 / 110°54.7796	2201	18:56:14	White dots on the sheet flow, rat tail
37°47.1875 / 110°54.7789	2201	18:56:51	Fissure in the sheet flow
37°47.1955 / 110°54.7732	2202	18:57:46	Munidopsis, swimming crinoids, several large fissures

Station 25-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
			and cracks
37°47.1998 / 110°54.7638	2203	18:58:18	Lots of animals
37°47.2137 / 110°54.7683	2202	18:59:22	Large fissures in second generation sheet flow
37°47.2343 / 110°54.8063	2197	19:01:09	Sheet flows at the bottom of the fissure, sedimented, slightly glassy
37°47.2386 / 110°54.8130	2201	19:02:30	Sponges on sheet flow
37°47.2417 / 110°54.8122	2205	19:03:31	Fissure in the sheet flow, bottom of the fissure contains lobate lava
37°47.2468 / 110°54.8054	2200	19:04:34	Sea star, sheet flow, rat tail
37°47.2574 / 110°54.8024	2205	19:05:35	White spots on sheet flow
37°47.2663 / 110°54.8009	2206	19:06:18	Lobate to pillow lava of the second generation, silica staining on fracture walls
37°47.2729 / 110°54.7987	2203	19:06:43	Silica staining, collapse structure
37°47.2785 / 110°54.7976	2204	19:07:08	Silica staining on fissure
37°47.2931 / 110°54.8019	2206	19:08:15	Fissure in glassy second generation sheet flow, silica staining
37°47.3024 / 110°54.8087	2206	19:09:08	Munidopsis on lobate lava
37°47.3083 / 110°54.8170	2206	19:10:13	Young pillows, sponges, crinoid
37°47.3092 / 110°54.8214	2208	19:10:46	Young sheets
37°47.3126 / 110°54.8264	2208	19:11:33	Young pillows and sheets, fish, crinoid, sponges
37°47.3166 / 110°54.8263	2206	19:12:09	Silica staining in fractures
37°47.3203 / 110°54.8272	2206	19:12:37	Silica staining in fractured young pillows
37°47.3236 / 110°54.8298	2206	19:13:17	Silica staining in broken pillows
37°47.3302 / 110°54.8284	2207	19:14:31	Broken pillows with silica staining
37°47.3347 / 110°54.8263	2206	19:15:26	Sheet flow
37°47.3394 / 110°54.8272	2205	19:15:58	Young lobate lava and sheets, some sponges, fish, holothurie
37°47.3460 / 110°54.8285	2205	19:17:09	Sheets slightly sedimented
37°47.3590 / 110°54.8176	2202	19:18:32	Lobate flows
37°47.3656 / 110°54.8128	2201	19:19:13	Young material, silica staining in cracks
37°47.3750 / 110°54.8146	2203	19:20:11	Sheets
37°47.3783 / 110°54.8171	2205	19:20:33	White patches, silica staining in cracks
37°47.3886 / 110°54.8238	2201	19:21:56	Fissure
37°47.3944 / 110°54.8278	2204	19:23:06	Some white patches on rocks, silica staining in cracks
37°47.4088 / 110°54.8303	2202	19:24:35	Free swimming crinoids over pillows of second generation
37°47.4150 / 110°54.8400	2206	19:25:14	Fissure with silica staining
37°47.4257 / 110°54.8464	2204	19:26:07	Fish
37°47.4300 / 110°54.8505	2207	19:26:41	Old pillows
37°47.4336 / 110°54.8515	2206	19:26:59	Stalked sponge
37°47.4352 / 110°54.8508	2208	19:27:20	Old pillows and lobate lava, fish
37°47.4431 / 110°54.8493	2208	19:28:17	Crab, old lobate and tubes, free swimming crinoids, stalked sponges, sea star
37°47.4480 / 110°54.8469	2208	19:28:58	Old pillows over young one
37°47.4531 / 110°54.8476	2208	19:29:36	Silica staining in cracks of broken pillows
37°47.4695 / 110°54.8534	2207	19:31:05	Sheet flow, old partly broken
37°47.4766 / 110°54.8552	2207	19:31:45	Broken pillows with silica staining in cracks
37°47.4841 / 110°54.8546	2208	19:32:31	Sheets and large pillows
37°47.4883 / 110°54.8534	2207	19:32:53	Crab
37°47.4952 / 110°54.8540	2205	19:33:37	Young lobate lava, sponge, large pillows
37°47.4974 / 110°54.8634	2207	19:34:36	Fissure, talus with silica staining
37°47.4975 / 110°54.8680	2208	19:35:18	Fish
37°47.4993 / 110°54.8653	2207	19:35:53	Young lobate lava and tubes
37°47.5000 / 110°54.8611	2208	19:36:15	Fissure with stained talus
37°47.5017 / 110°54.8486	2203	19:37:28	Ridge in the middle of the fissure
37°47.5049 / 110°54.8659	2204	19:38:36	Overhanging cliff
37°47.5235 / 110°54.8721	2209	19:41:36	Temperature anomaly
37°47.5260 / 110°54.8730	2207	19:41:51	Lots of crabs, clam bed

Station 25-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
37°47.5300 / 110°54.8730	2208	19:42:25	Chimney, temperature increase by 0.25°C
37°47.5350 / 110°54.8702	2204	19:42:55	Crabs and clams
37°47.5423 / 110°54.8607	2208	19:43:41	Clam field, chimneys
37°47.5483 / 110°54.8485	2206	19:44:26	Clam field, reddish stained bottom (sulfides), all along a fissure
37°47.5610 / 110°54.8585	2208	19:45:44	Big munidopsis, still dead clams along fissures between pillows or sheet flows
37°47.5675 / 110°54.8917	2207	19:47:15	Nearly out of the field, temperature back to background value
37°47.5685 / 110°54.8975	2208	19:48:05	Lots of biology but no staining
37°47.5707 / 110°54.8996	2207	19:49:04	Fish, crab over sheet flow
37°47.5744 / 110°54.8943	2207	19:49:39	Temperature anomaly of about 0.08°C, no signs of hydrothermal precipitates on seafloor
37°47.5798 / 110°54.8883	2208	19:50:37	Temperature is rising by 1.25°C, no sediments, no hydrothermal precipitates on seafloor
37°47.5903 / 110°54.8957	2205	19:51:50	slight Temperature anomaly (0.05°C)
37°47.5944 / 110°54.8987	2206	19:52:31	broken lava blocks, Temperature back to background values
37°47.6076 / 110°54.8925	2201	19:54:19	Crab
37°47.6117 / 110°54.8887	2201	19:55:08	Old large pillows
37°47.6188 / 110°54.8946	2206	19:57:35	New pillows over old ones
37°47.6219 / 110°54.8921	2207	19:58:11	Large old pillows
37°47.6229 / 110°54.8904	2208	19:58:25	Actinie
37°47.6346 / 110°54.8824	2206	20:00:03	Large old pillows, partly disintegrated, sediment cover
37°47.6816 / 110°54.9108	2205	20:05:47	Old pillows with some sediment cover
37°47.6859 / 110°54.9087	2204	20:06:53	Shrimp on old sedimented pillows
37°47.6910 / 110°54.9164	2205	20:08:02	Large pillows, fissured
37°47.6996 / 110°54.9118	2201	20:09:49	Old sheet flows, cracked, fissures filled with sediment
37°47.7028 / 110°54.9137	2206	20:11:54	Large old pillows with sponges
37°47.7278 / 110°54.9284	2202	20:17:38	Fissure in old rocks
37°47.7403 / 110°54.9377	2204	20:19:16	Old fissures in sheets
37°47.7496 / 110°54.9360	2203	20:20:29	Collapse pit, some crinoids
37°47.7673 / 110°54.9355	2201	20:22:16	Old sedimented sheets
37°47.7817 / 110°54.9446	2204	20:24:12	Old material covered by sediments
37°47.7802 / 110°54.9449	2203	20:25:03	Old sheets with fissures filled with sediments
37°47.7779 / 110°54.9429	2202	20:26:52	Old sedimented pillows and sheets
37°47.7916 / 110°54.9329	2204	20:29:01	Old blocky material, slightly sedimented
37°47.8152 / 110°54.9423	2201	20:32:51	Old broken pillows sedimented
37°47.8157 / 110°54.9424	2205	20:33:40	Swimming holothurie
37°47.8206 / 110°54.9417	2205	20:35:13	Sponges on old pillow
37°47.8250 / 110°54.9412	2207	20:35:52	Munidopsis, crinoids on large old pillows
37°47.8325 / 110°54.9391	2207	20:36:43	Large old, partly broken pillows
37°47.8517 / 110°54.9652	2207	20:39:22	Old pillows and sheet flow, heavily sedimented
37°47.8554 / 110°54.9500	2207	20:41:32	Large old pillows with sediment cover and sediments in pockets
37°47.8760 / 110°54.9611	2208	20:44:56	old material, old pillows and tubes, sedimented
37°47.8923 / 110°54.9701	2209	20:46:52	Munidopsis, on old large pillows
37°47.8973 / 110°54.9770	2208	20:47:23	Talus and large pillows, all old
37°47.9139 / 110°54.9719	2212	20:49:34	Large old pillows, talus surrounding
37°47.9266 / 110°54.9838	2208	20:51:32	Bottom contact lost and end of station
37°47.9283 / 110°54.9834	2206	20:51:41	Videos cameras turned off

