CRUISE REPORT 88-018(B) PHASE II; 88-018 (B) PHASE III F.R.V. NAVICULA Yarmouth, South - Yarmouth, North June 5th - June 17th, 1988

by

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CRUISE SUMMARY SHEET

Cruise No.:	88-018 (B) Phase II (Yarmouth, South)	
Vessel:	F.R.V. Navicula	
Cruise Dates:	June 5 - June 10, 1988	
Responsible Agency:	Atlantic Geoscience Centre, Geological Survey of Canada, Bedford Institute of Oceanography, Dartmouth, N.S., B2Y 4A2	
Area:	Pubnico, Cape Sable Island to Tusket Islands, Lobster Bay (See Index Map, Figure 1 and 2) and chart 4242 overlay in pocket	
Ship's Master:	Captain Niel Langille	
Senior Scientist:	Robert O. Miller	
Scientific Personnel:	Darrell Beaver	Technician, AGC
	Austin Boyce	Technician, AGC
	Arnaud Héquette	Scientist, AGC

Cruise No.:	88-018 (B) Phase III (Yarmouth, North)	
Vessel:	F.R.V. Navicula	
Cruise Dates:		
Responsible Agency:	Atlantic Geoscience Centre, Geological Survey of Canada, Bedford Institute of Oceanography, Dartmouth, N.S., B2Y 4A2	
Area:	Yarmouth to Cape St. Mary's (see Index Map, Figure 3 and 4) and chart 4243 overlay in pocket	
Ship's Master:	Captain Niel Langille	
Senior Scientist:	Robert O. Miller	
Scientific Personnel:	Darrell Beaver	Technician, AGC
	Austin Boyce	Technician, AGC
	Dave Doucet	Student, AGC

NAVICULA CRUISE
88-018 (B) Phase II; 88-018 (B) Phase III
YARMOUTH SOUTH (PUBNICO, CAPE SABLE ISLAND TO TUSKET ISLANDS, LOBSTER BAY) AND YARMOUTH NORTH

ITINERARY:

DATE (1988)	TIME (GMT)	OPERATION
June 4	1300 2330	Load truck for trip to Lower West Pubnico. Arrive at dock in Lower West Pubnico
June 5	0930	Load equipment on Navicula. Storm warnings are reduced to gale force warnings. Stayed in port.
June 6	0930 2000	Leave Dennis Point wharf in Lower West Pubnico. Survey all day with magnetometer, bathymetry, sparker and Klein® sidescan. Return to Dennis Point wharf.
June 7	0930 2130	Leave Dennis Point wharf in Lower West Pubnico and survey all day as above. Return to Dennis Point wharf.
June 8	0930 1500 1530 2130	Leave Dennis Point wharf in Lower West Pubnico to sample. Return to Dennis Point wharf to take two local fishermen out with us for a half day. Leave Dennis Point wharf to survey and sample in Lobster Bay. Return to Dennis Point wharf.
June 9	0930 2130	Leave Dennis Point wharf in Lower West Pubnico and survey all day as above. Return to Dennis Point wharf.
June 10	0930	Leave Dennis Point wharf in Lower West Pubnico to sample. Return to Dennis Point wharf to end Navicula cruise 88-018 (B) Phase II
June 11	0800 1200 2130	Survey party moves to Yarmouth Leave Yarmouth wharf for a half day survey. Return to Yarmouth
June 12	0730 2130	Leave Yarmouth wharf for full day of survey. Return to Yarmouth
June 13		Navicula in port all day to take on provisions and repair auto pilot.
June 14		Navicula in port all day waiting for repairs to auto pilot.
June 15	0730 0800 0900 1600	Leave Yarmouth wharf. Engines fail, lost all power off of Cape Fourchu Regain engines and collected 12 grab samples. Run long tie line from Cape St. Mary to Yarmouth. Return to Yarmouth wharf. Navicula engine is damaged; must be repaired. End cruise prematurely.

