

Seabed Video and Photographic Survey — Berth “B” and Cable Route

Minas Passage Tidal Energy Study Site

Based on Surveys on
July 2-3 and August 4-5, 2009

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Fundy Ocean Research Centre for Energy (FORCE)

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MARINE SURVEY REPORT
FUNDY TIDAL POWER RESEARCH AND DEVELOPMENT PROJECT

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EXECUTIVE SUMMARY

In 2008-2009, the Province of Nova Scotia contracted Minas Basin Pulp and Power Limited to establish a Tidal Energy Demonstration Facility to provide test facilities for tidal energy technologies in Nova Scotia’s Bay of Fundy. This report contains video images and still photographs of the seabed obtained in 2009 at Berth “B” and its proposed cable route to shore, one of three locations designated for tidal device installations at the test facility in northern Minas Passage, west of Cape Sharp. Surveys encompassing Berth “B” were carried out on July 2-3 and August 4-5, 2009 to provide input to the site selection process for the turbine deployment. Seabed surficial geology and biological communities observed at the site were representative of several of the major types observed in previous baseline studies (2008) over the broader extent of the tidal demonstration site.

INTRODUCTION

In 2007, the Province of Nova Scotia initiated a process aimed at developing tidal energy resources of the Bay of Fundy, as part of its strategy to meet Provincial renewable energy goals. The process resulted in the completion of a Strategic Environmental Assessment (SEA) in early 2008, which assessed the Bay of Fundy environment and potential impacts of various tidal energy technologies, and subsequently resulted in the award of initial funding to support the creation of a tidal energy demonstration facility in the Bay. The concept for the Tidal Energy Demonstration Facility was developed by Minas Basin Pulp and Power Company Limited, the successful contractor in the process; necessary background geophysical surveys and seabed photographic surveys were done and assessed; public consultation, a review of shipping traffic and local lobster fisheries was carried out; and a suitable demonstration site was chosen in northern Minas Passage slightly west of Cape Sharp in 2008. Subsequently, three berths (circular areas of the seabed 200 m in diameter) and associated cable routes to shore were selected for use by tidal device providers/consortia initially expressing interest, including the teams of Minas Basin Pulp and Power/Marine Current Turbines; Nova Scotia Power Inc (NSPI)/OpenHydro; and Clean Current/Alstom. The oversight body for the facility, the Fundy Ocean Research Centre for Energy (FORCE) was duly established in late 2009.

The tidal energy research facility includes three installation berths (A, B, & C) to be occupied by tidal energy device providers, each of which has an associated cable route to shore (International Telecom 2009), and an associated shore facility to provide a connection to the power grid. Berth “C” was the first scheduled to be occupied, proposed for a deployment of the NSPI/OpenHydro turbine¹ while Berth “A” and Berth “B” were designated for subsequent development. Video and 35 mm photographs to assess seabed geology and bottom characteristics was obtained at Berth “B” in July and August 2009, to give broad coverage of the installation site. This report summarizes information on geology and benthic communities obtained in seabed imagery obtained at Berth “B” and the associated cable route.²

METHODS

The present study was carried out to obtain detailed site-specific information from Berth “B” and the associated cable route to shore, areas which were not covered in the 2008 baseline video and photographic surveys (Envirosphere Consultants Limited 2008a & b). Surveys at Berth “B” took place on July 2-3 and August 4-5, 2009, from *Tide Force*, a 50’ lobster boat operated by Mr. Mark Taylor out of Halls Harbour, Nova Scotia. For positioning, a DGPS (Hemisphere, VS100 GPS Compass receiver, 0.6 m accuracy) and computer navigation software (WinFrog Integrated Navigation System, Fugro Pelagos Inc.) operated by Seaforth Geosurveys, Dartmouth, Nova Scotia, was used to both acquire and log position information.

A Sony Hi-8 handycam in an Amphibico® underwater housing (field of view of about 52.5 cm wide and 40 cm high (0.2 m²)) and SLD10 underwater light, both mounted in a protective aluminum frame (July & August), and a Benthos® deep-sea 35 mm camera with strobe, mounted on a 225 kg steel frame (July only), (1 m² area at the typical distance of 1 m above the bottom) were deployed from the vessel 30 minutes to up to 1 hour before and after slack tide, at current speeds from zero to moderate (up to about 3-4 kts).

¹ Deployed on November 12, 2009.

² Separate reports are available for Berths “A” and “C” and their associated cable routes.

Six locations at Berth “B” were pre-selected by the marine geological consultant (G. Fader, Atlantic Marine Geological Consulting) to give broad coverage of the site, a 200 m diameter circle centred on 45° 21’ 57.5820” N, 64° 26’ 12.6024” W, to assist in geological interpretation both locally and for the demonstration project area as a whole. As well, video was obtained along the centerline of the proposed cable route for Berth “B”. Following the survey, the video was digitized and still frame images as well as video from the sites were captured using video editing software (Barra Video, Halifax). Several cross sections of seabed features inside and adjacent to Berth “B” were extracted by Seaforth Geosurveys from the digital elevation model for the seabed at the site.

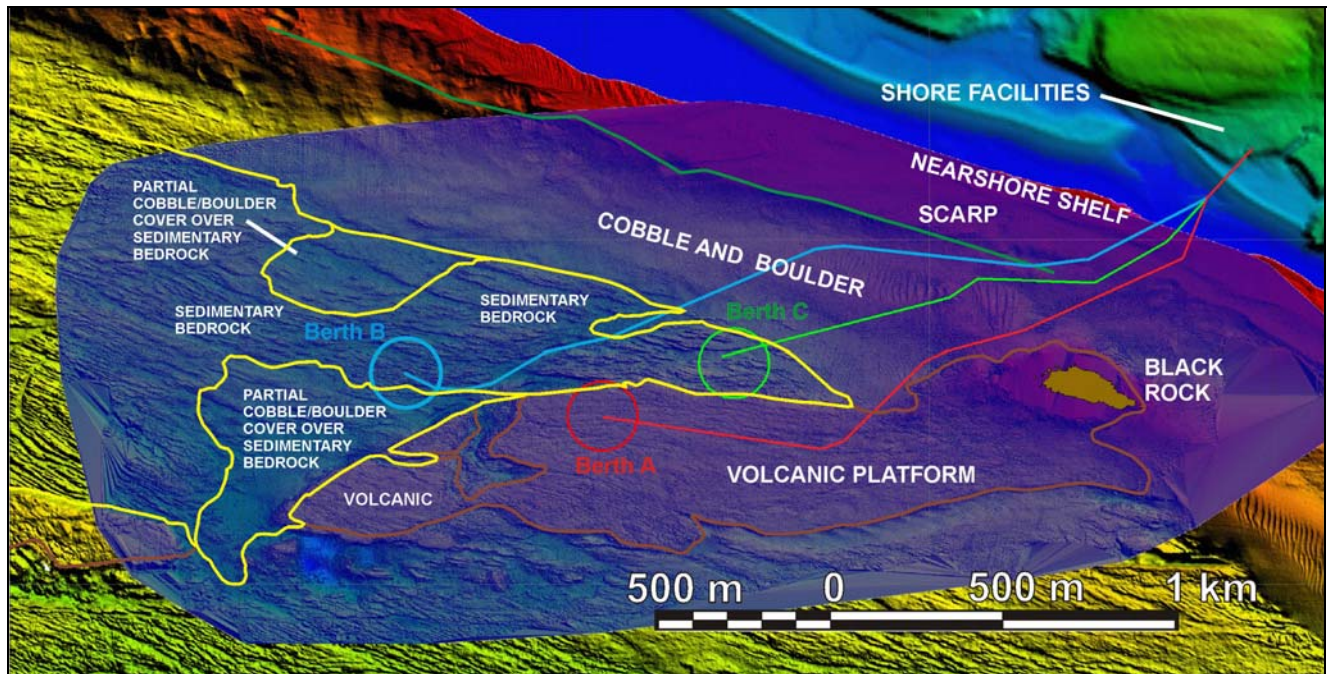


Figure 1. Surficial geology interpretation and locations of tidal turbine berths and proposed, cable routes, December 2009. Geology interpretation based on AMGC (2009).

RESULTS AND DISCUSSION

General

Maps of station locations, image captures and bottom photographs, as well as a DVD of the video for each survey are presented in Appendices A to C. Berth “B” is the furthest of the turbine berths from shore, as well as the deepest, and occurs in an area dominated by sedimentary bedrock outcrops (sandstone and intervening siltstone/mudstone) on the northern edge of a deeper basin with cobble and boulder predominant as characterized by AMGC (2009)(Figure 1 & 2). The seabed over most of the berth site is about 47 m below MLW, (average 47.1, ranging from 41.5 to 52.1 m)(Seaforth Engineering, Dartmouth, Nova Scotia, personal communication), and slopes gradually upward to the northeast, with bands of protruding outcrops of sandstone bedrock aligned WNW separated by level areas floored by cobble & boulder and occasional exposures of siltstone/mudstone

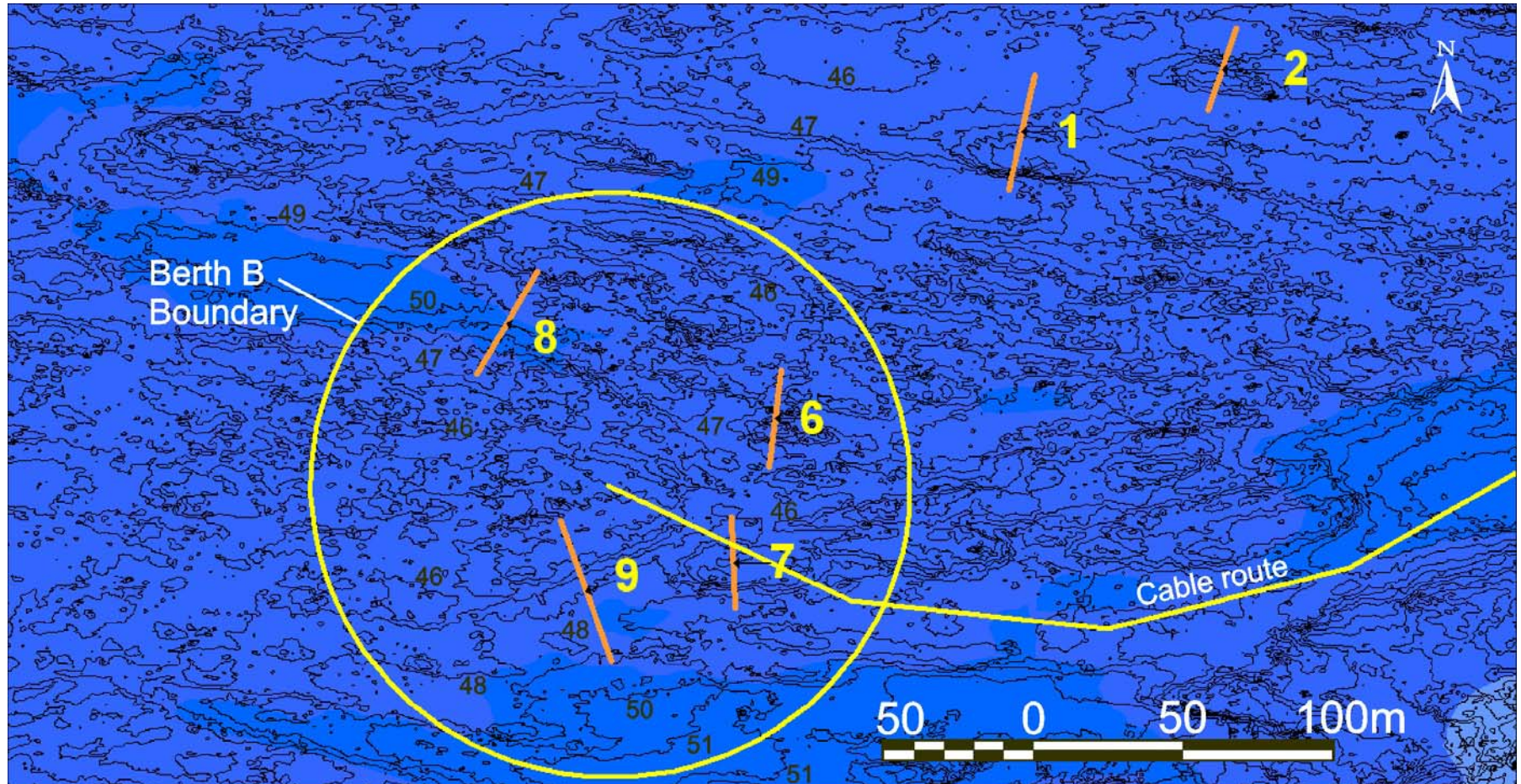


Figure 2. Bottom contours and locations of cross-sectional profiles from Berth B.

bedrock. The cable route to shore (Figure 1) extends along a long, linear, fault-like feature floored by sandstone and mudstone bedrock, frequently exposed, with overlying cobble and boulder, which cuts through the areas of sedimentary bedrock outcrops. Leaving the zone of sedimentary bedrock outcrops, the cable route crosses a zone dominated by boulder, cobble and gravel, and then runs eastward at the base of a scarp formed by the nearshore shelf in the area. Eventually, the cable route rises abruptly up the scarp onto a gravel shelf which borders the shore in the vicinity of the proposed cable landfall (Figure 1).

Berth Site

Bottom Type—The center of the 200 m diameter circle which delineates Berth “B” is approximately 1.8 km west of Black Rock. Berth “B” is located in an area dominated by sandstone bedrock ridges interspersed with troughs where softer siltstone/mudstone bedrock occurs, usually overlain by coarse material, predominantly cobble and boulder with occasional gravel and sand (Figures 3-13). Sandstone bedrock outcrops have a rough and irregular surface (Figure 3), while siltstone/mudstone in the troughs is usually smooth with small pits as well as rounded depressions (Figures 5, 7 & 11), and typically reddish and mottled with patches and stripes of grey. Bedrock features at Berth “B” appear more rounded and smooth than in earlier observations from other areas (e.g. Figure 6). The topography is quite irregular in the vicinity of sedimentary bedrock outcrops and level in the intervening troughs (Figures 2 & 4). Cobbles and boulders are derived from rock types in the area and as remnant material from earlier erosion of glacial till and glaciomarine sediments (AMGC 2009). This bottom type is an extension of the sedimentary bedrock outcrops which occurs more widely in the tidal demonstration site study area as a whole (AMGC 2009).

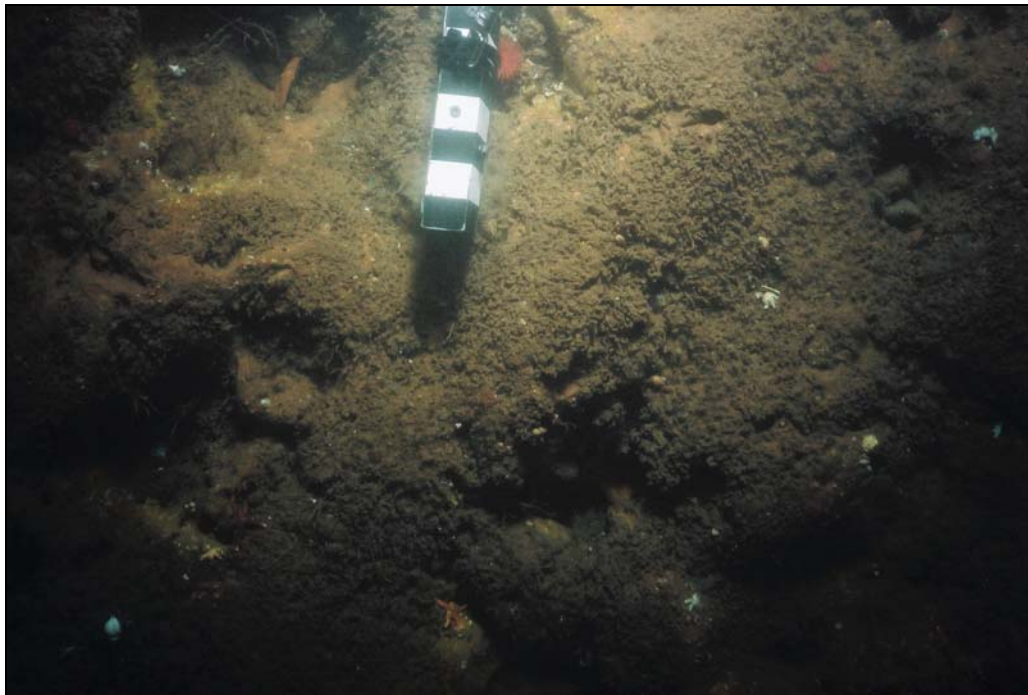


Figure 3 . Sandstone bedrock overlain by biolayer of tube building organisms, with barnacles, blood stars (*Henricia sanguinolenta*), juvenile sea stars, hermit crabs (in snail shells). Station BEN-B17-1, July 2009, Appendix B. Scale units are 2 cm.