Station 26-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°47.2828 / 110°54.7489	0	23:16:23	Station is located at the central axial high of the Pacific-Antarctic Ridge (37°47.5'S)

Station 26-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°47.4089 / 110°54.8431	2201	00:03:30	Bottom contact
37°47.4100 / 110°54.8437	2208	00:03:54	Young pillows, silica staining on the fractures, stalked crinoid
37°47.4102 / 110°54.8419	2207	00:05:10	Pillows and lobate lava
37°47.4097 / 110°54.8421	2210	00:05:47	Munidopsis, sponge on glassy lobate lava, fracture filled with talus
37°47.4095 / 110°54.8417	2210	00:06:17	Sponges, crinoid
37°47.4364 / 110°54.8638	2208	00:12:05	Sea star on glassy lobate lava, grab hopping up and down
37°47.4400 / 110°54.8619	2208	00:12:39	Medusa, sheets and lobate lava
37°47.4451 / 110°54.8632	2208	00:13:29	Fracture
37°47.4473 / 110°54.8643	2204	00:13:59	Talus with silica staining
37°47.4456 / 110°54.8702	2206	00:15:12	Fracture, two generations of lava, talus field
37°47.4437 / 110°54.8699	2210	00:15:38	Large pillows, vent crab, mottled sediment
37°47.4416 / 110°54.8693	2209	00:16:08	Silica staining on talus material
37°47.4410 / 110°54.8696	2209	00:17:02	Silica stained talus material
37°47.4505 / 110°54.8795	2215	00:18:47	Larger pillows and tubes, caulophacus
37°47.4523 / 110°54.8828	2214	00:19:24	Silica staining, free swimming crinoid
37°47.4526 / 110°54.8803	2214	00:19:56	Young lava without sediment
37°47.4516 / 110°54.8792	2216	00:20:11	Fracture, collapse pit
37°47.4468 / 110°54.8802	2216	00:21:03	Slightly sedimented lobate, swimming crinoid
37°47.4417 / 110°54.8768	2215	00:21:30	Fracture
37°47.4388 / 110°54.8634	2216	00:22:42	Swimming crinoids
37°47.4395 / 110°54.8621	2215	00:23:29	Stalked sponge
37°47.4414 / 110°54.8629	2215	00:24:06	Swimming crinoid, glassy lobate lava, sheet flow
37°47.4430 / 110°54.8640	2213	00:24:38	Munidopsis
37°47.4436 / 110°54.8717	2215	00:25:36	Fractured pillows
37°47.4450 / 110°54.8765	2216	00:26:29	Caulophacus
37°47.4481 / 110°54.8747	2214	00:27:22	Fish
37°47.4467 / 110°54.8719	2216	00:28:02	Munidopsis
37°47.4549 / 110°54.8793	2218	00:29:48	Red staining
37°47.4630 / 110°54.8708	2215	00:31:13	Sea star
37°47.4648 / 110°54.8695	2214	00:31:35	Munidopsis, swimming crinoid, slightly sedimented lobate lava
37°47.4652 / 110°54.8700	2215	00:31:59	Sea stars
37°47.4645 / 110°54.8706	2216	00:32:33	Less sediment, dead shells
37°47.4626 / 110°54.8698	2215	00:33:00	Barnacles, white shells
37°47.4595 / 110°54.8697	2214	00:33:46	Sulfide chimney
37°47.4599 / 110°54.8689	2214	00:34:48	Shells
37°47.4668 / 110°54.8637	2211	00:37:02	Edge of shell field, fresh pillows, snails
37°47.4639 / 110°54.8640	2211	00:37:41	Munidopsis, serpulids
37°47.4603 / 110°54.8660	2211	00:38:33	Munidopsis
37°47.4545 / 110°54.8667	2212	00:39:12	Barnacles
37°47.4538 / 110°54.8676	2214	00:39:25	Some more staining
37°47.4463 / 110°54.8683	2213	00:40:39	Shells, sea star
37°47.4555 / 110°54.8735	2215	00:42:09	Shells, sea star
37°47.4575 / 110°54.8732	2216	00:42:31	Red sediment, more shells
37°47.4617 / 110°54.8721	2216	00:44:09	Lots of mussels
37°47.4652 / 110°54.8708	2216	00:45:18	Munidopsis, mussels
37°47.4665 / 110°54.8716	2215	00:45:45	Chimney
37°47.4679 / 110°54.8705	2215	00:46:25	Mussels, shells
37°47.4695 / 110°54.8705	2214	00:46:52	Sponge on lava between mussels
37°47.4626 / 110°54.8568	2214	00:48:42	Rat tail
37°47.4597 / 110°54.8562	2213	00:49:10	Tube worms or barnacles
37°47.4558 / 110°54.8572	2212	00:49:45	Munidopsis, eel shaped fish, no mussels
37°47.4517 / 110°54.8621	2213	00:50:36	Swimming crinoid, munidopsis
37°47.4537 / 110°54.8556	2212	00:51:57	Large pillows
37°47.4604 / 110°54.8601	2214	00:52:36	Fracture
37°47.4622 / 110°54.8619	2213	00:53:16	Shrimp, fracture