PURPOSE OF CRUISE

The purpose of this cruise was to collect shallow seismic reflection, sidescan and magnetic data in support of a program to map the surficial sediments and shallow bedrock geology of the nearshore area south of Pubnico Harbour between Cape Sable Island and Seal Island and from Cape St. Mary's to Yarmouth. These data and their interpretations will assist in the understanding of the processes that have, and are affecting, the sediments. Specific objectives of the cruise were:

1) To assess the potential for aggregate and the mineralogy of the sediments within the survey area.
2) To collect magnetometer data within the area to assist in assessing the magnetic trends in the survey area and the bedrock geology.
3) To collect samples using a medium-sized van Veen grab sampler to ground truth the acoustic data.
4) To map the distribution of surficial sediments, surface and subsurface features of the area.

EQUIPMENT DESCRIPTION AND PERFORMANCE

Sidescan Sonar

A Klein® tow-fish containing a 100 kHz, 3/4° side-looking beam and a 200 kHz down-looking, wide-angle beam was used as a sound source. A wet paper sidescan 421T, 2 channel tranceiver-recorder was used to produce sonograms, and altimeter profiles were recorded on an EPC 1600 graphic recorder. Sidescan sonar data were recorded on a Racal Store 4D, reel-to-reel tape recorder using normal FM bias (channel one - port signal, TVG; channel two - starboard signal, TVG; channel three - 421T reference recorder pulses; and channel four - voice fix).

The Klein® system performed well and yielded high-quality sonograms of the sea floor. Data quality decreased in shallow water (<20 metres) when the fish was affected by the ship's wake.

Seismic Reflection Systems:

An O.R.E.® Geopulse seismic system (sparker) yielded the best results over hard seabeds of sand and gravel during a previous cruise (Navicula 88-018 (A) Phase I) intended as a shakedown cruise for the various seismic reflection systems. Despite a large bubble pulse (>5 m), the sparker system proved best at penetrating surficial sediments to the bedrock surface and therefore was used exclusively during this cruise.

A 15 tip Nova Scotia Research Foundation (N.S.R.F.) sparker was used during the survey. It was powered by an O.R.E.® Geopulse system amplifier and high voltage power unit with an output of 350 joules. A 25 foot N.S.R.F. surface streamer was used to receive the returning seismic signals. The seismic data was printed on an EPC 4100-19 inch graphic recorder set at 0.25 second sweep rate and fired at 0.75 second intervals.

Bathymetry

Bathymetry was recorded using Navicula's 30 kHz Elac type LAZ72 boat sounder. Time and sample locations were annotated on the echosounder profiles.

Magnetics

Total magnetic field data was collected with a Barringer Model M-123 portable sea magnetometer at a sensitivity of one gamma at a 10 second cycle rate using a toroidal, non-directional, noise cancelling GM-122 towed sensor on a 100 foot (30 m) tow cable. Readings in gammas were logged on computer disks at six readings per minute as well as on the integrated H.P. 7155 ink, strip chart paper recorder. During this cruise the chart span was set at 100 gammas.

An interference problem was resolved by the addition of an inhibit key pulse box so that the sparker seismic system could not be fired during the polarization/sense cycle.

Seabed Ground Truth

A medium size van Veen grab sampler was used to collect bottom samples. The Navicula boom was used as a high shive point and the deck capstan was used for hauling during recovery. This system was quick and efficient for sampling.

Navigation

Navigation was provided by rho rho Loran C. It was periodically calibrated by radar fixes. In some areas (especially Lobster Bay), radar was the only means of navigation because Loran C coverage stops at the mouth of the bay.