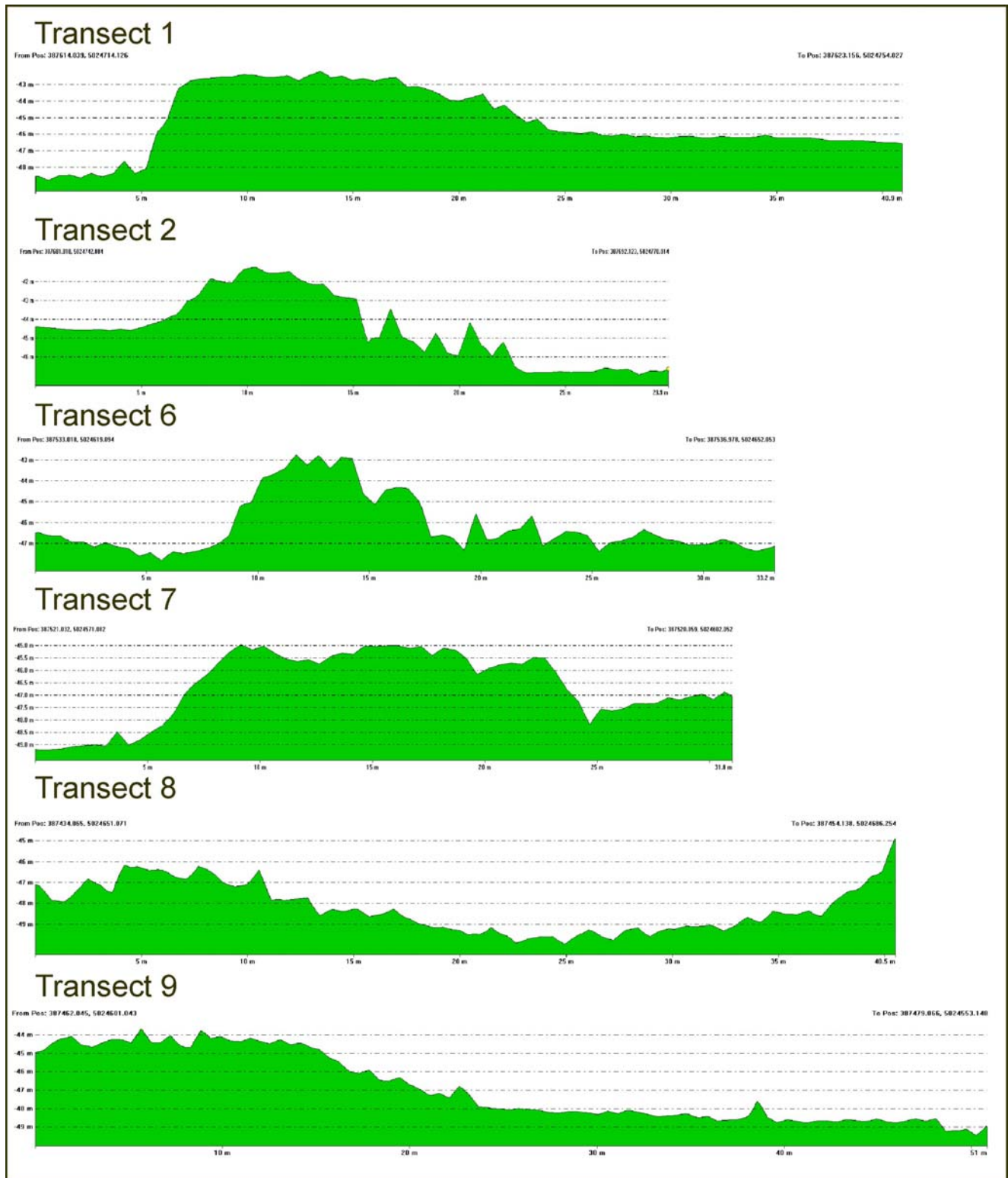


Figure 4. Cross sections in the vicinity of Berth B. For locations, see Figure 2.



Figure 5. Mudstone bedrock with pitting and depressions, and attached snail, seastar, and northern red anemone, at Berth “B”, Station BEN-B13-5, July 2009, Appendix B. Vertical dimension of photo is ~1 m.



Figure 6. Rounded sandstone bedrock at Berth “B”, including northern red anemone, blood star, juvenile seastars, breadcrumb sponge, ‘biolayer’ and barnacles. Station BEN-B13-6, July 2009, Appendix B. Vertical dimension of photo is ~1 m.

Biological Communities—Biological communities at Berth “B” resembled those sampled in the zone of sedimentary bedrock ridges in the 2008 surveys. The Northern Red Anemone (*Urticina felina*), the yellow, encrusting breadcrumb sponge (*Halichondria panicea*) and the red, blood star (*Henricia sanguinolenta*) occurred and were dominants, as they were in the broader study area (Table 1). Breadcrumb sponge occurred principally on bedrock but also on larger boulders. A surface ‘biolayer’ of tube-building organisms (presumably polychaete worms and amphipods (small crustaceans)) characteristically blanketed many sandstone bedrock surfaces; barnacles, juvenile seastars (possibly *Asterias* sp) and occasional hermit crabs occurred. A crab, possibly the Northern Stone Crab (*Lithodes maja*) was seen in video at Station B13-2. Many of the exposures of red mudstone bedrock had pits, suggested to be the holes of boring clams (Figure 14). Abundance and diversity appears to be relatively high in this area, with the irregular surfaces likely reducing currents there, allowing more ready attachment and providing an enhanced food regime (i.e. trapping particles).



Figure 7. Cobbles and boulders on exposed mudstone bedrock, showing ‘biolayer’ including tubes on edge of boulder, yellow breadcrumb sponge, northern red anemone, juvenile seastars, barnacles, hermit crabs and snails, Station BEN-B13-3, July 2009. Vertical dimension of photo is ~ 1 m.



Figure 8. Sandstone bedrock at Berth “B”, covered in ‘biolayer’ of tube-building organisms, patches of breadcrumb sponge (yellow), northern red anemone and juvenile seastars. A toad crab (*Hyas* sp) is at the top of the photo. Station B13-2-B, Appendix A. Scale units are 10 cm.



Figure 9. Sandstone bedrock at Berth “B” with ‘biolayer’ juvenile seastars, and attached ‘edge fauna’ of organism tubes. Station B13a-2-B, Appendix A. Scale units are 10 cm.



Figure 10. Mudstone bedrock at Berth “B”, with juvenile seastars, blood stars, northern red anemone, barnacles, and breadcrumb sponge. Station BJ12-12-B, Appendix A. Scale units are 10 cm.



Figure 11. Clean cobble over mudstone bedrock at Berth “B”. Station B12-1-B, Appendix A. Vertical dimension of image is ~ 30 cm.



Figure 12. Clean cobble to boulder in trough between bedrock ridges at Berth “B”, Station BEN-B13-2, July 2009, Appendix B. Vertical dimension of image is ~ 1 m.



Figure 13. Clean gravel to cobble and boulder in trough at Berth “B”, Station BEN-B16-1, July 2009, Appendix B. Vertical dimension of image is ~ 1m.

Cable Route

Bottom Type—The cable route from Berth “B” follows a trench-like feature in the zone of sedimentary bedrock ridges for about a kilometer eastward to the transition to predominantly cobble and boulder bottom which separates the bedrock ridges from the nearshore shelf (Figure 1, Figures 15-24 & Appendix C). In the trench, exposures of sandstone/mudstone bedrock are common, together with the occurrence of cobbles and small boulders. Clean cobble and boulder bottom with occasional well-sorted gravel and even coarse sand predominates shoreward of the end of the trench (approximately from video station BC22 shoreward, Appendix C). As the cable route reaches the edge of the nearshore shelf, the incidence of boulder bottom increases. This bottom type continues as the cable route follows eastward along the toe of the slope. Rising up the slope to make the landfall, cobble and boulder predominates on the break of the slope, and gravel to cobble bottom predominates on the remainder of the shelf.

Biological Communities—The trench through which the cable route runs through the sedimentary bedrock ridges east of Berth “B” is relatively devoid of organisms, with the exception of the occurrence of Breadcrumb Sponge, which is relatively common on larger boulders, and attached organisms such as barnacles, and hermit crabs. Where the bedrock zone transitions into cobble to boulder, occurring about 1 km east of Berth “B”, occurrence of the sponges drops off, but the species

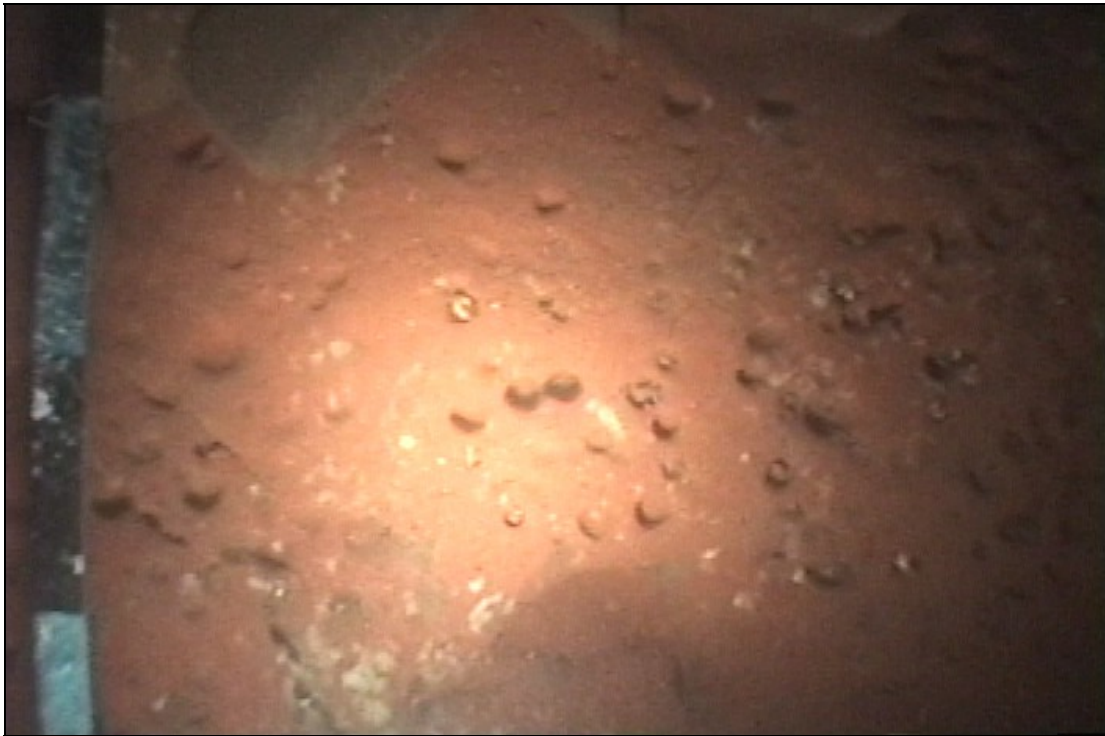


Figure 14. Boring clam burrows in mudstone bedrock along cable route at edge of Berth “B”, Station BC42-1-B, Appendix C. Scale units are 10 cm.

still occurs occasionally on larger boulders (e.g. Figure 19). Little in terms of visible biological communities occurs along the cable route where it crosses the cobble to boulder bottom which separates the sedimentary bedrock from the nearshore shelf (Figure 1). In the bouldery area at the base of the slope of the nearshore shelf, a ‘biolayer’ of tube-building organisms develops on boulders, and a community including seastars and barnacles occurs. Rising up to the break of the shelf, gravel to cobble bottom supports seaweeds (typically red seaweeds such as *Palmaria palmata* and encrusting corallines) as well as attached organisms such as barnacles, and commonly with occurrences of the erect bryozoan *Flustra foliacea*. Closer to shore, a patchy kelp bed dominated by *Laminaria longicruris* develops, in a community which continues to include seaweeds such as *Palmaria* and possibly *Chondrus crispus* and *Fucus*, as well as corallines. The kelp bed was not observed in the earlier surveys; individual fronds observed in the present study were large enough to be older than one year, and appear to be anchored and stable enough to resist ice abrasion and the strong currents. Other organisms in the subtidal communities were similar to those observed in 2008.



Figure 15. Exposed sandstone bedrock with ‘biolayer’ and other tube-building organisms along cable route, near Berth “B” (Station BC38-3-B, Appendix C). Vertical dimension of image is ~ 30 cm.



Figure 16. Exposed, streaked mudstone along cable route in zone of sedimentary bedrock ridges. ‘Biolayer’ occupies some surfaces. Station BC31-3-B, Appendix C. Vertical dimension of image is ~ 30 cm.



Figure 17. Well sorted gravel to cobble wave along Berth “B” cable route, Station BC17-3-B, Appendix C. Vertical dimension of image is ~ 30 cm.



Figure 18. Mixed coarse sand, gravel, cobble and boulder along cable route for Berth “B”, Station BC21-3-B, Appendix C. Breadcrumb sponge on basalt boulder shows zone of bedload scour near the seabed. Scale units are 10 cm.



Figure 19. Base and slope of nearshore shelf are dominated by boulders, often covered with ‘biolayer’ of tube-building organisms, and, in this case, with a seastar, probably *Asterias* sp. Station BC4-2-E, Appendix C. Scale units are 10 cm.

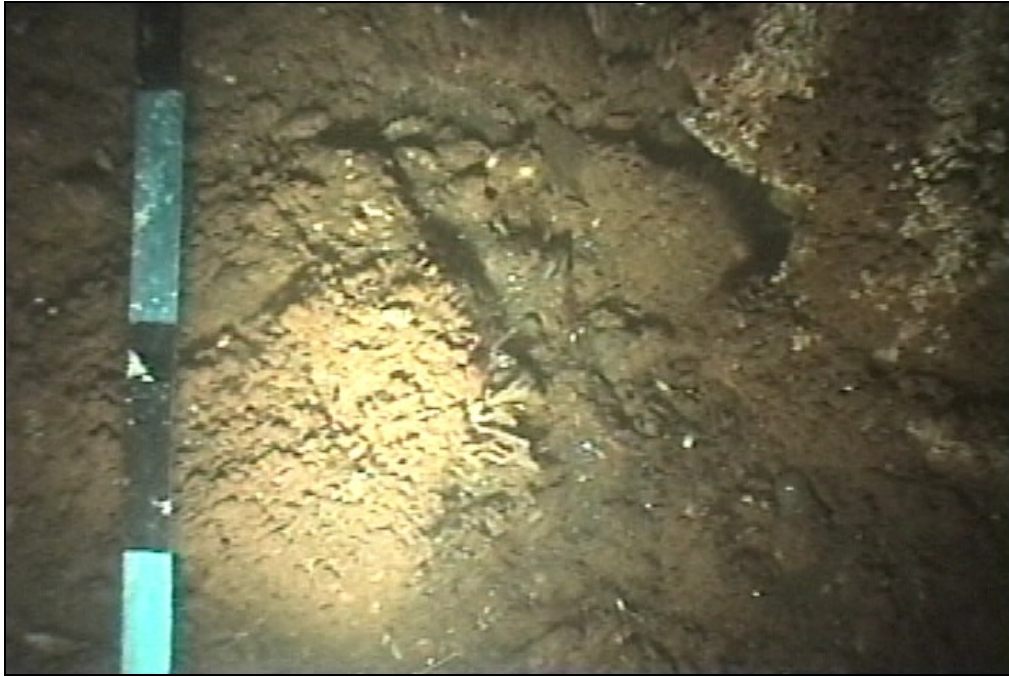


Figure 20. Cobble and boulder bottom on slope of nearshore shelf, showing ‘biolayer’ of tube-building organisms, and erect bryozoans (*Flustra foliacea*). Station BC4-1-B, Appendix C. Scale units are 10 cm.