Station 26-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°47.4687 / 110°54.8612	2213	00:55:33	Stalked and unstalked sponges
37°47.4691 / 110°54.8610	2213	00:56:29	Munidopsis
37°47.4656 / 110°54.8666	2213	00:58:02	Barnacles, munidopsis
37°47.4637 / 110°54.8724	2212	00:58:40	Small number of shells between pillows
37°47.4611 / 110°54.8742	2213	00:59:06	Barnacles
37°47.4611 / 110°54.8740	2214	00:59:55	Barnacles and munidopsis
37°47.4641 / 110°54.8738	2213	01:00:26	Serpulids on pillows
37°47.4609 / 110°54.8723	2213	01:03:43	Barnacles, open bivalves
37°47.4536 / 110°54.8690	2212	01:05:40	Shells, sea star
37°47.4554 / 110°54.8678	2213	01:06:12	Dense cluster of shells and mussels
37°47.4627 / 110°54.8792	2214	01:06:54	Red stained sediment
37°47.4701 / 110°54.8900	2214	01:07:56	Eel shaped fish
37°47.4743 / 110°54.8797	2212	01:09:20	Pillows
37°47.4721 / 110°54.8728	2211	01:10:14	Medusa, discus like
37°47.4625 / 110°54.8664	2220	01:11:18	Barnacles, mussels, polychaetes
37°47.4523 / 110°54.8581	2217	01:12:22	Attempt to sample, grab did not close
37°47.4483 / 110°54.8521	2213	01:13:22	Pillows, with barnacles
37°47.4463 / 110°54.8455	2213	01:16:04	Pillows
37°47.4456 / 110°54.8515	2211	01:19:13	Sponge on pillows
37°47.4637 / 110°54.8538	2210	01:21:31	Pillows
37°47.4682 / 110°54.8582	2210	01:22:38	Swimming crinoids, some older large pillows
37°47.4664 / 110°54.8572	2209	01:24:08	Starfish
37°47.4701 / 110°54.8561	2212	01:25:23	Barnacles, sponges, munidopsis
37°47.4692 / 110°54.8527	2212	01:26:31	Serpulids, shells
37°47.4678 / 110°54.8527	2208	01:27:12	Lots of shells and living mussels in pits between pillows
37°47.4594 / 110°54.8524	2212	01:29:07	Big sulfide chimney
37°47.4502 / 110°54.8566	2209	01:31:05	Serpulids in the vicinity of the chimney
37°47.4220 / 110°54.8462	2211	01:36:16	Rat tail between pillows
37°47.4225 / 110°54.8465	2209	01:36:49	Holothurie
37°47.4305 / 110°54.8516	2207	01:38:20	Silica stained talus
37°47.4433 / 110°54.8651	2211	01:42:02	Silica stained talus between pillows
37°47.4464 / 110°54.8647	2211	01:42:47	Lobate flows and silica stained talus
37°47.4534 / 110°54.8692	2213	01:44:46	Swimming crinoid, silica stained talus, white spots
37°47.4608 / 110°54.8431	2215	01:50:59	Lobate lava and younger pillows
37°47.4604 / 110°54.8444	2215	01:51:37	Bresingiid crinoid
37°47.4599 / 110°54.8490	2215	01:51:53	Silica stained talus
37°47.4570 / 110°54.8613	2208	01:52:51	Barnacles, sponges on pillows
37°47.4437 / 110°54.8524	2212	01:55:55	Silica stained talus
37°47.4454 / 110°54.8539	2211	01:56:21	Red sediment
37°47.4689 / 110°54.8574	2210	02:00:42	Barnacles on the edge of a pillow mound
37°47.4684 / 110°54.8575	2211	02:01:09	Silica stained talus
37°47.4706 / 110°54.8693	2209	02:02:03	Munidopsis
37°47.4723 / 110°54.8744	2210	02:02:43	Munidopsis
37°47.4742 / 110°54.8749	2213	02:03:01	Fracture with crinoids and small number of shells
37°47.4755 / 110°54.8726	2212	02:03:36	Stained sediment patch
37°47.4800 / 110°54.8656	2212	02:04:44	Barnacles, few shells
37°47.4862 / 110°54.8760	2212	02:05:27	Lots of live mussels among pillows
37°47.4886 / 110°54.8788	2212	02:06:19	Barnacles on a chimney-like structure
37°47.4888 / 110°54.8784	2213	02:06:40	Clam shells, barnacles
37°47.4901 / 110°54.8772	2214	02:06:59	Mussels, barnacles munidopsis
37°47.4859 / 110°54.8889	2213	02:09:28	Dense hydrothermal community
37°47.4591 / 110°54.8708	2210	02:17:27	Large pillows with some shells
37°47.4602 / 110°54.8740	2211	02:17:49	More shells, munidopsis
37°47.4604 / 110°54.8749	2210	02:18:04	Barnacles, mussels munidopsis
37°47.4632 / 110°54.8667	2212	02:19:01	Clams and barnacles
37°47.4672 / 110°54.8630	2211	02:20:14	Lots of clams and everything
37°47.4671 / 110°54.8613	2213	02:20:34	Attempt to sample
37°47.4590 / 110°54.8644	2212	02:23:05	Sulfides

Station 26-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°47.4741 / 110°54.8611	2210	02:29:36	Pillows and shells
37°47.4723 / 110°54.8704	2211	02:30:32	Serpulids, shells, barnacles on pillows
37°47.4691 / 110°54.8711	2213	02:31:33	Barnacles, munidopsis, shells
37°47.4701 / 110°54.8784	2214	02:33:10	Mussels between pillows
37°47.4795 / 110°54.8769	2212	02:34:42	Sulfide
37°47.4820 / 110°54.8786	2223	02:35:28	Attempt to sample sulfides, grab did not close
37°47.4806 / 110°54.8951	2219	02:36:39	Attempt to sample the hydrothermal vent community, mussels, munidopsis etc., grab did not close, sample lost
37°47.4803 / 110°54.9077	2203	02:40:06	Bottom contact lost and end of station
37°47.4196 / 110°54.8838	1491	02:57:48	Video cameras turned off

Station 30-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°47.4637 / 110°54.8954	1801	16:01:36	Station is located at the central axial high of the Pacific-Antarctic Ridge (37°47.5'S)
37°47.4650 / 110°54.8758	2099	16:11:26	Video cameras turned on
37°47.4483 / 110°54.8557	2199	16:14:30	Bottom contact
37°47.4476 / 110°54.8614	2204	16:14:43	Lots of shells
37°47.4454 / 110°54.8759	2212	16:15:33	Clusters of mussels, sediment, on the edge of the hydrothermal field
37°47.4521 / 110°54.8771	2212	16:16:23	Large old pillows and smaller pillows, hydrothermal fauna, mostly dead
37°47.4709 / 110°54.8702	2212	16:19:26	Sheet flow lots of broken, dead shells
37°47.4749 / 110°54.8819	2213	16:20:56	Barnacles on sheets
37°47.4747 / 110°54.8854	2214	16:21:15	Sulfide, attempt to sample, grab did not close
37°47.4803 / 110°54.8956	2212	16:25:55	Holothurie, barnacles, fish, mussels etc. on pillows
37°47.4764 / 110°54.8904	2209	16:27:44	Munidopsis, rat tail
No data	2205	16:30:48	Lava blocks
37°47.4821 / 110°54.8829	2208	16:33:21	Large pillows on the edge of the hydrothermal field
37°47.4814 / 110°54.8764	2208	16:38:03	Lots of munidopsis
37°47.4709 / 110°54.8752	2210	16:41:03	Bathymodiolus dead and alive, munidopsis etc. on pillows
37°47.4750 / 110°54.8734	2209	16:42:31	Lots of barnacles on pillows
37°47.4764 / 110°54.8754	2212	16:43:07	Lots of alive mussels, holothurie, shrimps
37°47.4912 / 110°54.8639	2210	16:45:00	Hydrothermal fauna, pillows
37°47.4891 / 110°54.8747	2211	16:47:32	Hydrothermal sediments
No data	2209	16:48:57	Thin cover of hydrothermal sediments on basalt
37°47.4862 / 110°54.8825	2208	16:55:05	Thin cover of hydrothermal sediments on basalt, munidopsis
37°47.4838 / 110°54.8807	2209	16:57:27	Large pillows
37°47.4958 / 110°54.8755	2210	17:02:34	Sediment cover of probably old pillows, sediment seems to contain some hydrothermal Fe oxides, red staining
37°47.4973 / 110°54.8521	2210	17:04:20	Video tapes changed
37°47.4977 / 110°54.8289	2212	17:06:12	Fissure, back in the field with a lot of hydrothermal fauna
37°47.4975 / 110°54.8289	2208	17:07:42	Calyptogena or bathymodiolus not quite clear but most of them are dead
37°47.5038 / 110°54.8359	2207	17:08:49	Stalked barnacles
37°47.5077 / 110°54.8426	2212	17:10:08	Clams sit in pockets of pillows
37°47.4962 / 110°54.8453	2210	17:12:33	Crinoids
37°47.5193 / 110°54.8815	2210	17:16:09	Vent fish
37°47.5153 / 110°54.8904	2211	17:16:49	Back in the clam field
37°47.5091 / 110°54.8923	2209	17:18:11	Shells of dead calyptogena seem to have the same size
37°47.5029 / 110°54.8827	2210	17:20:50	Clam field about 20-30 m across
37°47.5042 / 110°54.8853	2210	17:21:47	Glassy pillows