Technical Report

A normal survey set-up consisted of the sidescan deployed off the starboard sidearm using a Markey DEWS-8 slip ring winch with added hydraulic remote control in the lab, which proved to be absolutely

indispensable. The Klein® 422S-101AF tow fish with added K-wing I depressor was deployed to a maximum 60 metre depth at Navicula's minimum survey boat speed of four knots using a three channel, 300 metre armored tow cable. The sidescan was operated at 100 and 150 metre range settings. The sonograms had 30 kHz sounder and sparker interference caused by tow fish auto firing part way through the sidescan sweep. After many attempts to ground out sources of interference, it was concluded that the 30 kHz sounder had a high frequency acoustic component to it. The sparker interference resulted from the isolation of the tow cable armour due to the lack of a spare slip ring and a floating winch on the wooden deck of the ship.

The sparker was deployed from one half of the centre stern. The N.S.R.F. streamer reception was improved especially in rough seas by the addition of a five foot (1.5 m) retractable side boom to keep the streamer out of the ship's wake. The N.S.R.F. streamer detected significant background noise in seas greater than 1 m. This resulted in a decreased resolution on seismic records.

The magnetometer sensor was deployed off the port side arm. Communication with the bridge was accomplished with Atkinson intercoms.

NATURE AND QUANTITY OF DATA COLLECTED

See appendix attached and Figures 1, 2, 3 and 4 (cruise tracks and sample plots). See interpreted surficial geological maps - overlay charts 4243 and 4242 (in pocket).

DISCUSSION AND COMMENTS

Yarmouth South - Surficial Map Overlay - Chart 4242 (in pocket)

The dominant surficial formation present in this study area is the Sable Island Sand and Gravel Formation (King, 1970). It was also mapped in the adjacent offshore area of southwestern Nova Scotia by Fader *et al.*, 1977. The southern half of the map is dominated by a gravel facies of the Sable Island Sand and Gravel Formation. Bedrock often protrudes through the gravel lag and presents a rough seabed. Boulders are common across the seabed. The resolution of the sidescan sonar was approximately 0.5 m. Several buried channels exist beneath the surficial sediments which are cut into bedrock. Sand appears to lie over or close to the buried channels in the southern half of the study area. Gravel ripples occasionally occur within the gravel facies and indicate a recent origin. The grain size of these ripples are granule-pebble sized. One large sand ridge with megaripples on its surface occurs east of Seal Island. It was crossed on three survey lines and is probably maintained in response to very strong ($\simeq$4 knots) currents which sweep between Seal Island and Mud Island in an area known as the Hospital. It may represent a source of potential offshore aggregate for mining.

The surficial sediments in the northern half of the Yarmouth South study area are varied. A large body of sand occurs off Pubnico Point and is oriented to the southwest. Sand ribbons and megaripples are common on the sandier parts of the seabed in this area. Gravel, bedrock and small particles of sand are dominant in the immediate nearshore west of Pubnico Point and further offshore west of the large sand patch. Seabed samples were collected throughout the area on the basis of the previously collected sidescan sonar and seismic reflection data and were in agreement with the interpreted textures (see sample description in appendix).

Yarmouth North - Surficial Map Overlay - Chart 4243 (in pocket)

The seabed in this region is dominated by a pattern of gravel and bedrock outcrop interspersed with patches of sand with megaripples. The seabed off Cape St. Mary is dominantly sand with megaripples

and a few boulders which protrude through a thin layer of sand. In the outer area at longitude 60° 20' however, bedrock outcrops as a rough and irregular seabed. To the west and northwest of Port Maitland, the seabed is dominantly composed of gravel and boulders with large, flat, cobbled areas but with no bedrock cropping out. Approximately equal proportions of sand and gravel are present to the west of Nickerson's Point and continuing to the south for the remainder of the study area. The sand lies in small patches between areas of gravel and bedrock. Megaripples are common across the sand and boulders occur in most areas of gravel. Grab samples were also collected here, and were found to be in agreement with the interpreted acoustic reflectivities and textures.

ACKNOWLEDGMENTS

We wish to thank Captain Niel Langille and the crew of the MV Navicula for their excellent support during the cruise. The program support technicians of AGC also are thanked for their assistance and equipment development. Glynne Sharp of the Department of Fisheries and Oceans was very supportive of the program from a habitat perspective and allowed us the use of his onshore facilities. We appreciate the discussion and participation of fishermen Adolphe A. d'Eon and Edward A. d'Eon. L. Drummond typed the manuscript and many tables and we thank her. The manuscript was reviewed by I. Hardy and C.L. Amos.