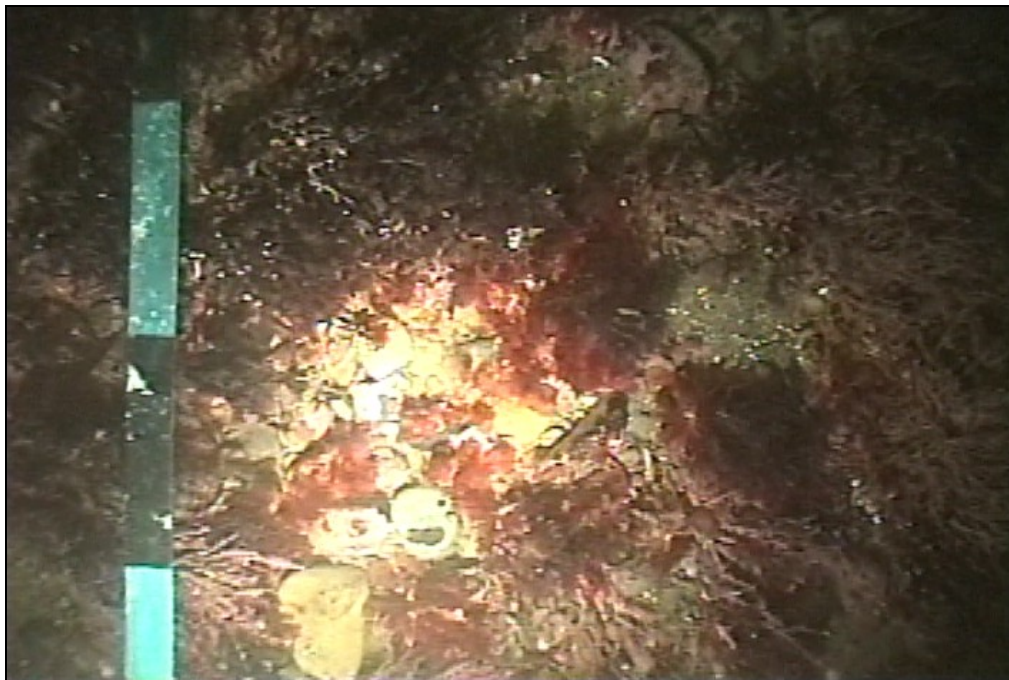


Figure 21. Gravel to cobble bottom with red algae (*Palmaria palmata*) community at about 5 m below MLW near the break in the nearshore shelf. Station BC2-1-C, Appendix C. Scale units are 10 cm.



Figure 22. Gravel to cobble bottom on nearshore shelf, at about 2.5 m below MLW, with red algae (*Palmaria palmata*), coralline algae, and possible *Fucus* or *Chondrus*. Station BC1-2-C, Appendix C. Scale units are 10 cm.



Figure 23. Kelp bed (*Laminaria longicuris* and possibly *L. digitata*) on gravel to cobble bottom on nearshore shelf at about 2.5 m below MLW, including *Fucus* sp and *Palmaria palmata*, Station BC1-1-C, Appendix C. Scale units are 10 cm.

CONCLUSIONS

In general, the same seabed types occur at Berth “B” as were observed in the 2008 survey, with the exception of the absence of volcanic bedrock (Envirosphere Consultants Limited 2008a & b)(AMGC 2009). Bottom communities at the Berth site were likewise similar to those observed in areas where sedimentary bedrock ridges predominate (AMGC 2009; Envirosphere Consultants Limited 2009; Stewart 2009). The cable route crossed an extended area of sedimentary bedrock, and bottom types and communities there were similar to those observed in similar types of bottom to the northwest in the earlier survey. Bottom types encountered between the zone of sedimentary bedrock and shore, where it crossed areas of cobble and boulder bottom, demonstrated the same characteristics and associated biological communities as determined in nearby areas to the west in earlier surveys. Communities on cobble to boulder bottom at the base of the nearshore shelf, as well as communities on the shelf break, were also similar to those observed in 2008; however the occurrence of kelp beds (*Laminaria longicuris*) in the shallowest water (below MLW) was not seen in the earlier surveys.

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Table 1. Surficial geology observations and biological information obtained in seabed video and still photography surveys, Berth “B” and associated cable route, July & August, 2009. Depths below mean low water (MLW) from digital terrain model. % = % cover; “o”= occasional; (N)=number in view.

Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
BERTH “B”					
July 2-3 & August 4-5, 2009	B12-1	49.2	video	mudstone bedrock with surface pebble to cobble	possible barnacles
	B12-2	49.6	video	mudstone bedrock with some surface pebble	possible barnacles
	B12-3	49.7	video	mudstone bedrock with surface gravel to cobble	possible barnacles
	B12-4	50.0	video	mudstone bedrock with gravel to pebble	possible barnacles, and boring clams.
	BJ12-8	49.0	video	pebble to boulder	yellow encrusting breadcrumb sponge (30%), barnacles
	BJ12-9	49.3	video	cobble to boulder	patch of biolayer, barnacles and <i>Asterias</i> sp.
	BJ12-10	48.9	video	gravel to cobble	possible barnacle, drift seaweed (<i>Ascophyllum</i>)
	BJ12-11	48.8	video	cobble	small patch of edge fauna and drift seaweed (<i>Ascophyllum</i>)
	BJ12-12	47.8	video	mudstone bedrock	yellow encrusting breadcrumb sponge (80%), barnacles, <i>Asterias</i> sp (~5)
	BJ12-13	47.9	video	sandstone bedrock	yellow encrusting breadcrumb sponge (5%), biolayer, barnacles, juvenile seastars
	BJ12-14	49.1	video	sandstone boulder	yellow encrusting breadcrumb sponge (30%), <i>Asterias</i> sp (~2), blood star, barnacles and a flat sponge
	BJ12-15	48.4	video	sandstone boulder with pits	biolayer with tube dwelling organisms, edge fauna, barnacles, patches of unid. yellow encrusting organisms, northern red anemone
	BJ12-16	46.4	video	pitted sandstone boulder	patches of yellow encrusting breadcrumb sponge, juvenile seastars (~3), barnacles
	BJ12-17	46.4	video	gravel to boulder	possible barnacles
	BJ12-18	47.6	video	mudstone bedrock	barnacles
	B12-19	46.6	video	sandstone boulder	biolayer, juvenile <i>Asterias</i> (~1), barnacles
	BJ12-20	45.5	video	sandstone cobble to boulder	biolayer, edge fauna, barnacles, juvenile seastar and possible northern red anemone.
	BJ12-21	46.1	video	sandstone boulder	biolayer with barnacles

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Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	BJ12-22	45.6	video	sandstone boulder	patches of yellow encrusting breadcrumb and white sponge, barnacles and biolayer with tube dwelling organisms.
	BJ12-23	46.9	video	gravel to cobble	no biota noted
	BJ12-24	45.2	video	gravel to cobble	no biota noted
	BJ12-25	49.4	video	sandstone boulder	biolayer with barnacles, patches of yellow encrusting sponge, edge fauna with tube dwelling organisms, juvenile seastar and several possible hermit crab.
	BJ12-27	47.7	video	mudstone bedrock with surface cobble	no biota noted
	B13-1	48.3	video	sandstone boulder/bedrock	patches of yellow encrusting breadcrumb sponge, juvenile seastars (~2), barnacles, biolayer, possible blood star and hermit crab.
	B13-2	46.0	video	sandstone boulder	patches of yellow encrusting breadcrumb sponge, northern red anemone, juvenile seastars (~3), barnacles, biolayer and possible northern stone crab.
	B13a-2	48.1	video	sandstone boulder	Biolayer with edge fauna (tubes present and <i>Flustra</i>), <i>Asterias</i> sp and barnacles.
	B13a-3	45.1	video	sandstone boulder	yellow encrusting breadcrumb sponge (95%), barnacles
	B14-1	46.4	video	mudstone bedrock with surface sandstone cobble	possible barnacles and small patches of yellow encrusting breadcrumb sponge.
	B14-2	46.3	video	sandstone boulder	patches of yellow encrusting breadcrumb sponge, <i>Asterias</i> sp, biolayer, edge fauna with barnacles and stalked tunicate (<i>Boltenia</i> sp)
	B14-3	44.8	video	sandstone boulder	edge fauna biolayer with tubes dwelling organisms, northern red anemone (2), <i>Asterias</i> sp and juvenile seastars, barnacles and small patches of yellow encrusting breadcrumb sponge.
	B14-4	44.3	video	mudstone bedrock	yellow encrusting breadcrumb sponge (85%), northern red anemone (1), juvenile seastars (~3), barnacles.
	B15-1	47.4	video	sandstone boulder	no biota noted

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Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	B15-3	48.9	video	sandstone bedrock with pits	biolayer with boring clam holes and possible yellow encrusting breadcrumb sponge, barnacles
	B15-4	48.8	video	sandstone bedrock	biolayer with barnacles, northern red anemone, small patch of yellow encrusting breadcrumb sponge and other flat sponge
	B17-1	47.8	video	sandstone bedrock	biolayer with blood star, small patches of yellow encrusting breadcrumb sponge, barnacles and some tube building organisms.
	B17-2	48.8	video	sandstone bedrock	biolayer and possible barnacles
	B17-3	46.7	video	clean gravel to boulder	no biota noted
	B20-1	46.7	video	gravel to cobble	no biota noted
	B20-2	46.8	video	gravel to cobble	small patch of biolayer, possible barnacles and juvenile seastar.
	B20-3	45.6	video	mudstone bedrock with surface gravel to cobble	no biota noted
	B21-1	51.3	video	cobble to boulder	biolayer, northern red anemone (~2)
	B21-2	51.4	video	gravel to cobble	patches of biolayer, some barnacles
	B21-3	51.3	video	gravel to cobble	no biota noted
	B21-4	50.8	video	gravel to cobble	no biota noted
	B21-5	50.7	video	cobble to boulder	edge fauna, biolayer with tubes, barnacles, juvenile seastars (~1), blood star and possible northern red anemone
BERTH “B”, 35 mm photos					
July 2-3, 2009	BEN B13-1	48.4	35 mm	Smooth cobble to boulder	Biolayer (5%), edge fauna (o), gastropod (Margarites)(1), hermit crab, barnacles occas., seastar juv. (1), breadcrumb sponge (<1%)
	BEN B13-2	47.7	35 mm	Smooth cobble to boulder	northern red anemone juv? (1), surface biolayer (o)
	BEN B13-3	45.9	35 mm	Cobble to boulder over red mudstone bedrock	Barnacle (1), seastar juv (2), <i>Henricia</i> (1), edge fauna (o), breadcrumb sponge (25%), Northern red anemone (5), biolayer (15%), hermit crab/snail (3)
	BEN B13-4	46.6	35 mm	red mudstone bedrock	Barnacles (o), <i>Henricia</i> (1), Northern Red Anemone (5), Breadcrumb sponge (35%)

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Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	BEN B13-5	47.0	35 mm	Cobble to boulder over mudstone bedrock	Seastar juv (1), snail (<i>Margarites?</i>), biolayer (patchy, 5%), northern red anemone (1+1?), boring clam holes
	BEN B13-6	46.0	35 mm	sandstone bedrock	breadcrumb sponge (20%), biolayer (70%), northern red anemone (15), seastar juv. (3), hermit crab (1), <i>Henricia</i> (1), edge fauna <1%
	BEN B16-1	46.8	35 mm	smooth gravel to cobble	hermit crab (2)
	BEN B17-1	49.1	35 mm	sandstone? bedrock	biolayer (95%), northern red anemone (3), orange erect sponge (1), <i>Henricia</i> (3), seastar juv (4), edge fauna, hermit crab (1)
	BEN B17-2	48.7	35 mm	sandstone bedrock (poor image)	biolayer (95%), barnacles (o), edge fauna
BERTH “B” CABLE ROUTE					
July 2-3 & August 4-5, 2009.	BC 1-1	2.6	video	gravel to cobble	red algae and kelp bed (<i>Laminaria</i> sp) with polychaetes (possibly <i>Spirorbis</i> sp) on fronds
	BC1-2	2.6	video	gravel to cobble	red algae, and kelp bed with polychaetes (<i>Spirorbis</i> sp) present
	BC1-3	2.4	video	gravel	red algae and kelp bed (<i>Laminaria</i> sp) with polychaete (<i>Spirorbis</i> sp) present
	BC2-1	5.0	video	gravel to cobble	red algae bed (some encrusted with corallines), possible moon snail shell
	BC2-2	5.2	video	gravel to cobble	red algae (some encrusted with coralline algae)
	BC2-3	5.3	video	gravel	red algae and kelp bed (<i>Laminaria</i> sp) with possible polychaete (<i>Spirorbis</i> sp)
	BC2-4	5.2	video	gravel	red algae kelp bed (some encrusted with corallines)
	BC3-1	7.0	video	gravel	<i>Flustra</i> and red algae (<i>Palmaria</i>)
	BC3-2	6.9	video	gravel	<i>Flustra</i> and red algae (<i>Palmaria</i>)
	BC3-3	7.2	video	gravel to boulder	red algae (some with coralline encrustation), possible white sponge
BC4-1	9	video	sandstone bedrock	biolayer, edge fauna, <i>Flustra</i> , tube dwelling organisms, possible barnacles	

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Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	BC4-2	8.3	video	sandstone bedrock	biolayer with red algae, possible barnacles and hermit crab (no shell); large <i>Asterias</i> sp
	BC4-3	8.9	video	sandstone bedrock	biolayer, <i>Flustra</i> , barnacles, red algae and possible hermit crab
	BC4-4	10.1	video	sandstone bedrock	biolayer with tube dwelling organisms, <i>Flustra</i> , small amount of red algae, barnacles
	BC4-5	12.3	video	sandstone bedrock	biolayer with white sponge, edge fauna, barnacles
	BC4-6	14.3	video	sandstone bedrock	<i>Flustra</i> , biolayer, barnacles, worm tubes present
	BC4-7	15.2	video	sandstone bedrock	biolayer, <i>Flustra</i> , barnacles
	BC4-8	15.0	video	sandstone bedrock	biolayer, <i>Flustra</i> , barnacles
	BC4-9	15.6	video	sandstone bedrock	biolayer, <i>Flustra</i> , possible barnacles
	BC4-10	15.9	video	sandstone bedrock	biolayer and possible barnacles
	BC4-12	15.2	video	gravel to cobble	no biota noted
	BC4-13	13.9	video	gravel to cobble	no biota noted
	BC4-14	13.0	video	boulder/bedrock	biolayer with shell debris and possible barnacle, juvenile blood star
	BC4-15	12.9	video	cobble to boulder	biolayer with edge fauna, blood star, barnacle
	BC4-16	13.6	video	gravel to cobble	possible barnacles
	BC4-17	14.9	video	gravel to cobble	biolayer, possible barnacles and shell debris
	BC4-18	14.9	video	cobble to boulder	biolayer with edge fauna, barnacles
	BC4-19	14.9	video	gravel to cobble	possible barnacles
	BC4-20	15.3	video	gravel to cobble	biolayer with possible barnacles
	BC4-22	16.1	video	sandstone boulder	biolayer with barnacles
	BC4-23	17.0	video	gravel to cobble	possible biolayer and barnacles
	BC4-24	17.5	video	gravel to cobble	biolayer with shell debris and possible barnacles
	BC4-39	25.7	video	gravel to cobble	yellow encrusting breadcrumb sponge (5%), possible barnacles and shell debris
	BC4-40	26.4	video	gravel	no biota noted
	BC8-1	13.9	video	Cobble, embedded boulder	biolayer, barnacles, shell debris, seastar juv.
	BC8-2	13.8	video	cobble to boulder	biolayer, shell debris, barnacles, sea star
	BC8-3	14.0	video	clean gravel to cobble with boulder	biolayer, possible barnacles, breadcrumb sponge <1%,