Station 30-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°47.5085 / 110°54.9007	2210	17:23:52	Nearly no sediments on glassy pillows
37°47.4960 / 110°54.8972	2210	17:27:29	Crinoids seem to dominate the periphery of the hydrothermal field but are not abundant in the field itself
37°47.4943 / 110°54.8901	2210	17:30:34	Young lobate lava, sheets and pillows with glassy surface, very thin sediment cover
37°47.4910 / 110°54.8946	2211	17:33:26	Some of the pillow basalt is still glassy, thin sediment cover
37°47.4760 / 110°54.8950	2209	17:36:58	Intensely sedimented pillows
37°47.4600 / 110°54.8857	2209	17:41:12	Pillow lava, still glassy
37°47.4492 / 110°54.8709	2208	17:44:18	Bathymodiolus between the pillow lava
37°47.4419 / 110°54.8692	2199	17:49:25	Attempt to grab some biological material on flat pillow surface, grab did not close
37°47.4419 / 110°54.8840	2217	17:52:33	Fissure
37°47.4626 / 110°54.8859	2216	17:54:24	Silica and Fe stained talus
37°47.4687 / 110°54.9024	2214	17:55:27	Silica stained talus
37°47.4612 / 110°54.8692	2217	18:05:56	Large fracture about 10 m across
37°47.4411 / 110°54.8629	2216	18:07:48	Pillows slightly sedimented
37°47.4425 / 110°54.8343	2214	18:09:50	Large pillows and tubes, still slightly sedimented
37°47.4272 / 110°54.8569	2216	18:13:36	Two different lava generations
37°47.4310 / 110°54.8541	2215	18:14:06	Silica staining in fractures
37°47.4342 / 110°54.8509	2214	18:14:24	Strongly stained pillow
37°47.4403 / 110°54.8498	2213	18:14:44	Stained talus along a wall
37°47.4514 / 110°54.8517	2210	18:15:53	Huge pillow cut into two pieces and silica stained
37°47.4675 / 110°54.8772	2211	18:19:04	Glassy pillows
37°47.4773 / 110°54.8815	2211	18:20:22	Two different lava generations: big old pillows surrounded by small younger flows
37°47.4836 / 110°54.8792	2211	18:21:15	Small fracture, stained talus
37°47.4774 / 110°54.8927	2212	18:25:48	Vent fish
37°47.4716 / 110°54.8825	2209	18:26:46	About 20 cm wide fissure
37°47.4765 / 110°54.8630	2212	18:30:43	Lots of barnacles sticking out of a pillows that is covered by hydrothermal sediment
37°47.4810 / 110°54.8914	2214	18:32:59	Lots of barnacles, dead and alive clams, thin cover of hydrothermal sediment
37°47.4520 / 110°54.8523	2213	18:40:51	Large pillows and tubes slightly sedimented, some free swimming crinoids
37°47.4488 / 110°54.8505	2214	18:41:51	White dots and snails on pillows
37°47.4550 / 110°54.8471	2214	18:43:28	Small white dots: stalked barnacles
37°47.4563 / 110°54.8629	2212	18:44:43	Staining of pillows
37°47.4788 / 110°54.8627	2215	18:48:21	Barnacles on pillows, clams in pockets, some hydrothermal sediment
37°47.4798 / 110°54.8741	2209	18:49:41	Small lava pillar
37°47.4817 / 110°54.8757	2212	18:50:20	Holothurie
37°47.4807 / 110°54.8787	2211	18:50:37	Hydrothermal sediments in pockets
37°47.4646 / 110°54.8816	2210	18:52:45	Lava pillar covered by barnacles
37°47.4673 / 110°54.8675	2212	18:56:24	Sample of hydrothermal vent community
37°47.4693 / 110°54.9034	2214	18:57:51	Grab is closed, off bottom and end of station

Station 31-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°46.4379 / 110°54.5698	0	20:56:06	Station is located at the central axial high of the Pacific-Antarctic Ridge (37°47.5'S)
37°46.5527 / 110°54.6337	2111	21:39:10	Video cameras turned on
37°46.5409 / 110°54.6233	2204	21:41:55	Bottom contact
37°46.5416 / 110°54.6214	2215	21:42:39	Red to orange sediment between pillows, sponge,

Station 31-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
			massive sulfide chimney
37°46.5365 / 110°54.6285	2210	21:44:38	Sulfide chimney
37°46.5374 / 110°54.6340	2214	21:45:10	Orange to red sediment between sediment
37°46.5369 / 110°54.6413	2214	21:46:47	Sedimented pillow lava, possibly sulfide talus
37°46.5304 / 110°54.6244	2215	21:49:21	Lobate lava, relatively fresh with possibly glassy material
37°46.5353 / 110°54.6203	2218	21:50:46	Sulfide talus
37°46.5409 / 110°54.6324	2231	21:55:32	Attempt to sample, grab did not close
37°46.5343 / 110°54.6238	2215	22:03:30	Sponge on the lobate lava
37°46.5332 / 110°54.6201	2215	22:04:35	Large sulfide blocks
37°46.5528 / 110°54.6218	2207	22:07:11	Attempt to sample the large sulfide blocks, they contain atacamite
37°46.5692 / 110°54.6270	2215	22:09:13	Lava covered the massive sulfides
37°46.5572 / 110°54.6040	2213	22:11:33	Two generation lava, larger older tubes are surrounded by younger material
37°46.5464 / 110°54.6240	2214	22:14:03	Two generations lava, young material is very glassy
37°46.5262 / 110°54.6188	2216	22:17:49	Fractured pillow material
37°46.5309 / 110°54.6227	2214	22:18:51	Talus material surrounded by younger generation lava
37°46.5432 / 110°54.6239	2216	22:19:54	Sulfide chimney
37°46.5244 / 110°54.6327	2212	22:25:09	Large sulfide blocks
37°46.5224 / 110°54.6304	2223	22:25:48	Attempt to sample, grab is empty
37°46.5403 / 110°54.6534	2212	22:32:36	Lobate to pillow lava of the younger generation
37°46.5551 / 110°54.6375	2212	22:33:57	Fresh and glassy lava, only little sediment, sheet flow
37°46.5668 / 110°54.6336	2214	22:35:05	Two generation of pillows, sponge, young generation pillows surrounds some large old pillows
37°46.5518 / 110°54.6432	2212	22:38:40	Sponge on younger generation lava
37°46.5445 / 110°54.6311	2211	22:40:01	Two generation lava with older generation sticking out of the younger smaller pillows
37°46.5417 / 110°54.6186	2214	22:44:35	Large old pillows
37°46.5309 / 110°54.6306	2211	22:50:12	Sulfide chimney
37°46.5379 / 110°54.6379	2225	22:52:22	Attempt to sample, grab has fallen over, only little material recovered
37°46.5440 / 110°54.6329	2201	22:55:45	Some material in the grab, off bottom and end of station