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1989: Cruise Report 88-018(A) Phase I, FRV Navicula, Halifax - Sambro. Geological Survey of Canada Open File 2093, 22 p. (includes map in pocket).

APPENDIX

Table 1: 88-018(B) Phase 2 Grabs

Samp. #	Sample Type	Jul. Day/ Time	Latitude	Longitude	Depth (m)	# of Attempts	# of Sub-samples	Geographic Location	Notes
001	van Veen	1601040	43°31.76'	65°49.38'	27	2	0	Yarmouth South	Fine silty, olive green sand with 5% shell hash, very fine, obtained in 2nd attempt, 1st attempt, same material but small sample, both in same bag.
002	van Veen	1601059	43°30.87'	65°51.35'	36	2	0	Yarmouth South	Lime green fine sand, 30% shell hash, a couple of sub-rounded cobbles, sea potatoes, 2 small samples of similar material, placed in one bag.
003	van Veen	1601112	43°30.38'	65°50.14'	54	3	0	Yarmouth South	1st attempt, fine silty sand, angular gravel sized clasts, shells, jaws open, small samples. 2nd same as 1st. 3rd same as 1st. All attempts jaws partially open. All samples on one bag.
004	van Veen	1601130	43°29.89'	65°51.62'	32	3	0	Yarmouth South	1st attempt, fine to medium sand, shell hash and shells. 2nd attempt jaws closed but not sample. 3rd attempt jaws closed but no sample. Small sample recovered from 1st attempt.
005	van Veen	1601146	43°29.39'	65°52.71'	39	3	0	Yarmouth South	1st attempt, jaws open-one sub-rounded cobble. 2nd attempt, jaws closed, small sample of fine green sand, shells and shell hash. 3rd attempt, jaws closed, small sample, same as 2nd attempt.
006	van Veen	1601212	43°28.31'	65°55.60'	30	1	0	Yarmouth South	Medium to coarse sand with shell hash, good sample.
007	van Veen	1601225	43°27.72'	65°57.19'	20	3	0	Yarmouth South	1st attempt, jaws open, recovered 2 sub-rounded cobbles, 2nd attempt, medium sand 85%, 15% pebbles - rounded to subounded. 3rd attempt, good clean sand, 5% shell hash one sand dollar. Placed in 3 separate bags.
008	van Veen	1601238	43°27.31'	65°57.99'	22	2		Yarmouth South	1st attempt, jaws closed, fine green sand, minor shell hash. 2nd attempt, jaws closed fine green well-sorted sand, minor shell hash, two attempts stored in two bags, 1 bucket.
009	van Veen	1601248	43°27.22'	65°58.69'	23	1	0	Yarmouth South	Clean well-sorted green sand, good sample.
010	van Veen	1601302	43°26.19'	65°57.06'	28	2	0	Yarmouth South	1st attempt, jaws closed, small sample of clean well-sorted fine green sand with minor shell hash. 2nd attempt, jaws closed same as 1st attempt, both samples in one bag.
011	van Veen	1601348	43°32.00'	65°53.16'	31	1	0	Yarmouth South	Clayey silty sand with one well-rounded cobble, some shell hash, green in colour.
012	van Veen	1601403	43°33.30'	65°52.89'	27	1	0	Yarmouth South	Clayey silt with 30% fine sand, few pebbles, minor shells (broken), small sample, green in colour.
013	van Veen	1601923	43°34.40'	65°52.20'	26	1	0	Yarmouth South	Fine silty sand, green, jaws closed, small sample.