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Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	BC13-1	18.3	video	gravel to cobble	shell debris, possible barnacles and <i>Flustra</i>
	BC13-2	18.5	video	gravel to boulder	patches of flat yellow sponge, barnacles and mussel shell debris
	BC13-3	18.9	video	gravel to cobble	biolayer with edge fauna, shell debris and possible barnacles
	BC14-1	21.3	video	gravel	possible barnacles and mussel shells
	BC14-2	22.0	video	gravel	possible barnacles and mussel shells
	BC14-3	22.3	video	gravel	possible barnacles and mussel shells
	BC15-1	21.8	video	siltstone (?) boulder	small patches of biolayer and possible barnacles
	BC15-2	22.2	video	cobble to boulder	possible barnacles, mussel shell debris, and northern red anemone
	BC15-3	22.5	video	gravel to cobble	possible barnacles and mussel shell debris
	BC17-1	25.1	video	gravel to cobble	yellow encrusting breadcrumb sponge (15%)
	BC17-2	24.9	video	gravel to cobble	possible barnacles
	BC17-3	25.0	video	gravel	possible barnacles and mussel shell debris
	BC17-4	24.3	video	gravel	possible barnacles and mussel shell debris
	BC17-5	24.0	video	gravel	possible barnacles and mussel shell debris
	BC17-6	23.9	video	gravel	possible barnacles and shell debris
	BC19-1	26.4	video	gravel to cobble	no biota noted
	BC19-2	26.2	video	gravel	possible barnacles
	BC19-3	25.9	video	gravel to cobble	possible barnacles and mussel shells
	BC19-4	25.9	video	gravel	possible barnacles and mussel shell
	BC19-5	25.9	video	gravel	possible barnacles and mussel shell debris
	BC19-6	25.7	video	gravel to cobble	possible barnacles and mussel shell debris
	BC20-1	26.8	video	gravel to cobble	possible barnacles
	BC20-2	26.6	video	gravel	possible barnacles
	BC20-3	26.5	video	gravel to cobble	possible barnacles
	BC21-1	29.2	video	gravel to boulder	no biota noted
	BC21-2	28.6	video	gravel to cobble	patch of white sponge

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Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	BC21-3	28.1	video	gravel to cobble	small patch of yellow encrusting breadcrumb sponge (2%)
	BC21-4	28.2	video	cobble to boulder	yellow encrusting breadcrumb sponge (50%), barnacles
	BC21-5	28.1	video	gravel to cobble	possible barnacle
	BC21-6	27.5	video	gravel to cobble	no biota noted
	BC21-7	27.3	video	gravel to cobble	no biota noted
	BC21-8	27.1	video	gravel to cobble	no biota noted
	BC22-1	28.9	video	gravel to cobble	possible barnacles
	BC22-2	28.5	video	gravel to cobble	possible barnacles
	BC22-3	27.8	video	cobble to boulder	northern red anemone (~2), biolayer and barnacles
	BC22a-1	30.9	video	gravel to cobble	no biota noted
	BC22a-2	32.4	video	sandstone boulder	biolayer with hermit crab and possible barnacle
	BC22a-3	33.5	video	gravel to boulder	yellow encrusting breadcrumb sponge (25%)
	BCJ22-2	30.3	video	cobble	no biota noted
	BC23-1	30.0	video	cobble	biolayer with edge fauna (tube building organisms), white sponge and possible hermit crab
	BC23-2	29.3	video	gravel to cobble	no biota noted
	BC23-3	29.0	video	gravel to cobble	biolayer, barnacles, blood star and hermit crab
	BC24-1	33.4	video	gravel to cobble	patch of white sponge and a barnacle
	BC24-2	33.1	video	gravel to cobble	no biota noted
	BC24-3	32.8	video	gravel to cobble	patch of biolayer with tube building organisms and barnacles
	BC25-1	36.1	video	cobble	yellow encrusting breadcrumb sponge (5%)
	BC25-2	36.9	video	cobble	yellow encrusting breadcrumb sponge (10%)
	BC25-3	35.8	video	cobble	yellow encrusting breadcrumb sponge (20%) and small patch of biolayer
	BC26-1	41.4	video	gravel to cobble	patch of yellow encrusting breadcrumb sponge (5%) and possible barnacles
	BC26-2	40.8	video	sandstone boulder	biolayer with patches of yellow encrusting breadcrumb sponge
	BC26-3	40.0	video	gravel to cobble	no biota noted
	BC27-1	42.3	video	gravel to boulder	patches of yellow encrusting breadcrumb sponge

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Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	BC27-2	41.4	video	gravel to boulder	no biota noted
	BC27-3	40.7	video	gravel to cobble	no biota noted
	BC27a-1	42.8	video	gravel to boulder	small patch of possible biolayer
	BC27a-2	42.6	video	gravel to cobble	no biota noted
	BC27a-3	43.3	video	gravel to boulder	patch of yellow encrusting breadcrumb sponge
	BC27a-4	43.4	video	gravel to cobble	no biota noted
	BC27a-5	43.4	video	gravel to cobble	possible barnacles
	BC28-1	47.3	video	cobble	small patches of yellow encrusting breadcrumb sponge and biolayer with possible barnacles
	BC28-2	46.1	video	mudstone bedrock with surface gravel to cobble	possible barnacles
	BC28-3	45.6	video	cobble to boulder	biolayer, patches of yellow encrusting breadcrumb sponge, barnacles and possible hermit crab (2)
	BC29-1	47.9	video	mudstone/siltstone bedrock with surface gravel to cobble	no biota noted
	BC29-2	46.5	video	gravel to boulder	small patch of biolayer
	BC29-3	45.4	video	mudstone bedrock with surface cobble	yellow encrusting breadcrumb sponge (40%)
	BC30-1	48.7	video	siltstone boulder	biolayer, <i>Flustra</i> and patch of yellow encrusting breadcrumb sponge
	BC30-2	47.8	video	cobble to boulder	barnacles, possible hermit crab, tube building organisms and biolayer
	BC30-3	44.6	video	sandstone bedrock	biolayer with edge fauna, tube building organisms, barnacles, northern red anemone and possible <i>Flustra</i> .
	BC31-1	49.7	video	gravel to cobble	no biota noted
	BC31-2	48.8	video	gravel to cobble	no biota noted
	BC31-3	46.9	video	mudstone bedrock with pits and band of siltstone	small patches of biolayer, barnacles and possible boring clam pits
	BC32-1	49.8	video	sandstone boulder	biolayer with barnacles and edge fauna and tube building organisms
	BC32-2	48.6	video	sandstone boulder	biolayer, small patches of yellow encrusting breadcrumb sponge, barnacles

Table 1. Surficial geology observations and biological information obtained in seabed video and still photography surveys, Berth “B” and associated cable route, July & August, 2009. Depths below mean low water (MLW) from digital terrain model. % = % cover; “o”= occasional; (N)=number in view.

Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	BC32-3	45.7	video	sandstone bedrock	biolayer with edge fauna and tube building organisms and possible barnacles
	BC33-1	50.6	video	gravel to cobble	no biota noted
	BC33-2	50.7	video	cobble to boulder (mudstone with band of siltstone)	patch of biolayer and edge fauna (tube building organisms)
	BC33-3	50.4	video	gravel to boulder	possible barnacles and boring clam pits
	BC35-1	49.5	video	gravel to cobble	no biota noted
	BC35-2	49.8	video	gravel to cobble	no biota noted
	BC35-3	45.2	video	sandstone boulder	biolayer with barnacles
	BC35-4	43.5	video	sandstone boulder	patches of yellow encrusting breadcrumb sponge and some white sponge, biolayer, edge fauna
	BC35-5	40.5	video	sandstone boulder	biolayer with tube dwelling organisms, patches of yellow encrusting breadcrumb sponge and barnacles.
	BC36-1	47.9	video	sandstone bedrock	barnacles with small patch of yellow breadcrumb sponge and small northern red anemone
	BC36-2	46.2	video	mudstone bedrock	biolayer and edge fauna and barnacles
	BC36-3	45.9	video	sandstone boulder	biolayer with barnacles, <i>Flustra</i> , possible northern red anemone and juvenile seastar
	BC37-1	42.8	video	sandstone boulders	patches of yellow encrusting breadcrumb sponge, biolayer with barnacles
	BC37-2	40.0	video	sandstone boulders	patches of yellow encrusting breadcrumb sponge, biolayer and barnacles
	BC37-3	52.6	video	sandstone boulder	yellow encrusting breadcrumb sponge with possible white sponge and barnacles
	BC38-1	52.8	video	cobble to boulder	no biota noted
	BC38-2	52.8	video	gravel to boulder	biolayer and edge fauna (stalked tunicate, <i>Boltenia</i>), barnacles, northern red anemone (~2)
	BC38-3	52.0	video	sandstone boulder	biolayer, edge fauna with tube building organism, barnacles
	BC39-1	46.8	video	sandstone boulder with crevices	yellow encrusting breadcrumb sponge (50%) with barnacles
	BC39-2	41.5	video	sandstone boulder	yellow encrusting breadcrumb sponge (20%), with barnacles and blood star

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Cruise Date	Station	Depth (m)	Image Type	Bottom Type	Biological Component
	BC39-3	41.5	video	cobble	biolayer, edge fauna with <i>Flustra</i> and stalked tunicates (<i>Boltenia</i>), barnacles
	BC40-1	47.7	video	cobble to boulder	biolayer with tube dwelling organisms and possible barnacles
	BC40-2	47.8	video	sandstone boulder	biolayer with barnacles
	BC40-3	47.7	video	cobble to boulder	biolayer to edge fauna (tube dwelling organisms), barnacles and juvenile seastars
	BC41-1	48.6	video	mudstone bedrock	biolayer with barnacles
	BC41-2	48.8	video	mudstone bedrock	biolayer with edge fauna (stalked tunicate, <i>Boltenia</i> sp) and barnacles
	BC41-3	49.1	video	mudstone boulders with pits	biolayer with barnacles
	BC42-1	48.9	video	mudstone bedrock with pits	possible barnacles
	BC42-2	48.7	video	mudstone bedrock with pits and overlaying cobble	biolayer with barnacles and edge fauna
	BC42-3	48.8	video	mudstone bedrock	biolayer with barnacles