Station 33-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°46.5053 / 110°54.5293	7	16:13:02	Station is located at the central axial high of the Pacific-Antarctic Ridge (37°47.5'S)
37°46.5444 / 110°54.6010	2098	16:56:35	Video cameras turned on
37°46.5547 / 110°54.6146	2211	17:00:01	Bottom contact
37°46.5523 / 110°54.6130	2215	17:00:26	Fracture, old lava, broken, slightly sedimented
37°46.5544 / 110°54.6131	2215	17:01:21	Old fractured sheets, slightly sedimented
37°46.5387 / 110°54.6145	2216	17:03:51	Old pillows slightly sedimented
37°46.5346 / 110°54.6272	2216	17:05:03	Fracture, sheets
37°46.5361 / 110°54.6315	2215	17:05:56	Fractured sheets, slightly sedimented
37°46.5430 / 110°54.6429	2218	17:08:37	Talus covered by hydrothermal sediments
37°46.5440 / 110°54.6481	2219	17:09:11	More sediment covering talus
37°46.5431 / 110°54.6534	2218	17:09:44	Complete thin sediment cover of talus
37°46.5458 / 110°54.6523	2217	17:10:45	Basalt talus covered by sediments
37°46.5441 / 110°54.6479	2218	17:11:11	Swimming and sessile crinoids
37°46.5428 / 110°54.6404	2217	17:12:36	Sheets, sediment cover a bit thinner
37°46.5384 / 110°54.6428	2216	17:13:01	Young glassy sheets, nearly no sediments
37°46.5379 / 110°54.6592	2215	17:15:09	Glassy sheets and lobate lava, nearly no sediment
37°46.5495 / 110°54.6476	2216	17:16:39	Lobate flows, glassy, sediment cover increases
37°46.5605 / 110°54.6442	2216	17:18:45	Still sheets and lobate lava, less sediment, holothurie and stalked crinoids

Station 33-GTV Lat. (S) / Long. (W)	Length (m)	Time (UTC)	Comment
37°46.5592 / 110°54.6406	2217	17:20:43	Glassy pillows and lobate lava over sheets, some old, large pillows
37°46.5543 / 110°54.6405	2214	17:22:51	Fish, stalked crinoids, more old pillows sticking through younger, smaller pillows
37°46.5569 / 110°54.6374	2213	17:23:27	Rat tail
37°46.5565 / 110°54.6332	2215	17:24:53	Still large old pillows and smaller young ones, sediment cover increases
37°46.5386 / 110°54.6295	2216	17:28:57	Sediment cover increases, more or less compete sediment cover on pillows and talus
37°46.5406 / 110°54.6299	2213	17:29:56	Large sedimented blocks
37°46.5431 / 110°54.6317	2217	17:30:30	Sulfide blocks, sedimented
37°46.5475 / 110°54.6233	2215	17:31:35	Sulfide chimney
37°46.5486 / 110°54.6225	2210	17:32:05	Sulfide chimney is about 2-3 m high, no hydrothermal activity
37°46.5453 / 110°54.6255	2212	17:33:13	Probably sulfide talus around chimney, all with sediment cover
37°46.5373 / 110°54.6245	2216	17:38:21	Old basalt blocks, sediment cover gets thinner
37°46.5369 / 110°54.6245	2216	17:38:41	Blocks consist of broken sheets and lobate lava
37°46.5419 / 110°54.6366	2218	17:45:52	Hydrothermal sediment over young glassy basalt
37°46.5391 / 110°54.6362	2218	17:47:08	Young pillows and sheets covered by a thin hydrothermal sediment
37°46.5394 / 110°54.6364	2219	17:47:40	Lobster, munidopsis, increasing sediment
37°46.5397 / 110°54.6288	2218	17:48:57	Stained talus between pillows
37°46.5428 / 110°54.6326	2218	17:50:28	Back to the small ridge
37°46.5446 / 110°54.6242	2216	18:10:18	Sediment covered pillows and sheets
37°46.5242 / 110°54.6464	2214	18:13:00	Fracture, broken blocks of sheets and pillows
37°46.5194 / 110°54.6528	2218	18:14:21	Sheets, thin sediment blanket, too far to the NW
37°46.5272 / 110°54.6369	2217	18:16:40	Young glassy basalt which may have covered a part of the hydrothermal field
37°46.5270 / 110°54.6200	2219	18:19:21	Large old pillows and young glassy basalt, bottom water is still very cloudy due to sediment plume
37°46.5326 / 110°54.6340	2219	18:21:57	Glassy sheets and pillows slightly sedimented
37°46.5417 / 110°54.6374	2216	18:24:40	Still glassy sheet flow with thin sediment cover
37°46.5416 / 110°54.6427	2218	18:26:58	Young sheets and older sedimented pillows
37°46.5553 / 110°54.6147	2218	18:30:53	Large sulfide blocks surrounded by sulfide talus
37°46.5563 / 110°54.6142	2218	18:31:43	Attempt to sample, sample lost
37°46.5577 / 110°54.6346	2210	18:35:44	Sediment covered talus
37°46.5577 / 110°54.6354	2217	18:36:27	Blocky material, big chimney
37°46.5582 / 110°54.6349	2219	18:36:57	Attempt to sample a chimney, several sulfide pieces in the grab
37°46.5637 / 110°54.6281	2206	18:41:32	Off bottom and end of station

Station 39-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
38°04.2495 / 110°59,6160	9	15:01:20	on station
38°04.2288 / 110°59.6278	2075	15:45:44	Video cameras turned on, temperature and conductivity are diverting which may be indicative for a hydrothermal plume
38°04.2259 / 110°59.6458	2164	15:48:20	Bottom contact, old slightly sedimented pillows and pillow talus
38°04.2408 / 110°59.6446	2167	15:50:24	White sponges and patchy sediment on pillow and tube talus, few holothurians
38°04.2706 / 110°59.6511	2156	15:53:21	Off bottom and end of station due to technical problems
38°04.2791 / 110°59.6628	2115	15:54:34	Video cameras turned off