Table 1: 88-018(B) Phase 2 Grabs (Continued)

Samp. #	Sample Type	Jul. Day/ Time	Latitude	Longitude	Depth (m)	# of Attempts	# of Sub-samples	Geographic Location	Notes
014	van Veen	1601934	43°35.50'	65°52.19'	25	1	0	Yarmouth South	Fine silty sand, small sample.
015	van Veen	1601949	43°37.62'	65°51.97'	23	1	0	Yarmouth South	Green sandy silt, some macrofauna.
016	van Veen	1601956	43°38.22'	65°51.96'	20	1	0	Yarmouth South	Green silty sand.
017	van Veen	1602002	43°38.70'	65°51.78'	19	1	0	Yarmouth South	Fine silty green sand.
018	van Veen	1602009	43°39.05'	65°51.46'	18	2	0	Yarmouth South	1st attempt, failed, missed target. 2nd attempt, jaws open but retrieved large sample of flat angular cobbles with 10% silty sand matrix, some growth on cobbles.
019	van Veen	1602016	43°39.18'	65°51.35'	19	1	0	Yarmouth South	Silty sand, some macrofauna, and broken shells, green in colour.
020	van Veen	1621132	43°26.42'	65°43.32'	24	4	0	Yarmouth South	1st attempt, jaws closed but no sample. 2nd attempt, jaws closed, small sample green silty sand. 5% shell hash. 3rd attempt, very small sample, green silty sand. 4th attempt, small sample green silty sand.
021	van Veen	1621218	43°22.70'	65°49.39'	40	3	0	Yarmouth South	1st attempt, jaws open but small sub-rounded cobble with *lithothamnia*, cobble kept. 2nd attempt, no sample, jaws closed. 3rd attempt, no sample, jaws closed.
022	van Veen	1621237	43°19.58'	65°48.40'	36	3	0	Yarmouth South	1st attempt, jaws partially open, small sample, pebble sized clasts, 5% broken shells, trace of sand, 2nd attempt, jaws partially open, no sample, 3rd attempt, jaws open, one cobble with *lithothamnia*.
023	van Veen	1621346	43°23.82'	65°58.00'	35	1	0	Yarmouth South	Medium grey-green sand with 10% shell hash.
024	van Veen	1621403	43°24.34'	65°55.10'	20	1	0	Yarmouth South	Clean well-sorted medium sand, green in colour.
025	van Veen	1621421	43°25.00'	65°51.50'	33	3	0	Yarmouth South	1st attempt, jaws closed but no sample. 2nd attempt, jaws open but small pebble with *lithothamnia*, kept in bucket. 3rd attempt, no sample, jaws closed.
026	van Veen	1621432	43°25.26'	65°50.55'	47	3	0	Yarmouth South	1st attempt, jaws closed, no sample. 2nd attempt, jaws open by cobbles with sand sticking to it. Few other smaller sub-rounded pebbles, saved in plastic bag. 3rd attempt, no sample.

Table 2: Sidescan Records 88-018(B) Phase 2

Roll #	Start Day/ Time	Stop Day/ Time	Line #	Geographic Location	Recorder	Sidescan System
001	1581020	1581527	1-2	Yarmouth South	Klein	100 kHz Klein®SSS
002	1581529	1581634	2	Yarmouth South	Klein	100 kHz Klein®SSS
003	1591024	1591742	4	Yarmouth South	Klein	100 kHz Klein®SSS
004	1591748	1592026	4	Yarmouth South	Klein	100 kHz Klein®SSS
005	1601551	1601909	5	Yarmouth South	Klein	100 kHz Klein®SSS
006	1611134	1611619	6	Yarmouth South	Klein	100 kHz Klein®SSS
007	1611621	1611926	6	Yarmouth South	Klein	100 kHz Klein®SSS
001	1581020	1581530	1-2	Yarmouth South	EPC 1600	100 kHz SSS Altitude
002	1581532	1581630	2	Yarmouth South	EPC 1600	100 kHz SSS Altitude
003	1591016	1591504	4	Yarmouth South	EPC 1600	100 kHz SSS Altitude
004	1591507	1592026	4	Yarmouth South	EPC 1600	100 kHz SSS Altitude
005	1601551	1601600	5	Yarmouth South	EPC 1600	100 kHz SSS Altitude
006	1601603	1601909	5	Yarmouth South	EPC 1600	100 kHz SSS Altitude
007	1611134	1611415	6	Yarmouth South	EPC 1600	100 kHz SSS Altitude
008	1611410	1611926	6	Yarmouth South	EPC 1600	100 kHz SSS Altitude