APPENDIX A- JULY AND AUGUST SURVEY, 2009, BERTH "B", IMAGE CAPTURES

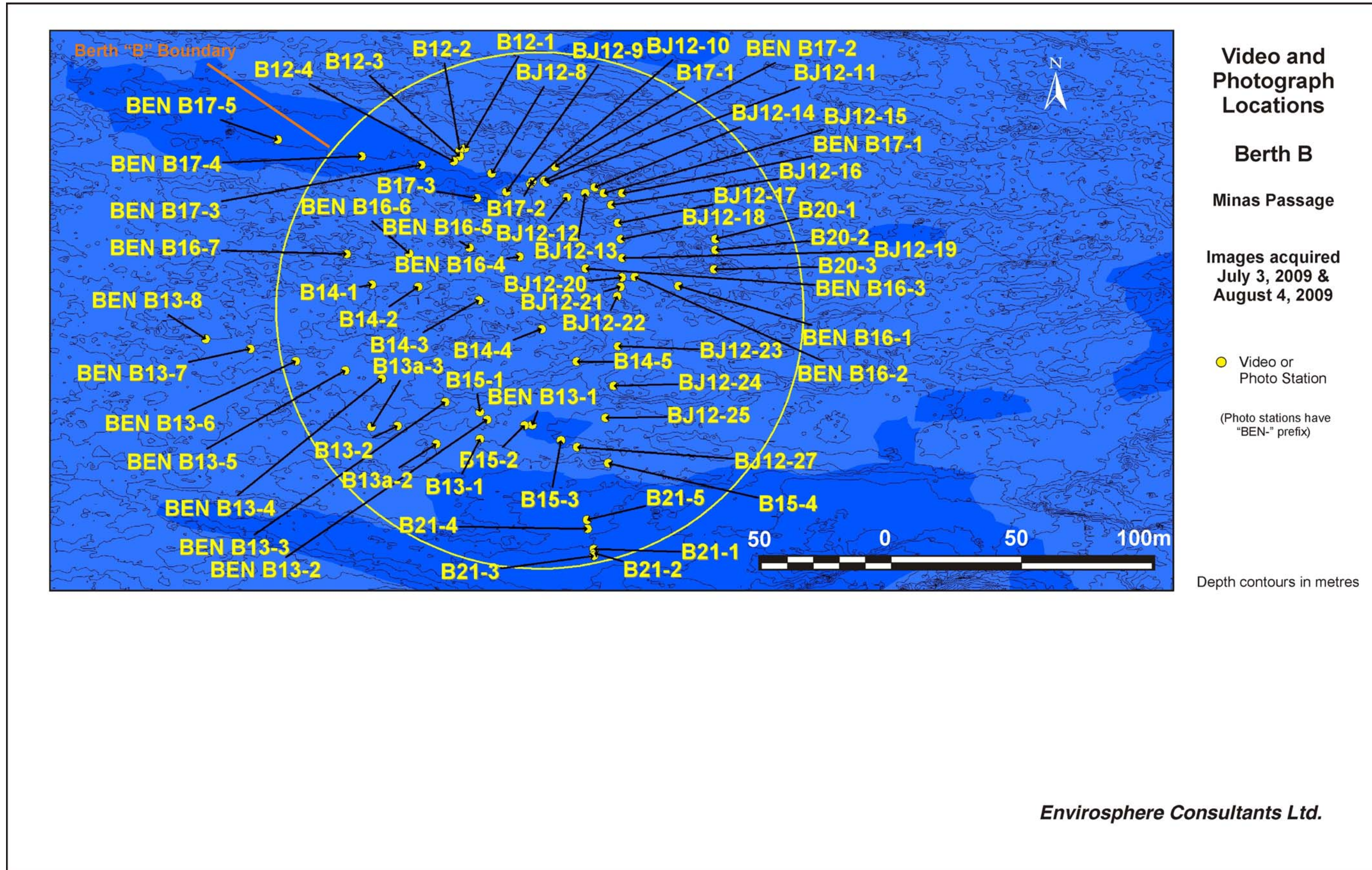


Table A1. List of video sampling stations, Minas Passage study site, Berth "B", July and August, 2009.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)	TYPE OF SAMPLE	COMMENT
B12 - 1	8/4/2009	18:32:0	45 21.9932	64 26.2329	49.1 m	video	
B12 - 2	8/4/2009	18:32:2	45 21.9927	64 26.2344	49.6 m	video	
B12 - 3	8/4/2009	18:32:5	45 21.9915	64 26.2344	49.7 m	video	
B12 - 4	8/4/2009	18:33:1	45 21.9904	64 26.2362	49.9 m	video	
B13 - 1	7/3/2009	11:42:3	45 21.9324	64 26.2270	48.2 m	video	
B13 - 2	7/3/2009	11:43:0	45 21.9348	64 26.2514	45.9 m	video	
B13a - 1	7/3/2009	11:48:3	45 21.9301	64 26.2093	48.8 m	video	
B13a - 2	7/3/2009	11:49:0	45 21.9312	64 26.2398	48.1 m	video	
B13a - 3	7/3/2009	11:49:2	45 21.9345	64 26.2591	45.1 m	video	
B14 - 1	7/3/2009	11:04:0	45 21.9643	64 26.2597	46.3 m	video	
B14 - 2	7/3/2009	11:04:3	45 21.9640	64 26.2459	46.3 m	video	
B14 - 3	7/3/2009	11:04:5	45 21.9614	64 26.2279	44.7 m	video	
B14 - 4	7/3/2009	11:05:2	45 21.9556	64 26.2093	44.2 m	video	
B14 - 5	7/3/2009	11:05:4	45 21.9490	64 26.1988	45.5 m	video	
B15 - 1	7/3/2009	10:58:0	45 21.9380	64 26.2271	47.4 m	video	
B15 - 2	7/3/2009	10:58:2	45 21.9354	64 26.2138	48.0 m	video	
B15 - 3	7/3/2009	10:58:3	45 21.9324	64 26.2030	48.8 m	video	
B15 - 4	7/3/2009	10:59:0	45 21.9279	64 26.1889	48.8 m	video	
B17 - 1	7/3/2009	11:35:2	45 21.9897	64 26.2062	47.8 m	video	
B17 - 2	7/3/2009	11:35:5	45 21.9865	64 26.2129	48.8 m	video	
B17 - 3	7/3/2009	11:36:3	45 21.9828	64 26.2292	46.7 m	video	
B20 - 1	8/4/2009	18:36:5	45 21.9752	64 26.1584	46.7 m	video	
B20 - 2	8/4/2009	18:37:1	45 21.9729	64 26.1584	46.7 m	video	
B20 - 3	8/4/2009	18:37:4	45 21.9688	64 26.1587	45.5 m	video	
B21 - 1	8/4/2009	18:40:4	45 21.9098	64 26.1927	51.2 m	video	
B21 - 2	8/4/2009	18:41:1	45 21.9090	64 26.1925	51.3 m	video	
B21 - 3	8/4/2009	18:41:3	45 21.9084	64 26.1927	51.3 m	video	
B21 - 4	8/4/2009	18:42:1	45 21.9141	64 26.1947	50.7 m	video	
B21 - 5	8/4/2009	18:42:3	45 21.9159	64 26.1948	50.7 m	video	

Table A1. List of video sampling stations, Minas Passage study site, Berth "B", July and August, 2009.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)	TYPE OF SAMPLE
BJ12 - 1	7/3/2009	11:09:1	45 21.9967	64 26.2682	50.5 m	video
BJ12 - 2	7/3/2009	11:09:3	45 21.9952	64 26.2634	50.5 m	video
BJ12 - 3	7/3/2009	11:09:5	45 21.9942	64 26.2554	50.4 m	video
BJ12 - 4	7/3/2009	11:10:2	45 21.9933	64 26.2493	50.2 m	video
BJ12 - 5	7/3/2009	11:10:4	45 21.9905	64 26.2433	49.8 m	video
BJ12 - 6	7/3/2009	11:11:1	45 21.9910	64 26.2363	49.6 m	video
BJ12 - 7	7/3/2009	11:11:4	45 21.9904	64 26.2300	49.2 m	video
BJ12 - 8	7/3/2009	11:12:0	45 21.9880	64 26.2249	48.9 m	video
BJ12 - 9	7/3/2009	11:12:3	45 21.9842	64 26.2204	49.2 m	video
BJ12 - 10	7/3/2009	11:13:0	45 21.9860	64 26.2134	48.9 m	video
BJ12 - 11	7/3/2009	11:13:3	45 21.9864	64 26.2087	48.8 m	video
BJ12 - 12	7/3/2009	11:14:1	45 21.9833	64 26.2026	47.7 m	video
BJ12 - 13	7/3/2009	11:14:3	45 21.9843	64 26.1971	47.8 m	video
BJ12 - 14	7/3/2009	11:14:5	45 21.9855	64 26.1943	49.0 m	video
BJ12 - 15	7/3/2009	11:15:2	45 21.9843	64 26.1916	48.3 m	video
BJ12 - 16	7/3/2009	11:15:4	45 21.9819	64 26.1893	46.4 m	video
BJ12 - 17	7/3/2009	11:16:2	45 21.9782	64 26.1873	46.3 m	video
BJ12 - 18	7/3/2009	11:16:4	45 21.9748	64 26.1864	47.5 m	video
BJ12 - 19	7/3/2009	11:17:2	45 21.9708	64 26.1859	46.6 m	video
BJ12 - 20	7/3/2009	11:18:0	45 21.9668	64 26.1859	45.4 m	video
BJ12 - 21	7/3/2009	11:18:2	45 21.9648	64 26.1862	46.1 m	video
BJ12 - 22	7/3/2009	11:18:5	45 21.9628	64 26.1871	45.6 m	video
BJ12 - 23	7/3/2009	11:19:2	45 21.9523	64 26.1866	46.8 m	video
BJ12 - 24	7/3/2009	11:19:5	45 21.9440	64 26.1877	45.1 m	video
BJ12 - 25	7/3/2009	11:20:3	45 21.9373	64 26.1899	49.4 m	video
BJ12 - 26	7/3/2009	11:21:0	45 21.9338	64 26.1931	49.2 m	video
BJ12 - 27	7/3/2009	11:21:4	45 21.9311	64 26.1982	47.7 m	video
BJ12 - 28	7/3/2009	11:22:1	45 21.9291	64 26.2021	48 m	video



Figure A1. B12-1-A



Figure A4. B12-1-D



Figure A7. B12-2-C



Figure A2. B12-1-B



Figure A5. B12-2-A



Figure A8. B12-2-D



Figure A3. B12-1-C



Figure A6. B12-2-B



Figure A9. B12-3-A

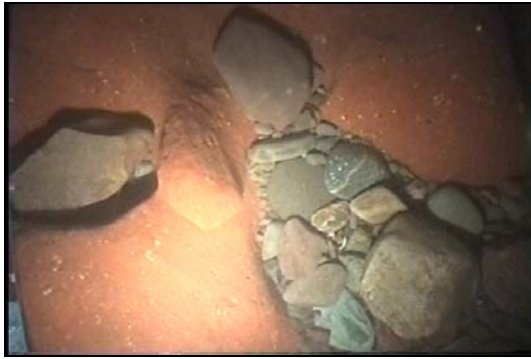


Figure A10. B12-3-B



Figure A13. B12-4-B



Figure A16. B13-1-B



Figure A11. B12-3-C



Figure A14. B12-4-C



Figure A17. B13-1-C



Figure A12. B12-4-A



Figure A15. B13-1-A



Figure A18. B13-1-D



Figure A19. B13-2-A



Figure A22. B13a-2-A



Figure A25. B13a-3-A



Figure A20. B13-2-B



Figure A23. B13a-2-B



Figure A26. B13a-3-B



Figure A21. B13-2-C



Figure A24. B13a-2-C



Figure A27. B13a-3-C



Figure A28. B13a-3-D



Figure A31. B14-1-A



Figure A34. B14-2-A



Figure A29. B13a-3-E



Figure A32. B14-1-B



Figure A35. B14-2-B



Figure A30. B13a-3-F



Figure A33. B14-1-C



Figure A36. B14-2-C



Figure A37. B14-2-D



Figure A40. B14-3-C



Figure A43. B14-4-C



Figure A38. B14-3-A



Figure A41. B14-4-A



Figure A44. B15-1-A



Figure A39. B14-3-B



Figure A42. B14-4-B



Figure A45. B15-1-B



Figure A46. B15-3-A



Figure A49. B15-3-D



Figure A52. B15-4-C

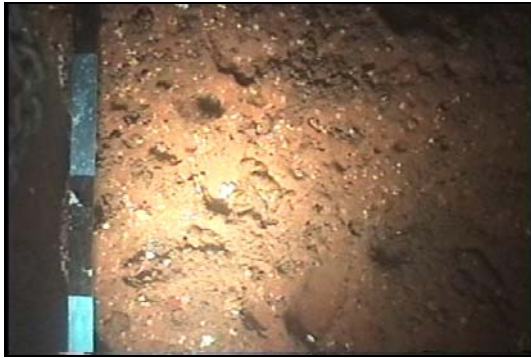


Figure A47. B15-3-B



Figure A50. B15-4-A



Figure A53. B15-4-D



Figure A48. B15-3-C



Figure A51. B15-4-B

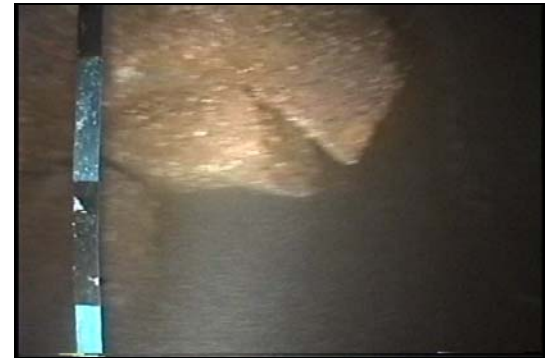


Figure A54. B15-4-E



Figure A55. B17-1-A



Figure A58. B17-2-B



Figure A61. B17-2-E



Figure A56. B17-1-B



Figure A59. B17-2-C



Figure A62. B17-2-F



Figure A57. B17-2-A



Figure A60. B17-2-D



Figure A63. B17-2-G



Figure A64. B17-3-A



Figure A67. B20-1-A



Figure A70. B20-2-A



Figure A65. B17-3-B



Figure A68. B20-1-B



Figure A71. B20-2-B



Figure A66. B17-3-C



Figure A69. B20-1-C



Figure A72. B20-2-C



Figure A73. B20-3-A



Figure A76. B20-3-D



Figure A79. B20-3-G



Figure A74. B20-3-B



Figure A77. B20-3-E



Figure A80. B20-3-H



Figure A75. B20-3-C



Figure A78. B20-3-F



Figure A81. B20-3-I



Figure A82. B20-3-J



Figure A85. B21-1-C



Figure A88. B21-2-C



Figure A83. B21-1-A



Figure A86. B21-2-A



Figure A89. B21-3-A



Figure A84. B21-1-B



Figure A87. B21-2-B



Figure A90. B21-3-B



Figure A91. B21-3-C



Figure A94. B21-4-C



Figure A97. B21-5-C



Figure A92. B21-4-A



Figure A95. B21-5-A



Figure A98. BJ12-8-A



Figure A93. B21-4-B



Figure A96. B21-5-B



Figure A99. BJ12-8-B



Figure A100. BJ12-8-C



Figure A103. BJ12-9-C



Figure A106. BJ12-10-A



Figure A101. BJ12-9-A



Figure A104. BJ12-9-D



Figure A107. BJ12-10-B



Figure A102. BJ12-9-B



Figure A105. BJ12-9-E



Figure A108. BJ12-10-C



Figure A109. BJ12-11-A



Figure A112. BJ12-12-A

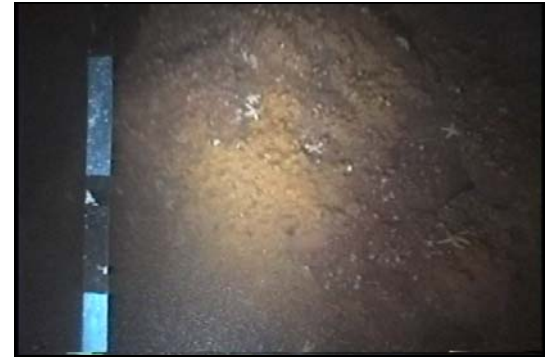


Figure A115. BJ12-12-D



Figure A110. BJ12-11-B



Figure A113. BJ12-12-B



Figure A116. BJ12-13-A



Figure A111. BJ12-11-C



Figure A114. BJ12-12-C



Figure A117. BJ12-13-B



Figure A118. BJ12-13-C



Figure A121. BJ12-14-A



Figure A124. BJ12-14-D



Figure A119. BJ12-13-D



Figure A122. BJ12-14-B



Figure A125. BJ12-14-E



Figure A120. BJ12-13-E



Figure A123. BJ12-14-C



Figure A126. BJ12-15-A



Figure A127. BJ12-15-B



Figure A130. BJ12-16-A



Figure A133. BJ12-17-A



Figure A128. BJ12-15-C



Figure A131. BJ12-16-B



Figure A134. BJ12-17-B



Figure A129. BJ12-15-D



Figure A132. BJ12-16-C



Figure A135. BJ12-17-C



Figure A136. BJ12-18-A



Figure A139. BJ12-19-A



Figure A142. BJ12-20-A



Figure A137. BJ12-18-B



Figure A140. BJ12-19-B



Figure A143. BJ12-20-B



Figure A138. BJ12-18-C



Figure A141. BJ12-19-C



Figure A144. BJ12-20-C



Figure A145. BJ12-21-A



Figure A148. BJ12-22-A



Figure A151. BJ12-22-D



Figure A146. BJ12-21-B



Figure A149. BJ12-22-B



Figure A152. BJ12-23-A



Figure A147. BJ12-21-C



Figure A150. BJ12-22-C



Figure A153. BJ12-23-B



Figure A154. BJ12-23-C



Figure A157. BJ12-24-C



Figure A160. BJ12-25-B



Figure A155. BJ12-24-A



Figure A158. BJ12-24-D



Figure A161. BJ12-25-C



Figure A156. BJ12-24-B



Figure A159. BJ12-25-A



Figure A162. BJ12-25-D



Figure A163. BJ12-27-A

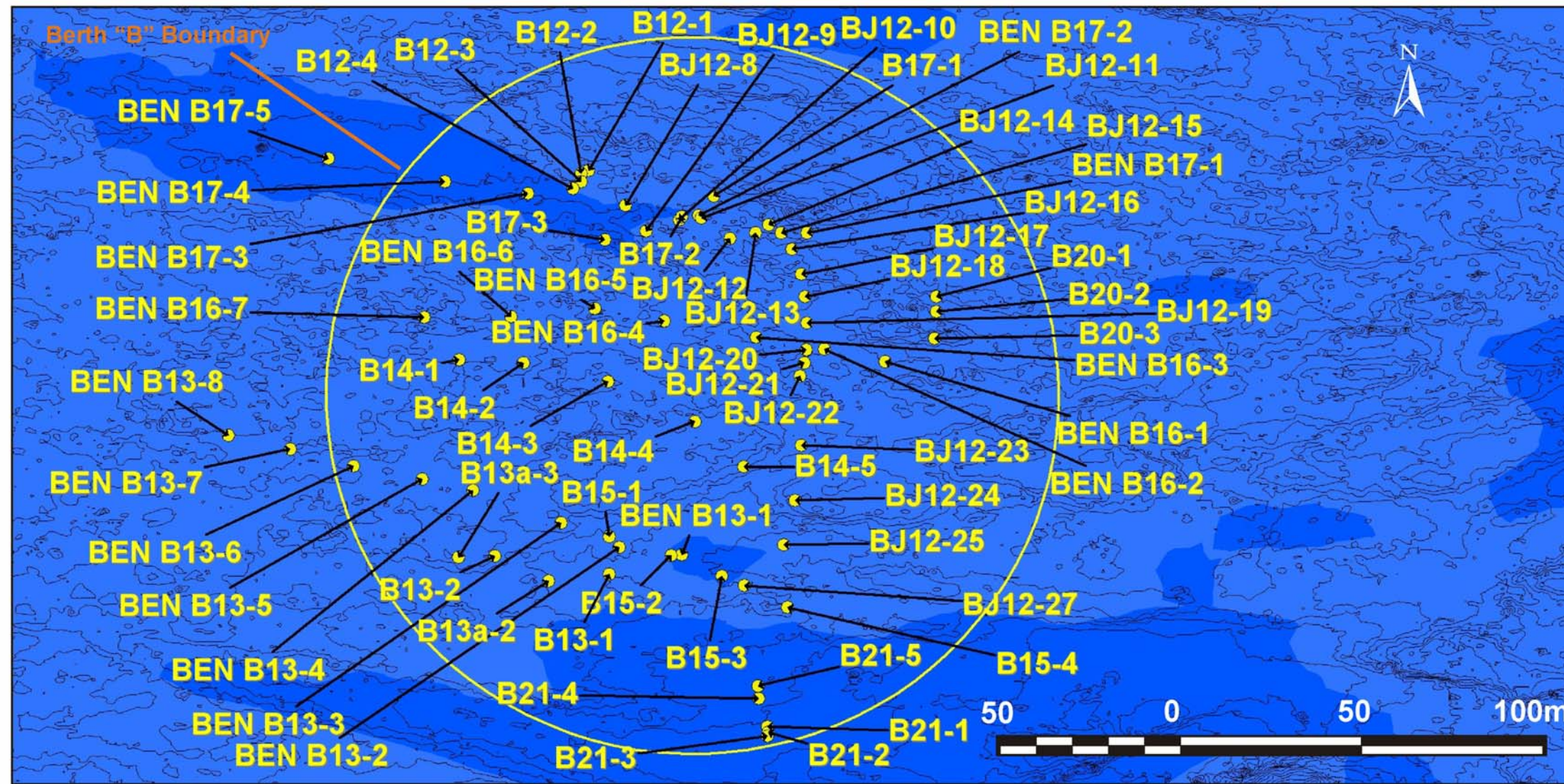


Figure A164. BJ12-27-B



Figure A165. BJ12-27-C

APPENDIX B- JULY VIDEO AND PHOTOGRAPHIC SURVEY, BERTH “B”, JULY 2-3, 2009, 35 mm Photos



**Video and
Photograph
Locations**

Berth B

Minas Passage

Images acquired
July 3, 2009 &
August 4, 2009

● Video or
Photo Station

(Photo stations have
“BEN-” prefix)

Depth contours in metres

Envirosphere Consultants Ltd.