Station 66-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
39°24.0862 / 111°18.1476	0	23:11:07	OFOS-66 is targeted in a NNE-SSW direction towards the axial high and will hopefully continue into the cleft area starting at 39°28.5'S
39°23.9843 / 111°18.4577	2104	23:59:56	Video cameras turned on
39°24.0029 / 111°18.4484	2218	00:03:09	Bottom contact
39°24.0065 / 111°18.4487	2226	00:03:56	Large pillow and sheet flow
39°24.0102 / 111°18.4485	2225	00:04:32	Sheet flows are slightly covered by sediments
39°24.0216 / 111°18.4493	2229	00:06:05	Sheet lava with some sediment cover
39°24.0258 / 111°18.4554	2228	00:06:58	Bresingiid on a pillar
39°24.0295 / 111°18.4644	2229	00:07:42	Some large tubes
39°24.0350 / 111°18.4786	2228	00:09:05	Large pillows, still glassy material, sediment cover is very thin
39°24.0399 / 111°18.4868	2227	00:10:11	Sponge, rat tail, tube lava, hyocriantos
39°24.0494 / 111°18.4900	2227	00:11:30	Lava is dominantly sheet like, on the fringes of the flows transition to tubes and pillows
39°24.0561 / 111°18.4931	2226	00:12:24	Large pillows next to lava sheet, rat tail
39°24.0629 / 111°18.4984	2227	00:13:30	Sponge, large glassy pillow, slightly sedimented, dominantly sheet like
39°24.0660 / 111°18.5064	2228	00:14:14	Rat tail, hyaloclastite is resedimented and preferentially located in the depressions
39°24.0742 / 111°18.5402	2228	00:16:26	Large tube lava, thin sediment cover
39°24.0764 / 111°18.5470	2229	00:17:20	Eel shaped fish
39°24.0819 / 111°18.5525	2229	00:18:38	Large pillows, dominantly sheet flow
39°24.1016 / 111°18.5572	2231	00:21:20	Lobate lava, sediment accumulated in the depressions between the individual tubes and lobes
39°24.1070 / 111°18.5605	2230	00:22:09	1.5 m large tubes and pillows
39°24.1120 / 111°18.5657	2227	00:22:51	Going up hill, clear transition from sheet to pillow lava, only little glassy material, sediment accumulated in the depressions between the pillows
39°24.1161 / 111°18.5760	2224	00:24:00	Sponge, rat tail
39°24.1210 / 111°18.5822	2225	00:24:56	2 m in diameter tubes and pillows
39°24.1302 / 111°18.5852	2219	00:26:11	Scattered talus material on the lobate lava
39°24.1357 / 111°18.5900	2224	00:27:08	Intensely sedimented tubes and pillows, sponge
39°24.1408 / 111°18.5977	2224	00:28:13	Several meters large pillows and tubes, rat tail
39°24.1427 / 111°18.6110	2223	00:29:16	The large old tubes are sedimented and probably belong to a larger pillow mound, actinie
39°24.1537 / 111°18.6265	2217	00:32:39	Several meters large pillows, sedimented
39°24.1770 / 111°18.6241	2211	00:35:01	Large old tubes and pillows, sedimented
39°24.1854 / 111°18.6332	2213	00:36:03	Sponge on old several meters large pillow
39°24.1914 / 111°18.6444	2213	00:36:52	Rat tail, large old pillows, sedimented, sponge
39°24.2062 / 111°18.6768	2213	00:39:11	Several meters large old pillows and tubes, sedimented
39°24.2206 / 111°18.6697	2211	00:40:49	Rat tail, large old pillows, slightly sedimented
39°24.2272 / 111°18.6633	2208	00:41:35	Collapsed pillow, flat fish
39°24.2364 / 111°18.6491	2210	00:42:41	Bresingiid, less sedimented several meters large pillows and tubes
39°24.2421 / 111°18.6364	2209	00:43:32	Bresingiid (?), large old pillows, slightly sedimented
39°24.2506 / 111°18.6123	2211	00:44:56	Rat tail, old large pillows, slightly sedimented
39°24.2612 / 111°18.5931	2209	00:46:24	Large old pillows, slightly sedimented
39°24.2778 / 111°18.5883	2209	00:48:02	Sheet like lava, some lobate lava, rat tail
39°24.2876 / 111°18.5976	2210	00:48:54	Several meters large old pillows, slightly sedimented
39°24.3035 / 111°18.6220	2207	00:50:56	Several meters large tubes, slightly sedimented, sponge
39°24.3100 / 111°18.6282	2200	00:51:58	Lobster, vent fish, large old tubes, slightly sedimented
39°24.3150 / 111°18.6297	2197	00:52:38	Climbing up the pillow mound
39°24.3249 / 111°18.6299	2192	00:53:50	Bresingiid, old lava tubes, slightly sedimented, east facing scarp
39°24.3385 / 111°18.6337	2192	00:55:08	Some resedimented hyaloclastite in the sediment between individual pillows
39°24.3495 / 111°18.6440	2191	00:56:35	Rat tail, old pillows (several meters in diameter), some

Station 66-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
			sediment
39°24.3749 / 111°18.6449	2195	00:59:28	Actinie, strong bottom current
39°24.3999 / 111°18.6388	2202	01:01:41	Large tubes and pillows, slightly sedimented
39°24.4122 / 111°18.6414	2198	01:02:53	Swimming crinoid, large old pillows, slightly sedimented, sponges
39°24.4189 / 111°18.6455	2197	01:03:29	Gorgonaria on old pillow
39°24.4425 / 111°18.6769	2197	01:05:58	Several meters large old slightly sedimented pillows
39°24.4596 / 111°18.6972	2196	01:07:59	Sponge on old sedimented pillows, rat tail
39°24.4656 / 111°18.7056	2195	01:08:43	Possibly smoke in the water column
39°24.4838 / 111°18.7163	2202	01:10:40	Two rat tails, old and sedimented pillows and tubes
39°24.5115 / 111°18.7105	2199	01:13:18	Large sedimented pillows, rat tail, no glassy material, sponge
39°24.5190 / 111°18.7124	2198	01:14:00	Rat tail
39°24.5457 / 111°18.7363	2199	01:16:40	Two generations of tubes, the younger tubes are more glassy
39°24.5526 / 111°18.7405	2198	01:17:21	Gorgonaria, sponge
39°24.5593 / 111°18.7421	2199	01:18:01	Sponge on large old pillow, slightly sedimented
39°24.5823 / 111°18.7461	2203	01:20:12	Fracture in the pillow material
39°24.5959 / 111°18.7489	2201	01:21:33	Large fractures in the large tubes and pillows, some of them are several meters (ca. 3-4 m) in size
39°24.6227 / 111°18.7666	2200	01:24:23	Large (50 to 100 cm) tubes and pillows
39°24.6370 / 111°18.7844	2198	01:26:08	Large pillows (2-3 m in size), slightly sedimented, crinoid
39°24.6539 / 111°18.7908	2196	01:27:54	Sheets and some tubes, rat tail
39°24.6721 / 111°18.7924	2200	01:29:39	Sponge on large pillow that is slightly covered by sediments
39°24.6911 / 111°18.8040	2203	01:31:26	Five rat tails
39°24.6956 / 111°18.8086	2202	01:31:50	Large old pillows and tubes, slightly sedimented
39°24.6994 / 111°18.8121	2201	01:32:19	Actinie, rat tails
39°24.7148 / 111°18.8164	2192	01:33:56	Sponge on large old pillow
39°24.7306 / 111°18.8144	2191	01:35:22	Gorgonaria on old pillow
39°24.7523 / 111°18.8210	2196	01:37:02	Several rat tails
39°24.7611 / 111°18.8297	2192	01:37:55	Large (several meters) old pillows and tubes, slightly sedimented, sponges
39°24.7760 / 111°18.8436	2186	01:39:36	Small temperature and conductivity anomaly
39°24.7868 / 111°18.8521	2184	01:41:03	Large old and slightly sedimented pillows, rat tails
39°24.7921 / 111°18.8574	2181	01:41:45	Some staining on the lava, reddish staining
39°24.8117 / 111°18.8725	2181	01:43:38	Swimming crinoid, rat tails, some staining on the lava
39°24.8204 / 111°18.8797	2179	01:44:24	More swimming crinoids
39°24.8236 / 111°18.8823	2178	01:44:41	Swimming crinoid
39°24.8298 / 111°18.8889	2180	01:45:15	Abundant rat tails
39°24.8425 / 111°18.9000	2183	01:46:30	Several meters large tubes and pillows, slightly sedimented
39°24.8506 / 111°18.9044	2179	01:47:06	Broken pillows and some staining
39°24.8600 / 111°18.9094	2175	01:47:56	Stalked crinoid on old pillow lava, slightly sedimented
39°24.8802 / 111°18.9166	2159	01:49:44	Killing of a rat tail
39°24.8887 / 111°18.9192	2160	01:50:34	Several meters large tubes, slightly sedimented
39°24.9187 / 111°18.9184	2160	01:53:16	Actinie, large old and slightly sedimented tubes
39°24.9312 / 111°18.9173	2154	01:54:14	Swimming crinoid, less sedimented than previously
39°24.9383 / 111°18.9182	2158	01:54:54	Munidopsis
39°24.9485 / 111°18.9181	2156	01:55:39	Stalked sponge, tube lava, only very little sediment, several overlapping tubes
39°24.9693 / 111°18.9258	2156	01:57:29	Munidopsis, crinoid, large tubes, only little sediment cover
39°24.9843 / 111°18.9420	2156	01:58:54	Resedimented hyaloclastite
39°25.0281 / 111°18.9545	2149	02:02:46	Two munidopsis
39°25.0322 / 111°18.9551	2150	02:03:05	Munidopsis
39°25.0441 / 111°18.9562	2152	02:04:08	Large old lava tubes, very thin sediment cover