Table 3: Sidescan Tapes 88-018(B) Phase 2

Tape #	Start Day/ Time	Stop Day/ Time	Line #	Geographic Location	Channel Information	Sidescan System
001	1581025	1581348	1	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
002	1581355	1591058	1-2-4	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
003	1591058	1591407	4	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
004	1591410	1591730	4	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
005	1591735	1601625	4-5	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
006	1601630	1611205	5-6	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
007	1611209	1611527	6	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
008	1611530	1611842	6	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
009	1611845	1611930	6	Yarmouth South	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz

Table 4: Seismic Records 88-018(B) Phase 2

Tape #	Start Day/ Time	Stop Day/ Time	Hydrophone	Line #	Geographic Location	Recorder	System/Sound Source
001	1581030	1581636	NSRF	1-2	Yarmouth South	EPC 4100	Geopulse Sparker
002	1591025	1591731	NSRF	4	Yarmouth South	EPC 4100	Geopulse Sparker
003	1591741	1601906	NSRF	4-5	Yarmouth South	EPC 4100	Geopulse Sparker
004	1611130	1611921	NSRF	6	Yarmouth South	EPC 4100	Geopulse Sparker

Table 5: Bathymetry Records 88-018(B) Phase 2

Roll #	Start Day/ Time	Stop Day/ Time	Line #	Geographic Location	Frequency	Recorder
001	1581020	1591720	1-2-3-4	Yarmouth South	30 kHz	ELAC
002	1591720	1621435	4-5-6	Yarmouth South	30kHz	ELAC

Table 6: Magnetics Records 88-018(B) Phase 2

Roll #	Start Day/ Time	Stop Day/ Time	Line #	Geographic Location	Recorder
001	1581030	1611920	1-2-3-4-5-6	Yarmouth South	HP 7155

Table 7: 88-018(B) Phase 2 Grabs

Samp. #	Sample Type	Jul. Day/ Time	Latitude	Longitude	Depth (m)	# of Attempts	# of Sub-samples	Geographic Location	Notes
001	van Veen	1671154	43°48.90'	66°19.54'	56	2	0	Yarmouth North	1st attempt, jaws closed, small sample, fine sand, 10% angular pebbles, few pieces of shells, 2nd attempt, grab full, coarse sand, sub-rounded to angular pebbles, 10% broken shells.
002	van Veen	1671219	43°51.88'	66°18.91'	50	1	0	Yarmouth North	Jaws closed, some fines, washing out on recovery, silty sand with 5-10% sub-rounded pebbles, poorly sorted.
003	van Veen	1671237	43°53.60'	66°15.19'	54	1	0	Yarmouth North	Jaws closed on recovery, some fines washing out, small sample recovered, poorly sorted, silty sand, 20% broken shells. Few sub-rounded pebbles.
004	van Veen	1671304	43°52.94'	66°11.00'	26	1	0	Yarmouth North	Small sample, fine silty sand, green in colour.
005	van Veen	1671318	43°54.63	66°11.40'	30	1	0	Yarmouth North	Small sample, fine silty sand, green in colour.
006	van Veen	1671338	43°56.20'	66°13.92'	34	3	0	Yarmouth North	1st attempt, silty sand, mussels, shells, debris, sample saved. 2nd attempt, jaws closed but no sample. 3rd attempt, fine sand, green, some silt, 5-10% broken shells.
007	van Veen	1671400	43°57.31'	66°17.50'	34	3	0	Yarmouth North	1st attempt, jaws open, retained a few flat, sub-rounded cobbles, some with *lithothamnia*, few broken shells. 2nd attempt, same as 1st. 3rd attempt, jaws closed but no sample. 1-2 in same bag.
008	van Veen	1671420	43°58.93'	66°14.42'	25	3	0	Yarmouth North	1st attempt, jaws closed but no sample. 2nd attempt, jaws closed, no sample, one sponge. 3rd attempt, jaws closed, no recovery.
009	van Veen	1671437	43°58.96'	66°12.20'	26	3	0	Yarmouth North	1st attempt, small sample, sand, few sub-rounded flat cobbles, few mussel shells and 5-10% shell hash. 2nd attempt, fine-medium sand, very small sample. 3rd attempt, medium green sand. Grab full.
010	van Veen	1671513	44°01.32'	66°16.88'	28	6	0	Yarmouth North	1st attempt, 3 mussles. 2nd attempt, no recovery. 3rd attempt, few sponges. 4th attempt, no sample, jaws closed. 5th attempt, just seaweed. 6th attempt, one mussel, sponges. All in one bag.
011	van Veen	1671544	44°02.68'	66°20.51'	54	3	0	Yarmouth North	1st attempt, jaws closed but no sample. 2nd attempt, jaws partially open, recovered few small rounded pebbles, one shell. 3rd attempt, jaws held open by one angular cobble with some macrofauna.
012	van Veen	1671615	44°04.15'	66°15.71'	33	3	0	Yarmouth North	1st attempt, jaws closed, on angular pebble, on mussel. 2nd attempt, small sample, medium sand, green, minor shell hash. 3rd attempt, medium to coarse sand, 5% shell hash.