Table B1. List of 35mm photo sampling stations, Minas Passage study site, Berth "B", July, 2009.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)	TYPE OF SAMPLE
BEN B13 - 1	7/3/2009	4:17:39	45 21.9355	64 26.2116	48.4 m	photo
BEN B13 - 2	7/3/2009	4:18:00	45 21.9365	64 26.2250	47.6 m	photo
BEN B13 - 3	7/3/2009	4:18:19	45 21.9400	64 26.2374	45.9 m	photo
BEN B13 - 4	7/3/2009	4:18:47	45 21.9446	64 26.2563	46.6 m	photo
BEN B13 - 5	7/3/2009	4:19:03	45 21.9462	64 26.2670	46.9 m	photo
BEN B13 - 6	7/3/2009	4:19:25	45 21.9480	64 26.2817	46.0 m	photo
BEN B13 - 7	7/3/2009	4:19:47	45 21.9503	64 26.2953	46.1 m	photo
BEN B13 - 8	7/3/2009	4:20:06	45 21.9522	64 26.3084	46.1 m	photo
BEN B16 - 1	7/3/2009	4:10:25	45 21.9652	64 26.1691	46.7 m	photo
BEN B16 - 2	7/3/2009	4:10:43	45 21.9669	64 26.1820	46.2 m	photo
BEN B16 - 3	7/3/2009	4:11:04	45 21.9685	64 26.1966	44.9 m	photo
BEN B16 - 4	7/3/2009	4:11:31	45 21.9707	64 26.2162	44.8 m	photo
BEN B16 - 5	7/3/2009	4:11:51	45 21.9724	64 26.2310	44.8 m	photo
BEN B16 - 6	7/3/2009	4:12:13	45 21.9709	64 26.2488	45.4 m	photo
BEN B16 - 7	7/3/2009	4:12:37	45 21.9706	64 26.2673	45.0 m	photo
BEN B17 - 1	7/3/2009	4:01:51	45 21.9844	64 26.1862	49.1 m	photo
BEN B17 - 2	7/3/2009	4:02:19	45 21.9867	64 26.2092	48.7 m	photo
BEN B17 - 3	7/3/2009	4:03:08	45 21.9896	64 26.2456	49.5 m	photo
BEN B17 - 4	7/3/2009	4:03:30	45 21.9911	64 26.2634	50.1 m	photo
BEN B17 - 5	7/3/2009	4:04:00	45 21.9943	64 26.2882	50.4 m	photo



Figure B1. Station BEN-B13-1, July 2009

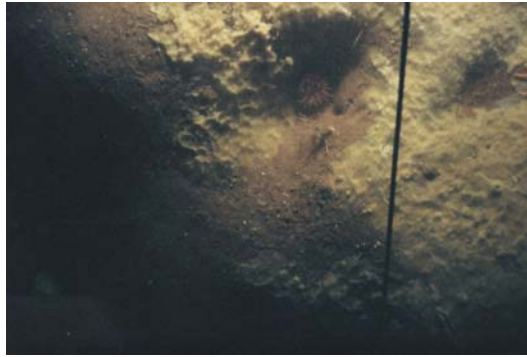


Figure B4. Station BEN-B13-4.



Figure B7. Station BEN-B16-1, July 2009



Figure B2. Station BEN-B13-2, July 2009



Figure B5. Station BEN-B13-5, July 2009.

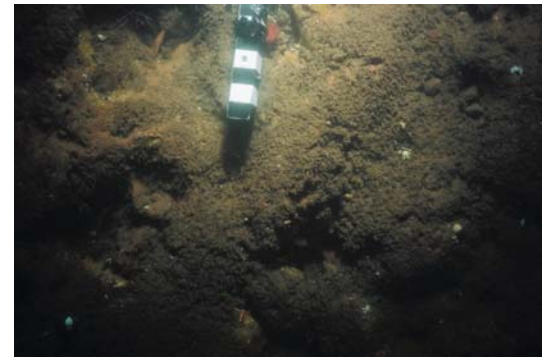


Figure B8. Station BEN-B17-1, July 2009



Figure B3. Station BEN-B13-3, July 2009.

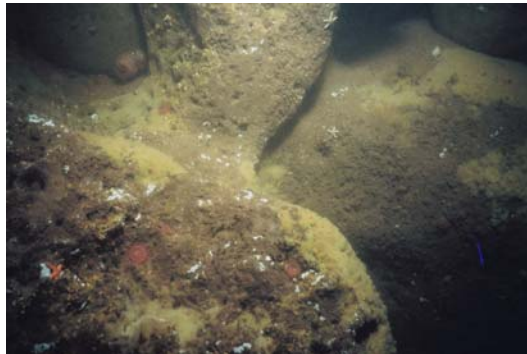


Figure B6. Station BEN-B13-6, July 2009.



Figure B9. Station BEN-B17-2, July 2009.

APPENDIX C- VIDEO SURVEY, BERTH "B" CABLE ROUTE, JULY & AUGUST, 2009

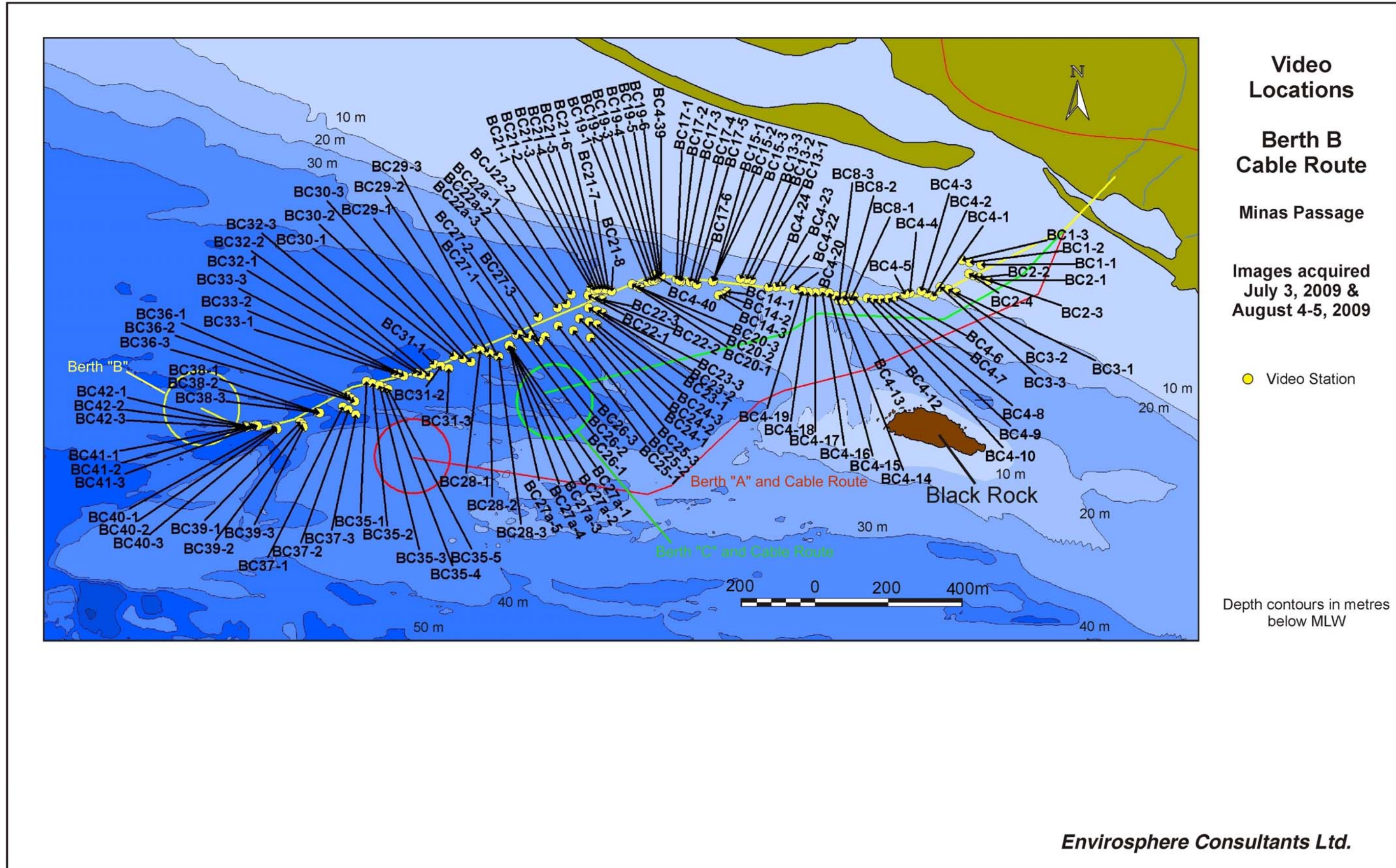


Table C1. List of video sampling stations, Minas Passage study site, Berth "B" Cable Route, July and August, 2009.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)	TYPE OF SAMPLE
BC 1 - 1	7/3/2009	10:45:2	45 22.2002	64 24.6070	2.55 m	video
BC 1 - 2	7/3/2009	10:45:4	45 22.2030	64 24.6308	2.57 m	video
BC 1 - 3	7/3/2009	10:46:0	45 22.2064	64 24.6474	2.38 m	video
BC 2 - 1	7/3/2009	10:48:5	45 22.1776	64 24.5915	4.99 m	video
BC 2 - 2	7/3/2009	10:49:1	45 22.1812	64 24.6103	5.2 m	video
BC 2 - 3	7/3/2009	10:49:3	45 22.1843	64 24.6230	5.28 m	video
BC 2 - 4	7/3/2009	10:49:3	45 22.1869	64 24.6320	5.24 m	video
BC 3 - 1	7/3/2009	10:51:4	45 22.1588	64 24.6575	7.02 m	video
BC 3 - 2	7/3/2009	10:52:0	45 22.1635	64 24.6742	6.87 m	video
BC 3 - 3	7/3/2009	10:52:2	45 22.1666	64 24.6901	7.24 m	video
BC 4 - 1	7/3/2009	10:54:4	45 22.1524	64 24.7052	9 m	video
BC 4 - 2	7/3/2009	10:54:5	45 22.1566	64 24.7179	8.27 m	video
BC 4 - 3	7/3/2009	10:55:1	45 22.1592	64 24.7294	8.9 m	video
BC 4 - 4	7/3/2009	10:55:3	45 22.1564	64 24.7535	10.1 m	video
BC 4 - 5	7/3/2009	10:55:4	45 22.1541	64 24.7630	12.3 m	video
BC 4 - 6	7/3/2009	10:56:0	45 22.1503	64 24.7818	14.2 m	video
BC 4 - 7	7/3/2009	10:56:2	45 22.1475	64 24.7978	15.2 m	video
BC 4 - 8	7/3/2009	10:56:3	45 22.1464	64 24.8132	14.9 m	video
BC 4 - 9	7/3/2009	10:56:5	45 22.1463	64 24.8272	15.5 m	video
BC 4 - 10	7/3/2009	10:57:0	45 22.1470	64 24.8405	15.9 m	video
BC 4 - 12	7/3/2009	10:57:3	45 22.1496	64 24.8687	15.1 m	video
BC 4 - 13	7/3/2009	10:57:5	45 22.1488	64 24.8873	13.8 m	video
BC 4 - 14	7/3/2009	10:58:0	45 22.1494	64 24.9056	13.0 m	video
BC 4 - 15	7/3/2009	10:58:2	45 22.1530	64 24.9197	12.8 m	video
BC 4 - 16	7/3/2009	10:58:3	45 22.1544	64 24.9338	13.6 m	video
BC 4 - 17	7/3/2009	10:58:5	45 22.1533	64 24.9486	14.8 m	video
BC 4 - 18	7/3/2009	10:59:0	45 22.1537	64 24.9623	14.9 m	video
BC 4 - 19	7/3/2009	10:59:1	45 22.1548	64 24.9753	14.8 m	video
BC 4 - 20	7/3/2009	10:59:3	45 22.1568	64 24.9912	15.3 m	video

Table C1. List of video sampling stations, Minas Passage study site, Berth "B" Cable Route, July and August, 2009.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)	TYPE OF SAMPLE
BC 4 - 22	7/3/2009	10:59:5	45 22.1612	64 25.0189	16.1 m	video
BC 4 - 23	7/3/2009	11:00:1	45 22.1600	64 25.0305	16.9 m	video
BC 4 - 24	7/3/2009	11:00:2	45 22.1589	64 25.0449	17.5 m	video
BC 4 - 39	7/3/2009	11:04:1	45 22.1713	64 25.2683	25.7 m	video
BC 4 - 40	7/3/2009	11:04:3	45 22.1724	64 25.2819	26.4 m	video
BC 8 - 1	8/5/2009	1:03:47	45 22.1431	64 24.8762	13.8 m	video
BC 8 - 2	8/5/2009	1:04:13	45 22.1430	64 24.8878	13.8 m	video
BC 8 - 3	8/5/2009	1:04:36	45 22.1427	64 24.8991	13.9 m	video
BC13 - 1	8/5/2009	0:59:06	45 22.1689	64 25.0809	18.2 m	video
BC13 - 2	8/5/2009	0:59:26	45 22.1697	64 25.0916	18.5 m	video
BC13 - 3	8/5/2009	0:59:51	45 22.1705	64 25.1040	18.8 m	video
BC14 - 1	8/5/2009	0:55:11	45 22.1512	64 25.1313	21.3 m	video
BC14 - 2	8/5/2009	0:55:43	45 22.1470	64 25.1400	22.0 m	video
BC14 - 3	8/5/2009	0:56:08	45 22.1450	64 25.1478	22.3 m	video
BC15 - 1	8/5/2009	0:51:46	45 22.1668	64 25.1596	21.7 m	video
BC15 - 2	8/5/2009	0:52:08	45 22.1661	64 25.1600	22.1 m	video
BC15 - 3	8/5/2009	0:52:26	45 22.1651	64 25.1612	22.5 m	video
BC17 - 1	8/5/2009	0:47:04	45 22.1669	64 25.2365	25.1 m	video
BC17 - 2	8/5/2009	0:47:28	45 22.1655	64 25.2308	24.8 m	video
BC17 - 3	8/5/2009	0:47:51	45 22.1640	64 25.2261	25.0 m	video
BC17 - 4	8/5/2009	0:48:29	45 22.1633	64 25.2080	24.3 m	video
BC17 - 5	8/5/2009	0:48:48	45 22.1623	64 25.1991	24.0 m	video
BC17 - 6	8/5/2009	0:49:10	45 22.1600	64 25.1941	23.8 m	video
BC19 - 1	8/5/2009	0:43:16	45 22.1622	64 25.2950	26.4 m	video
BC19 - 2	8/5/2009	0:43:44	45 22.1636	64 25.2871	26.2 m	video
BC19 - 3	8/5/2009	0:44:08	45 22.1642	64 25.2812	25.8 m	video
BC19 - 4	8/5/2009	0:44:38	45 22.1671	64 25.2747	25.9 m	video
BC19 - 5	8/5/2009	0:44:54	45 22.1688	64 25.2722	25.8 m	video
BC19 - 6	8/5/2009	0:45:15	45 22.1698	64 25.2691	25.7 m	video