Station 66-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
39°25.0934 / 111°19.0021	2157	02:08:21	Changing video tapes
39°25.0980 / 111°19.0069	2159	02:08:44	Video cameras turned on
39°25.1161 / 111°19.0235	2163	02:10:31	Munidopsis, large old tubes
39°25.1276 / 111°19.0299	2170	02:11:25	Silica staining on fractures
39°25.1295 / 111°19.0310	2170	02:11:38	Silica staining along fractures
39°25.1481 / 111°19.0398	2169	02:12:54	Tubes are fractured and form local talus
39°25.1577 / 111°19.0452	2169	02:13:41	Different kind of munidopsis
39°25.1806 / 111°19.0582	2176	02:15:26	Large old interfingering tubes, thin sediment cover, sponge, actinie
39°25.1968 / 111°19.0680	2173	02:16:47	Bythograea, large old tubes, thin sediment cover
39°25.2196 / 111°19.0672	2170	02:18:39	Resedimented hyaloclastite next to the large tubes, thin sediment cover
39°25.2273 / 111°19.0641	2170	02:19:14	Munidopsis
39°25.2321 / 111°19.0625	2170	02:19:32	Munidopsis
39°25.2426 / 111°19.0605	2175	02:20:18	Munidopsis
39°25.2458 / 111°19.0616	2175	02:20:30	Large old pillows and tubes, very little sediment
39°25.2567 / 111°19.0646	2177	02:21:14	Rat tail, large old pillows and tubes, resedimented hyaloclastite next to large pillow
39°25.2676 / 111°19.0723	2180	02:22:03	Eel shaped fish
39°25.2703 / 111°19.0761	2181	02:22:16	Munidopsis
39°25.2821 / 111°19.0969	2184	02:23:19	Abundant local talus, silica stained
39°25.2954 / 111°19.1153	2172	02:24:32	Climbing up hill, large old tubes and some pillows, resedimented hyaloclastite
39°25.3113 / 111°19.1254	2163	02:25:53	Two munidopsis
39°25.3158 / 111°19.1265	2160	02:26:23	Munidopsis
39°25.3195 / 111°19.1269	2159	02:26:36	Four munidopsis, collapse pit
39°25.3405 / 111°19.1194	2159	02:28:19	Munidopsis, sponge on old large tubes and pillows, only little sediment cover
39°25.3578 / 111°19.1177	2169	02:29:42	Different kind of munidopsis
39°25.4572 / 111°19.1573	2118	02:41:10	The recording did not work for 8 minutes, passed a field with many munidopsis, talus field with well sorted talus material
39°25.4655 / 111°19.1626	2109	02:42:21	Large tubes, three actinies, slightly sedimented
39°25.4690 / 111°19.1723	2106	02:43:26	Small fracture, two munidopsis
39°25.4726 / 111°19.1756	2114	02:44:20	Silica staining
39°25.4745 / 111°19.1753	2123	02:44:53	Talus material and some scattered old pillows, slightly sediment colored
39°25.4787 / 111°19.1745	2127	02:45:28	Medium sized (20 to 50 cm) talus, poorly sorted
39°25.4917 / 111°19.1651	2140	02:46:59	Talus material on large old tubes and pillows, actinie
39°25.4995 / 111°19.1602	2136	02:47:36	Large old lava tubes, rat tail, thin sediment cover
39°25.5083 / 111°19.1542	2131	02:48:30	Rat tails and old tube lava, thin sediment cover
39°25.5124 / 111°19.1545	2127	02:49:20	Broken material derived from a fractured lava tube, silica staining
39°25.5142 / 111°19.1565	2125	02:49:47	Munidopsis
39°25.5177 / 111°19.1609	2124	02:50:18	Resedimented hyaloclastite in depressions between individual tubes
39°25.5309 / 111°19.1665	2125	02:52:14	Large tubes, slightly sedimented, sponge
39°25.5351 / 111°19.1642	2123	02:52:47	Several rat tails
39°25.5403 / 111°19.1619	2125	02:53:16	Eel like fish, old tube lava and some pillows
39°25.5473 / 111°19.1585	2127	02:54:04	Several rat tails
39°25.5750 / 111°19.1546	2138	02:58:12	Large talus material, gorgonaria
39°25.5868 / 111°19.1499	2135	02:59:40	Different kind of munidopsis, sponge, gorgonaria
39°25.5896 / 111°19.1503	2132	03:00:08	Large broken material of former sheet lava
39°25.5954 / 111°19.1544	2129	03:01:27	Large fracture
39°25.5970 / 111°19.1577	2129	03:01:48	Large talus material and relatively steep scarp
39°25.5961 / 111°19.1720	2118	03:03:13	Large talus blocks, sponge
39°25.5972 / 111°19.1748	2113	03:03:43	Several rat tails
39°25.5972 / 111°19.1747	2116	03:04:02	Large pillows and tubes, only slightly sedimented