Table 8: Sidescan Records 88-018(B) Phase 3

Roll #	Start Day/ Time	Stop Day/ Time	Line #	Geographic Location	Recorder	Sidescan System
001	1631548	1632035	1	Yarmouth North	Klein	100 kHz Klein®SSS
002	1641054	1641440	2	Yarmouth North	Klein	100 kHz Klein®SSS
003	1641443	1642037	2	Yarmouth North	Klein	100 kHz Klein®SSS
004	1671641	1672023	3	Yarmouth North	Klein	100 kHz Klein®SSS
001	1631548	1632035	1	Yarmouth North	EPC 1600	100 kHz SSS Altitude
002	1641054	1641138	2	Yarmouth North	EPC 1600	100 kHz SSS Altitude
003	1671640	1672023	3	Yarmouth North	EPC 1600	100 kHz SSS Altitude

Table 9: Sidescan Tapes 88-018(B) Phase 3

Tape #	Start Day/ Time	Stop Day/ Time	Line #	Geographic Location	Channel Information	Sidescan System
001	1631555	1631904	1	Yarmouth North	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
002	1631906	1641232	1-2	Yarmouth North	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
003	1641235	1641543	2	Yarmouth North	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
004	1641545	1641855	2	Yarmouth North	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
005	1641858	1671813	2-3	Yarmouth North	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz
006	1671813	1672020	3	Yarmouth North	Stbd.-FM Port-FM Ref.-DR Speed-DR	Klein®100 kHz