Table C1. List of video sampling stations, Minas Passage study site, Berth "B" Cable Route, July and August, 2009.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)	TYPE OF SAMPLE
BC20 - 1	8/5/2009	0:39:51	45 22.1580	64 25.3281	26.8 m	video
BC20 - 2	8/5/2009	0:40:19	45 22.1556	64 25.3181	26.6 m	video
BC20 - 3	8/5/2009	0:40:45	45 22.1526	64 25.3099	26.4 m	video
BC21 - 1	8/5/2009	0:35:25	45 22.1511	64 25.4123	29.1 m	video
BC21 - 2	8/5/2009	0:35:45	45 22.1476	64 25.4046	28.5 m	video
BC21 - 3	8/5/2009	0:36:00	45 22.1489	64 25.3990	28.0 m	video
BC21 - 4	8/5/2009	0:36:15	45 22.1494	64 25.3937	28.1 m	video
BC21 - 5	8/5/2009	0:36:31	45 22.1495	64 25.3878	28.1 m	video
BC21 - 6	8/5/2009	0:36:49	45 22.1492	64 25.3817	27.4 m	video
BC21 - 7	8/5/2009	0:37:03	45 22.1483	64 25.3766	27.3 m	video
BC21 - 8	8/5/2009	0:37:23	45 22.1466	64 25.3696	27.0 m	video
BC22 - 1	8/5/2009	0:31:42	45 22.1399	64 25.4175	28.9 m	video
BCJ22 - 2	7/3/2009	11:19:4	45 22.1403	64 25.4522	30.3 m	video
BC22 - 2	8/5/2009	0:32:06	45 22.1373	64 25.4037	28.4 m	video
BC22 - 3	8/5/2009	0:32:29	45 22.1343	64 25.3894	27.7 m	video
BC22a - 1	8/5/2009	1:11:44	45 22.1261	64 25.4626	30.9 m	video
BC22a - 2	8/5/2009	1:12:25	45 22.1203	64 25.4807	32.4 m	video
BC22a - 3	8/5/2009	1:13:06	45 22.1178	64 25.5013	33.5 m	video
BC23 - 1	8/5/2009	0:27:39	45 22.1217	64 25.4167	30 m	video
BC23 - 2	8/5/2009	0:28:00	45 22.1178	64 25.3989	29.3 m	video
BC23 - 3	8/5/2009	0:28:15	45 22.1149	64 25.3872	29.0 m	video
BC24 - 1	8/5/2009	0:23:18	45 22.1059	64 25.4345	33.4 m	video
BC24 - 2	8/5/2009	0:23:42	45 22.1018	64 25.4140	33.1 m	video
BC24 - 3	8/5/2009	0:24:01	45 22.0978	64 25.3977	32.7 m	video
BC25 - 1	8/4/2009	19:54:1	45 22.0944	64 25.4782	36.0 m	video
BC25 - 2	8/4/2009	19:54:4	45 22.0880	64 25.4460	36.9 m	video
BC25 - 3	8/4/2009	19:55:0	45 22.0779	64 25.4108	35.7 m	video
BC26 - 1	8/4/2009	19:48:2	45 22.0804	64 25.5591	41.4 m	video
BC26 - 2	8/4/2009	19:48:4	45 22.0795	64 25.5320	40.7 m	video

Table C1. List of video sampling stations, Minas Passage study site, Berth "B"
 Cable Route, July and August, 2009.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)	TYPE OF SAMPLE
BC26 - 3	8/4/2009	19:49:0	45 22.0784	64 25.5049	39.9 m	video
BC27 - 1	8/4/2009	19:43:2	45 22.0793	64 25.5638	42.2 m	video
BC27 - 2	8/4/2009	19:43:4	45 22.0751	64 25.5396	41.4 m	video
BC27 - 3	8/4/2009	19:44:0	45 22.0701	64 25.5161	40.7 m	video
BC27a - 1	8/5/2009	1:17:49	45 22.0589	64 25.5730	42.8 m	video
BC27a - 2	8/5/2009	1:18:13	45 22.0591	64 25.5750	42.6 m	video
BC27a - 3	8/5/2009	1:18:37	45 22.0613	64 25.5752	43.3 m	video
BC27a - 4	8/5/2009	1:18:54	45 22.0626	64 25.5762	43.3 m	video
BC27a - 5	8/5/2009	1:19:13	45 22.0638	64 25.5785	43.4 m	video
BC28 - 1	8/4/2009	19:39:2	45 22.0551	64 25.6379	47.3 m	video
BC28 - 2	8/4/2009	19:39:4	45 22.0510	64 25.6180	46.0 m	video
BC28 - 3	8/4/2009	19:40:0	45 22.0466	64 25.5992	45.5 m	video
BC29 - 1	8/4/2009	19:34:2	45 22.0579	64 25.6452	47.8 m	video
BC29 - 2	8/4/2009	19:34:4	45 22.0528	64 25.6216	46.5 m	video
BC29 - 3	8/4/2009	19:35:0	45 22.0481	64 25.6020	45.3 m	video
BC30 - 1	8/4/2009	19:29:2	45 22.0461	64 25.6918	48.6 m	video
BC30 - 2	8/4/2009	19:29:5	45 22.0420	64 25.6726	47.8 m	video
BC30 - 3	8/4/2009	19:30:1	45 22.0379	64 25.6562	44.6 m	video
BC31 - 1	8/4/2009	19:25:2	45 22.0330	64 25.7319	49.6 m	video
BC31 - 2	8/4/2009	19:25:4	45 22.0306	64 25.7181	48.8 m	video
BC31 - 3	8/4/2009	19:26:0	45 22.0277	64 25.7016	46.9 m	video
BC32 - 1	8/4/2009	19:20:3	45 22.0193	64 25.7682	49.8 m	video
BC32 - 2	8/4/2009	19:20:4	45 22.0178	64 25.7563	48.6 m	video
BC32 - 3	8/4/2009	19:21:0	45 22.0151	64 25.7398	45.7 m	video
BC33 - 1	8/4/2009	19:15:2	45 22.0188	64 25.8134	50.6 m	video
BC33 - 2	8/4/2009	19:15:4	45 22.0172	64 25.8046	50.6 m	video
BC33 - 3	8/4/2009	19:16:0	45 22.0148	64 25.7935	50.3 m	video
BC35 - 1	8/4/2009	19:10:1	45 22.0055	64 25.8709	49.5 m	video
BC35 - 2	8/4/2009	19:10:4	45 22.0032	64 25.8589	49.8 m	video

Table C1. List of video sampling stations, Minas Passage study site, Berth "B"
 Cable Route, July and August, 2009.

STATION NUMBER	DATE	TIME (ADT)	LATITUDE	LONGITUDE	DEPTH (m)	TYPE OF SAMPLE
BC35 - 3	8/4/2009	19:11:0	45 21.9999	64 25.8442	45.2 m	video
BC35 - 4	8/4/2009	19:11:2	45 21.9974	64 25.8341	43.5 m	video
BC35 - 5	8/4/2009	19:11:4	45 21.9949	64 25.8255	40.5 m	video
BC36 - 1	8/4/2009	19:06:3	45 21.9839	64 25.9095	47.8 m	video
BC36 - 2	8/4/2009	19:06:5	45 21.9799	64 25.9017	46.2 m	video
BC36 - 3	8/4/2009	19:07:1	45 21.9756	64 25.8935	45.8 m	video
BC37 - 1	8/4/2009	19:01:0	45 21.9674	64 25.9182	42.8 m	video
BC37 - 2	8/4/2009	19:01:2	45 21.9631	64 25.9070	39.9 m	video
BC37 - 3	8/4/2009	19:02:1	45 21.9560	64 25.8910	52.6 m	video
BC38 - 1	8/4/2009	18:57:0	45 21.9589	64 25.9708	52.7 m	video
BC38 - 2	8/4/2009	18:57:2	45 21.9584	64 25.9698	52.8 m	video
BC38 - 3	8/4/2009	18:57:4	45 21.9574	64 25.9652	52.0 m	video
BC39 - 1	8/4/2009	18:52:5	45 21.9429	64 26.0051	46.8 m	video
BC39 - 2	8/4/2009	18:53:1	45 21.9396	64 26.0007	41.5 m	video
BC39 - 3	8/4/2009	18:53:3	45 21.9362	64 25.9980	41.5 m	video
BC40 - 1	8/4/2009	18:49:2	45 21.9356	64 26.0552	47.6 m	video
BC40 - 2	8/4/2009	18:49:4	45 21.9339	64 26.0537	47.7 m	video
BC40 - 3	8/4/2009	18:50:0	45 21.9319	64 26.0528	47.7 m	video
BC41 - 1	8/4/2009	18:47:1	45 21.9358	64 26.1026	48.6 m	video
BC41 - 2	8/4/2009	18:47:3	45 21.9366	64 26.0975	48.8 m	video
BC41 - 3	8/4/2009	18:47:5	45 21.9364	64 26.0933	49.0 m	video
BC42 - 1	8/4/2009	18:45:4	45 21.9358	64 26.1189	48.8 m	video
BC42 - 2	8/4/2009	18:46:0	45 21.9349	64 26.1173	48.7 m	video
BC42 - 3	8/4/2009	18:46:2	45 21.9337	64 26.1160	48.7 m	video