Station 66-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
39°25.6010 / 111°19.1746	2117	03:04:40	Fracture, large talus blocks of pillow lava, slightly sedimented
39°25.6086 / 111°19.1723	2115	03:05:32	Munidopsis
39°25.6159 / 111°19.1676	2116	03:06:19	Large old pillows and tubes, slightly sedimented
39°25.6389 / 111°19.1605	2119	03:08:32	Large old tubes and pillows, thin sediment cover, no glassy material
39°25.6495 / 111°19.1618	2120	03:09:56	Large pillows, slightly sedimented
39°25.6598 / 111°19.1641	2121	03:11:38	Very large (several meters) talus blocks, several rat tails
39°25.6659 / 111°19.1695	2124	03:12:47	Large loose bocks of pillow basalt, sponge, munidopsis, eel like fish
39°25.6776 / 111°19.1697	2123	03:14:15	Large pillows, different kind of munidopsis, slightly covered by sediments
39°25.6998 / 111°19.1767	2123	03:17:20	Well sorted talus material, blocky and angular material, some staining
39°25.7163 / 111°19.1864	2104	03:19:33	Steep scarp
39°25.7324 / 111°19.1836	2113	03:20:55	Large old pillows, thin sediment cover
39°25.7541 / 111°19.1702	2110	03:22:59	Lobate lava
39°25.7564 / 111°19.1688	2111	03:23:19	Munidopsis, different kind of munidopsis on large talus blocks
39°25.7720 / 111°19.1671	2115	03:25:30	Large fissure
39°25.7870 / 111°19.1713	2119	03:27:54	Large old tubes and pillows, rat tail, some sediment cover
39°25.8139 / 111°19.1689	2126	03:30:29	Large old tubes and pillows, slightly sedimented
39°25.8272 / 111°19.1800	2126	03:33:21	Increasing amounts of sediment on the pillows and tubes
39°25.8301 / 111°19.1816	2127	03:34:07	Different kind of munidopsis
39°25.8392 / 111°19.1785	2128	03:35:01	Munidopsis
39°25.8554 / 111°19.1703	2130	03:36:06	Different kind of munidopsis
39°25.8672 / 111°19.1588	2134	03:36:55	Large tubes and pillows, relatively old, some sediment cover, munidopsis
39°25.8792 / 111°19.1502	2134	03:37:40	Several munidopsis
39°25.8909 / 111°19.1385	2139	03:38:34	Large tube and pillow talus
39°25.9060 / 111°19.1259	2137	03:39:48	Talus material, poorly sorted
39°25.9124 / 111°19.1200	2124	03:40:56	Actinie
39°25.9104 / 111°19.1180	2120	03:42:04	Different kind of munidopsis (lithodidae ?)
39°25.9089 / 111°19.1168	2120	03:42:35	Large tubes and pillows, slightly sedimented, some talus material
39°25.9083 / 111°19.1155	2115	03:43:17	Rat tail, paralomis, old tubes and pillows, thin cover of sediment
39°25.9410 / 111°19.1159	2115	03:47:20	Talus material and a steep scarp
39°25.9557 / 111°19.1196	2101	03:48:50	Old tubes and pillows, several meters in size, abundant sediment
39°25.9699 / 111°19.1333	2096	03:50:59	Large tubes and pillows, intensely sedimented, sponge
39°25.9686 / 111°19.1402	2094	03:51:32	Different kind of munidopsis, intensely sedimented tube lava
39°25.9653 / 111°19.1498	2091	03:52:06	Small temperature anomaly
39°25.9611 / 111°19.1627	2095	03:53:05	Swimming crinoid
39°25.9613 / 111°19.1682	2092	03:53:32	Munidopsis
39°25.9613 / 111°19.1697	2091	03:53:38	Actinie, large tubes, relatively thick sediment cover
39°25.9681 / 111°19.1804	2079	03:55:12	Swimming crinoid
39°25.9712 / 111°19.1859	2074	03:55:43	Several munidopsis, old tube lava
39°25.9748 / 111°19.1933	2069	03:56:16	Increasing munidopsis number
39°25.9797 / 111°19.2001	2068	03:56:55	Sponge, munidopsis, old tube lava
39°25.9932 / 111°19.2208	2071	03:58:36	Large old pillows and tubes, several meters in size
39°25.9949 / 111°19.2296	2067	03:59:09	Many crustaceans
39°25.9925 / 111°19.2439	2066	03:59:54	Several munidopsis, large old pillows, sediment covered
39°25.9890 / 111°19.2503	2065	04:00:22	Pond of sediment between two lava tubes
39°25.9871 / 111°19.2574	2061	04:00:47	Abundant different kind of munidopsis
39°25.9827 / 111°19.2724	2058	04:02:10	Actinie

Station 66-OFOS Lat. (S) / Long. (W)	Depth (m)	Time (UTC)	Comment
39°25.9851 / 111°19.2781	2063	04:02:39	Abundant lobsters
39°25.9883 / 111°19.2828	2074	04:03:10	Talus material, medium sized (20-60 cm), thin sediment cover
39°26.0036 / 111°19.2966	2074	04:04:29	Abundant lobsters, tube lava, thin sediment cover
39°26.0187 / 111°19.3173	2078	04:05:50	Sponge, large tubes, no glassy material, abundant lobsters
39°26.0323 / 111°19.3136	2081	04:06:59	Old large pillows and tubes
39°26.0567 / 111°19.3280	2089	04:09:13	Large old pillows and tubes, thin sediment cover
39°26.0735 / 111°19.3395	2102	04:10:52	Actinie, sponge, crabs
39°26.0841 / 111°19.3462	2106	04:11:42	Large tubes, several meters in size
39°26.0946 / 111°19.3509	2107	04:12:30	Eel like fish, munidopsis, large old tubes, scattered talus with large pillow fragments
39°26.1119 / 111°19.3475	2105	04:13:46	Poorly sorted talus
39°26.1297 / 111°19.3473	2096	04:15:11	Well sorted, medium sized talus material, blocky and angular
39°26.1406 / 111°19.3499	2086	04:16:05	Old gorgonaria on talus field, medium sized, blocky and angular
39°26.1489 / 111°19.3546	2079	04:16:56	Red staining
39°26.1497 / 111°19.3568	2074	04:17:07	Stained talus material, medium sized (20-50 cm)
39°26.1594 / 111°19.3680	2054	04:18:19	Gorgonaria on steep slope
39°26.1694 / 111°19.3719	2052	04:19:12	Sponge, dead gorgonarias
39°26.1882 / 111°19.3800	2052	04:20:43	Large pillow and tube fragments, thin sediment cover, actinie
39°26.1936 / 111°19.3832	2053	04:21:12	Dead gorgonarias
39°26.2065 / 111°19.3850	2054	04:22:13	Abundant dead gorgonarias
39°26.2209 / 111°19.3811	2059	04:23:14	Large gorgonaria
39°26.2385 / 111°19.3838	2073	04:24:19	Crab and lobsters, large talus material of pillows, slightly sedimented
39°26.2495 / 111°19.3890	2079	04:25:09	Large talus blocks, several meters in size, fractured pillows and some angular fragments
39°26.2553 / 111°19.3927	2082	04:25:46	Some staining on the talus
39°26.2583 / 111°19.3935	2083	04:26:07	Steep wall
39°26.2726 / 111°19.3974	2085	04:27:26	Sponge on talus material, talus contains some large pillow and tube fragments
39°26.2919 / 111°19.3952	2090	04:28:58	Dead gorgonarias on large old tubes, slightly sedimented
39°26.2983 / 111°19.3931	2095	04:29:26	Increasing sediment abundance
39°26.3128 / 111°19.3929	2102	04:30:33	Locally there is still some glass attached to the pillows and tubes
39°26.3388 / 111°19.4054	2120	04:33:02	Some large talus blocks
39°26.3426 / 111°19.4086	2121	04:33:27	Several meters large tubes, rat tail
39°26.3563 / 111°19.4104	2124	04:34:37	Several meters large lava tubes, no glassy material, thin sediment cover
39°26.3860 / 111°19.4073	2117	04:36:46	Huge tube and pillow fragments in talus
39°26.4065 / 111°19.4136	2123	04:38:08	Actinie on large pillow fragments
39°26.4192 / 111°19.4242	2122	04:39:22	Munidopsis on talus material, poorly sorted, gorgonaria
39°26.4258 / 111°19.4287	2114	04:40:12	Gorgonaria on pillow fragments, thin sediment cover
39°26.4364 / 111°19.4323	2106	04:41:09	Several meters large tube lava
39°26.4414 / 111°19.4325	2106	04:41:37	Sponge on large old pillows
39°26.4675 / 111°19.4249	2101	04:43:25	Several meters large tubes and pillows, thin sediment cover, rat tail, sponge
39°26.4823 / 111°19.4202	2103	04:44:22	Abundant tube lava, rat tail, very thin sediment cover
39°26.4904 / 111°19.4234	2105	04:45:02	Sponge, no sediment cover on top of the tube lava
39°26.4991 / 111°19.4343	2104	04:45:59	Off bottom and end of station