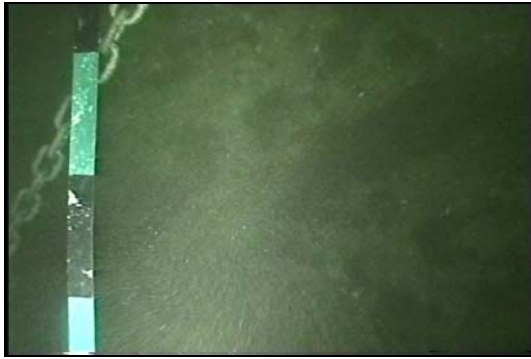


Figure C1. BC1-1-A



Figure C4. BC1-1-D



Figure C7. BC1-2-B



Figure C2. BC1-1-B

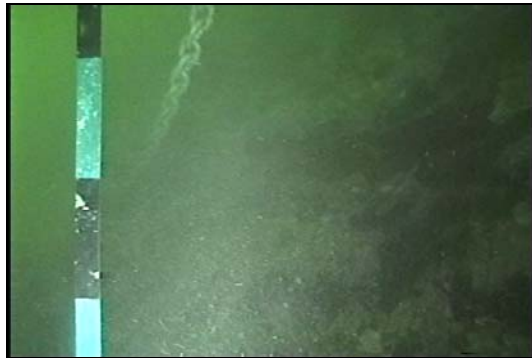


Figure C5. BC1-1-E



Figure C8. BC1-2-C



Figure C3. BC1-1-C



Figure C6. BC1-2-A



Figure C9. BC1-2-D



Figure C10. BC1-3-A



Figure C13. BC2-1-A



Figure C16. BC2-1-D



Figure C11. BC1-3-B

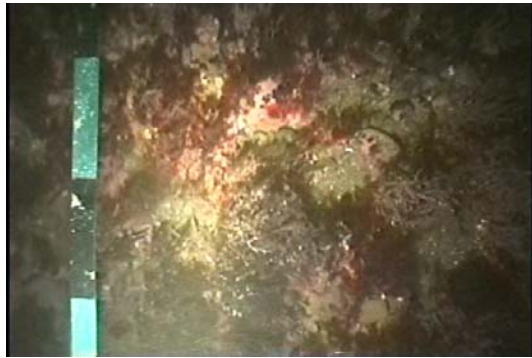


Figure C14. BC2-1-B



Figure C17. BC2-2-A



Figure C12. BC1-3-C

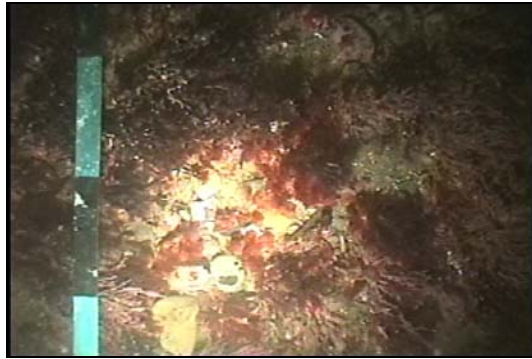


Figure C15. BC2-1-C



Figure C18. BC2-2-B

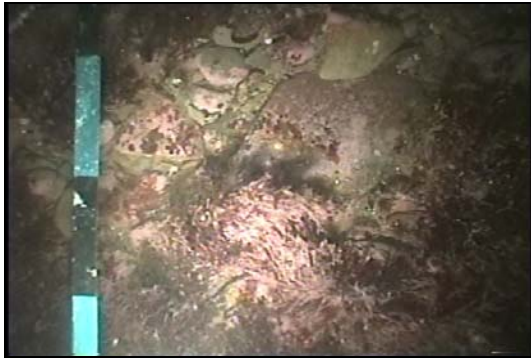


Figure C19. BC2-2-C



Figure C22. BC2-3-A



Figure C25. BC2-3-D



Figure C20. BC2-2-D



Figure C23. BC2-3-B



Figure C26. BC2-4-A



Figure C21. BC2-2-E



Figure C24. BC2-3-C



Figure C27. BC2-4-B



Figure C28. BC2-4-C

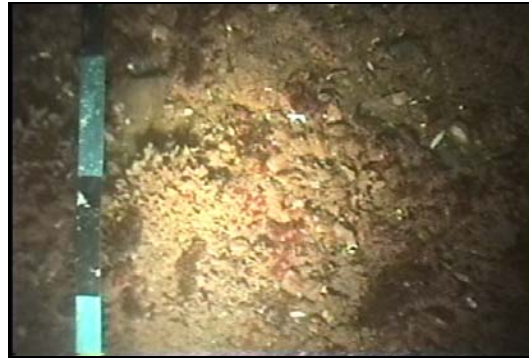


Figure C31. BC3-1-B



Figure C34. BC3-2-A



Figure C29. BC2-4-D



Figure C32. BC3-1-C



Figure C35. BC3-2-B



Figure C30. BC3-1-A



Figure C33. BC3-1-D



Figure C36. BC3-2-C



Figure C37. BC3-3-A



Figure C40. BC4-1-A



Figure C43. BC4-1-D



Figure C38. BC3-3-B



Figure C41. BC4-1-B



Figure C44. BC4-1-E

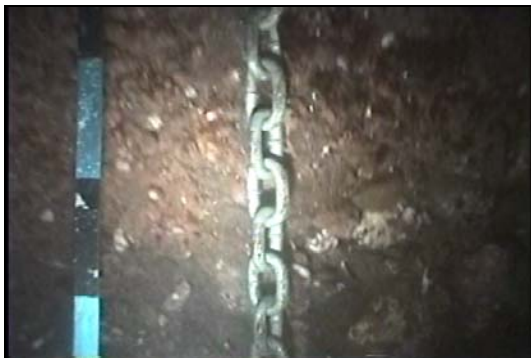


Figure C39. BC3-3-C



Figure C42. BC4-1-C



Figure C45. BC4-2-A



Figure C46. BC4-2-B



Figure C49. BC4-2-E



Figure C52. BC4-3-C



Figure C47. BC4-2-C



Figure C50. BC4-3-A



Figure C53. BC4-4-A



Figure C48. BC4-2-D



Figure C51. BC4-3-B



Figure C54. BC4-4-B



Figure C55. BC4-4-C



Figure C58. BC4-5-C



Figure C61. BC4-6-A



Figure C56. BC4-5-A



Figure C59. BC4-5-D



Figure C62. BC4-6-B

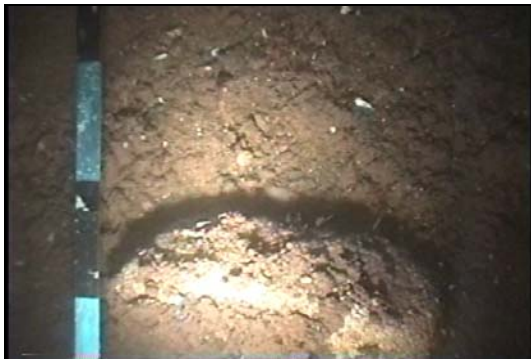


Figure C57. BC4-5-B



Figure C60. BC4-5-E



Figure C63. BC4-6-C



Figure C64. BC4-7-A



Figure C67. BC4-8-A



Figure C70. BC4-9-A



Figure C65. BC4-7-B



Figure C68. BC4-8-B



Figure C71. BC4-9-B



Figure C66. BC4-7-C



Figure C69. BC4-8-C



Figure C72. BC4-9-C



Figure C73. BC4-10-A



Figure C76. BC4-12-B



Figure C79. BC4-13-C



Figure C74. BC4-10-B



Figure C77. BC4-13-A



Figure C80. BC4-14-A



Figure C75. BC4-12-A



Figure C78. BC4-13-B



Figure C81. BC4-14-B



Figure C82. BC4-14-C



Figure C85. BC4-15-C



Figure C88. BC4-16-C



Figure C83. BC4-15-A



Figure C86. BC4-16-A



Figure C89. BC4-17-A



Figure C84. BC4-15-B



Figure C87. BC4-16-B



Figure C90. BC4-17-B



Figure C91. BC4-17-C



Figure C94. BC4-18-B



Figure C97. BC4-19-B



Figure C92. BC4-17-D



Figure C95. BC4-18-C



Figure C98. BC4-19-C



Figure C93. BC4-18-A



Figure C96. BC4-19-A



Figure C99. BC4-20-A



Figure C100. BC4-20-B



Figure C103. BC4-22-B



Figure C106. BC4-23-B



Figure C101. BC4-20-C



Figure C104. BC4-22-C



Figure C107. BC4-24-A



Figure C102. BC4-22-A



Figure C105. BC4-23-A



Figure C108. BC4-24-B



Figure C109. BC4-24-C



Figure C112. BC4-39-C



Figure C115. BC4-40-C



Figure C110. BC4-39-A



Figure C113. BC4-40-A



Figure C116. BC8-1-A



Figure C111. BC4-39-B



Figure C114. BC4-40-B



Figure C117. BC8-1-B



Figure C118. BC8-1-C



Figure C121. BC8-2-C



Figure C124. BC8-3-C



Figure C119. BC8-2-A



Figure C122. BC8-3-A



Figure C125. BC13-1-A



Figure C120. BC8-2-B



Figure C123. BC8-3-B



Figure C126. BC13-1-B



Figure C127. BC13-1-C



Figure C130. BC13-2-C



Figure C133. BC13-3-C



Figure C128. BC13-2-A



Figure C131. BC13-3-A



Figure C134. BC14-1-A



Figure C129. BC13-2-B



Figure C132. BC13-3-B



Figure C135. BC14-1-B



Figure C136. BC14-1-C



Figure C139. BC14-2-C



Figure C142. BC14-3-C



Figure C137. BC14-2-A



Figure C140. BC14-3-A



Figure C143. BC15-1-A



Figure C138. BC14-2-B



Figure C141. BC14-3-B



Figure C144. BC15-1-B



Figure C145. BC15-1-C



Figure C148. BC15-2-C



Figure C151. BC15-3-C



Figure C146. BC15-2-A



Figure C149. BC15-3-A



Figure C152. BC17-1-A



Figure C147. BC15-2-B



Figure C150. BC15-3-B



Figure C153. BC17-1-B



Figure C154. BC17-1-C



Figure C157. BC17-2-C



Figure C160. BC17-3-C



Figure C155. BC17-2-A



Figure C158. BC17-3-A



Figure C161. BC17-4-A



Figure C156. BC17-2-B



Figure C159. BC17-3-B



Figure C162. BC17-4-B



Figure C163. BC17-4-C



Figure C166. BC17-5-C



Figure C169. BC16-6-C



Figure C164. BC17-5-A



Figure C167. BC17-6-A



Figure C170. BC19-1-A



Figure C165. BC17-5-B



Figure C168. BC17-6-B



Figure C171. BC19-1-B



Figure C172. BC19-1-C



Figure C175. BC19-2-B



Figure C178. BC19-3-B



Figure C173. BC19-1-D



Figure C176. BC19-2-C



Figure C179. BC19-3-C



Figure C174. BC19-2-A



Figure C177. BC19-3-A



Figure C180. BC19-4-A



Figure C181. BC19-4-B



Figure C184. BC19-5-B



Figure C187. BC19-6-B



Figure C182. BC19-4-C



Figure C185. BC19-5-C



Figure C188. BC19-6-C



Figure C183. BC19-5-A



Figure C186. BC19-6-A



Figure C189. BC20-1-A



Figure C190. BC20-1-B



Figure C193. BC20-2-B



Figure C196. BC20-3-B



Figure C191. BC20-1-C



Figure C194. BC20-2-C



Figure C197. BC20-3-C



Figure C192. BC20-2-A



Figure C195. BC20-3-A



Figure C198. BC21-1-A



Figure C199. BC21-1-B



Figure C202. BC21-2-B



Figure C205. BC21-3-B



Figure C200. BC21-1-C



Figure C203. BC21-2-C



Figure C206. BC21-3-C



Figure C201. BC21-2-A



Figure C204. BC21-3-A



Figure C207. BC21-4-A



Figure C208. BC21-4-B



Figure C211. BC21-5-B



Figure C214. BC21-6-B



Figure C209. BC21-4-C



Figure C212. BC21-5-C



Figure C215. BC21-6-C



Figure C210. BC21-5-A



Figure C213. BC21-6-A



Figure C216. BC21-7-A



Figure C217. BC21-7-B



Figure C220. BC21-8-B



Figure C223. BC22-1-B



Figure C218. BC21-7-C



Figure C221. BC21-8-C



Figure C224. BC22-1-C



Figure C219. BC21-8-A



Figure C222. BC22-1-A



Figure C225. BC22-2-A



Figure C226. BC22-2-B



Figure C229. BC22-3-B



Figure C232. BC22a-1-B



Figure C227. BC22-2-C



Figure C230. BC22-3-C



Figure C233. BC22a-1-C



Figure C228. BC22-3-A



Figure C231. BC22a-1-A



Figure C234. BC22a-2-A



Figure C235. BC22a-2-B



Figure C238. BC22a-3-B



Figure C241. BC23-1-B



Figure C236. BC22a-2-C



Figure C239. BC22a-3-C



Figure C242. BC23-1-C



Figure C237. BC22a-3-A



Figure C240. BC23-1-A



Figure C243. BC23-1-D



Figure C244. BC23-2-A



Figure C247. BC23-2-D



Figure C250. BC23-3-C



Figure C245. BC23-2-B



Figure C248. BC23-3-A



Figure C251. BC24-1-A



Figure C246. BC23-2-C



Figure C249. BC23-3-B



Figure C252. BC24-1-B



Figure C253. BC24-1-C



Figure C256. BC24-2-C



Figure C259. BC24-3-B



Figure C254. BC24-2-A



Figure C257. BC24-2-D



Figure C260. BC24-3-C



Figure C255. BC24-2-B



Figure C258. BC24-3-A



Figure C261. BC25-1-A



Figure C262. BC25-1-B



Figure C265. BC25-2-B



Figure C268. BC25-3-B



Figure C263. BC25-1-C



Figure C266. BC25-2-C



Figure C269. BC25-3-C



Figure C264. BC25-2-A



Figure C267. BC25-3-A



Figure C270. BC26-1-A



Figure C271. BC26-1-B



Figure C274. BC26-2-A



Figure C277. BC26-3-A



Figure C272. BC26-1-C



Figure C275. BC26-2-B



Figure C278. BC26-3-B



Figure C273. BC26-1-D



Figure C276. BC26-2-C



Figure C279. BC26-3-C



Figure C280. BC27-1-A



Figure C283. BC27-2-A



Figure C286. BC27-3-A



Figure C281. BC27-1-B



Figure C284. BC27-2-B



Figure C287. BC27-3-B



Figure 2C82. BC27-1-C



Figure C285. BC27-2-C



Figure C288. BC27-3-C



Figure C289. BC27a-1-A



Figure C292. BC27a-2-A



Figure C295. BC27a-3-A



Figure C290. BC27a-1-B



Figure C293. BC27a-2-B



Figure C296. BC27a-3-B



Figure C291. BC27a-1-C



Figure C294. BC27a-2-C



Figure C297. BC27a-3-C



Figure C298. BC27a-4-A



Figure C301. BC27a-5-A



Figure C304. BC28-1-A



Figure C299. BC27a-4-B



Figure C302. BC27a-5-B



Figure C305. BC28-1-B



Figure C300. BC27-4-C



Figure C303. BC27a-5-C



Figure C306. BC28-1-C



Figure C307. BC28-2-A



Figure C310. BC28-3-A



Figure C313. BC29-1-A



Figure C308. BC28-2-B



Figure C311. BC28-3-B



Figure C314. BC29-1-B



Figure C309. BC28-2-C



Figure C312. BC28-3-C



Figure C315. BC29-1-C



Figure C316. BC29-2-A



Figure C319. BC29-2-D



Figure C322. BC29-3-C



Figure C317. BC29-2-B



Figure C320. BC29-3-A



Figure C323. BC30-1-A



Figure C318. BC29-2-C



Figure C321. BC29-3-B



Figure C324. BC30-1-B



Figure C325. BC30-1-C



Figure C328. BC30-2-C



Figure C331. BC30-3-C



Figure C326. BC30-2-A



Figure C329. BC30-3-A



Figure C332. BC30-3-D



Figure C327. BC30-2-B



Figure C330. BC30-3-B



Figure C333. BC31-1-A



Figure C334. BC31-1-B



Figure C337. BC31-2-B



Figure C340. BC31-3-B



Figure C335. BC31-1-C



Figure C338. BC31-2-C



Figure C341. BC31-3-C



Figure C336. BC31-2-A



Figure C339. BC31-3-A



Figure C342. BC32-1-A



Figure C343. BC32-1-B



Figure C346. BC32-2-B



Figure C349. BC32-3-B



Figure C344. BC32-1-C



Figure C347. BC32-2-C



Figure C350. BC32-3-C



Figure C345. BC32-2-A



Figure C348. BC32-3-A



Figure C351. BC33-1-A



Figure C352. BC33-1-B



Figure C355. BC33-2-B



Figure C358. BC33-3-B



Figure C353. BC33-1-D



Figure C356. BC33-2-C



Figure C359. BC33-3-C



Figure C354. BC33-2-A



Figure C357. BC33-3-A



Figure C360. BC35-1-A



Figure C361. BC35-1-B



Figure C364. BC35-2-B



Figure C367. BC35-3-B



Figure C362. BC35-1-C



Figure C365. BC35-2-C



Figure C368. BC35-3-C



Figure C363. BC35-2-A



Figure C366. BC35-3-A



Figure C369. BC35-4-A



Figure C370. BC35-4-B



Figure C373. BC35-5-B



Figure C376. BC36-1-B



Figure C371. BC35-4-C



Figure C374. BC35-5-C



Figure C377. BC36-1-C



Figure C372. BC35-5-A



Figure C375. BC36-1-A



Figure C378. BC36-2-A



Figure C379. BC36-2-B



Figure C382. BC36-3-A



Figure C385. BC36-3-D



Figure C380. BC36-2-C



Figure C383. BC36-3-B



Figure C386. BC37-1-A



Figure C381. BC36-2-D



Figure C384. BC36-3-C



Figure C387. BC37-1-B



Figure C388. BC37-1-C



Figure C391. BC37-2-B



Figure C394. BC37-3-B



Figure C389. BC37-1-D



Figure C392. BC37-2-C



Figure C395. BC37-3-C



Figure C390. BC37-2-A



Figure C393. BC37-3-A



Figure C396. BC37-3-D



Figure C397. BC37-3-E



Figure C400. BC38-1-C



Figure C403. BC38-2-C



Figure C398. BC38-1-A



Figure C401. BC38-2-A



Figure C404. BC38-3-A



Figure C399. BC38-1-B



Figure C402. BC38-2-B



Figure C405. BC38-3-B



Figure C406. BC38-3-C



Figure C409. BC39-1-C



Figure C412. BC39-2-C



Figure C407. BC39-1-A



Figure C410. BC39-2-A



Figure C413. BC39-2-D



Figure C408. BC39-1-B



Figure C411. BC39-2-B



Figure C414. BC39-2-E



Figure C415. BC39-2-F



Figure C418. BC39-3-C



Figure C421. BC40-1-C



Figure C416. BC39-3-A



Figure C419. BC40-1-A



Figure C422. BC40-2-A



Figure C417. BC39-3-B

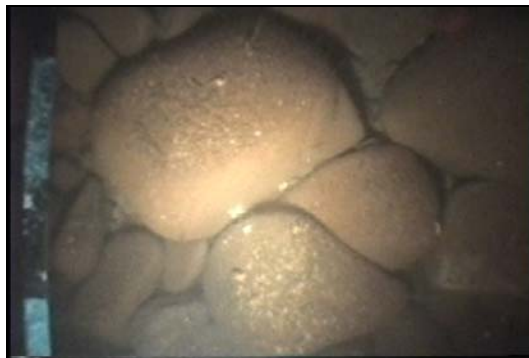


Figure C420. BC40-1-B



Figure C423. BC40-2-B



Figure C424. BC40-2-C



Figure C427. BC40-3-C



Figure C430. BC40-1-C



Figure C425. BC40-3-A



Figure C428. BC41-1-A



Figure C431. BC41-2-A



Figure C426. BC40-3-B



Figure C429. BC41-1-B



Figure C432. BC41-2-B



Figure C433. BC41-2-C



Figure C436. BC41-3-C



Figure C439. BC42-1-C



Figure C434. BC41-3-A



Figure C437. BC42-1-A



Figure C440. BC42-2-A



Figure C435. BC41-3-B



Figure C438. BC42-1-B



Figure C441. BC42-2-B



Figure C442. BC42-2-C



Figure C445. BC42-3-C



Figure C448. BCJ22-2-C



Figure C443. BC42-3-A



Figure C446. BCJ22-2-A



Figure C444. BC42-3-B



Figure C447. BCJ22-2-B