Table 10: Seismic Records 88-018(B) Phase 3

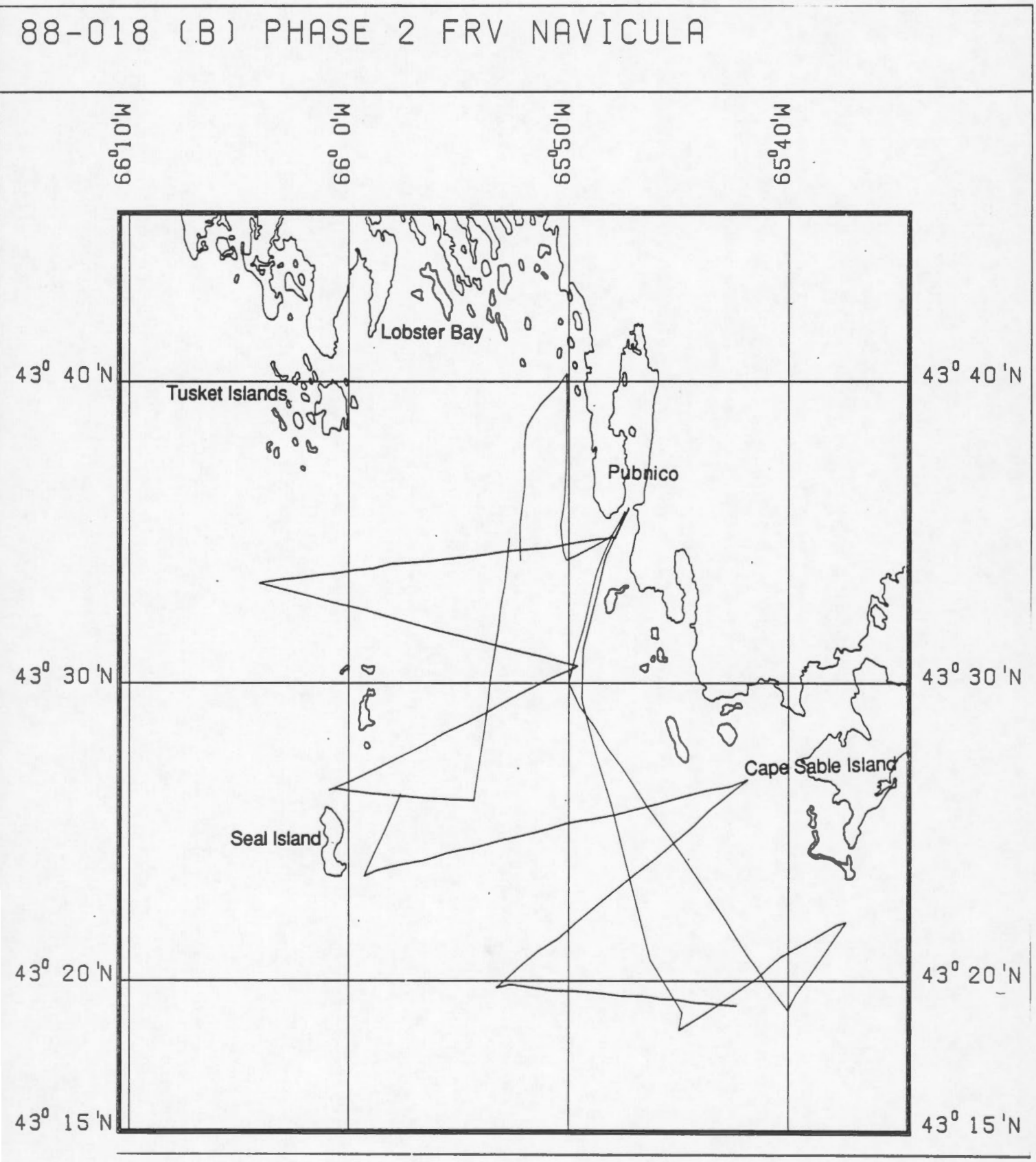
Tape #	Start Day/ Time	Stop Day/ Time	Hydrophone	Line #	Geographic Location	Recorder	System/Sound Source
001	1631552	1632030	NSRF	1	Yarmouth North	EPC 4100	Geopulse Sparker
002	1641136	1642302	NSRF	2	Yarmouth North	EPC 4100	Geopulse Sparker
003	1641747	1672020	NSRF	2-3	Yarmouth North	EPC 4100	Geopulse Sparker

Table 11: Bathymetry Records 88-018(B) Phase 3

Roll #	Start Day/ Time	Stop Day/ Time	Line #	Geographic Location	Frequency	Recorder
001	1631548	1632030	1	Yarmouth North	30 kHz	ELAC
002	1641050	1672020	2-3	Yarmouth North	30 kHz	ELAC

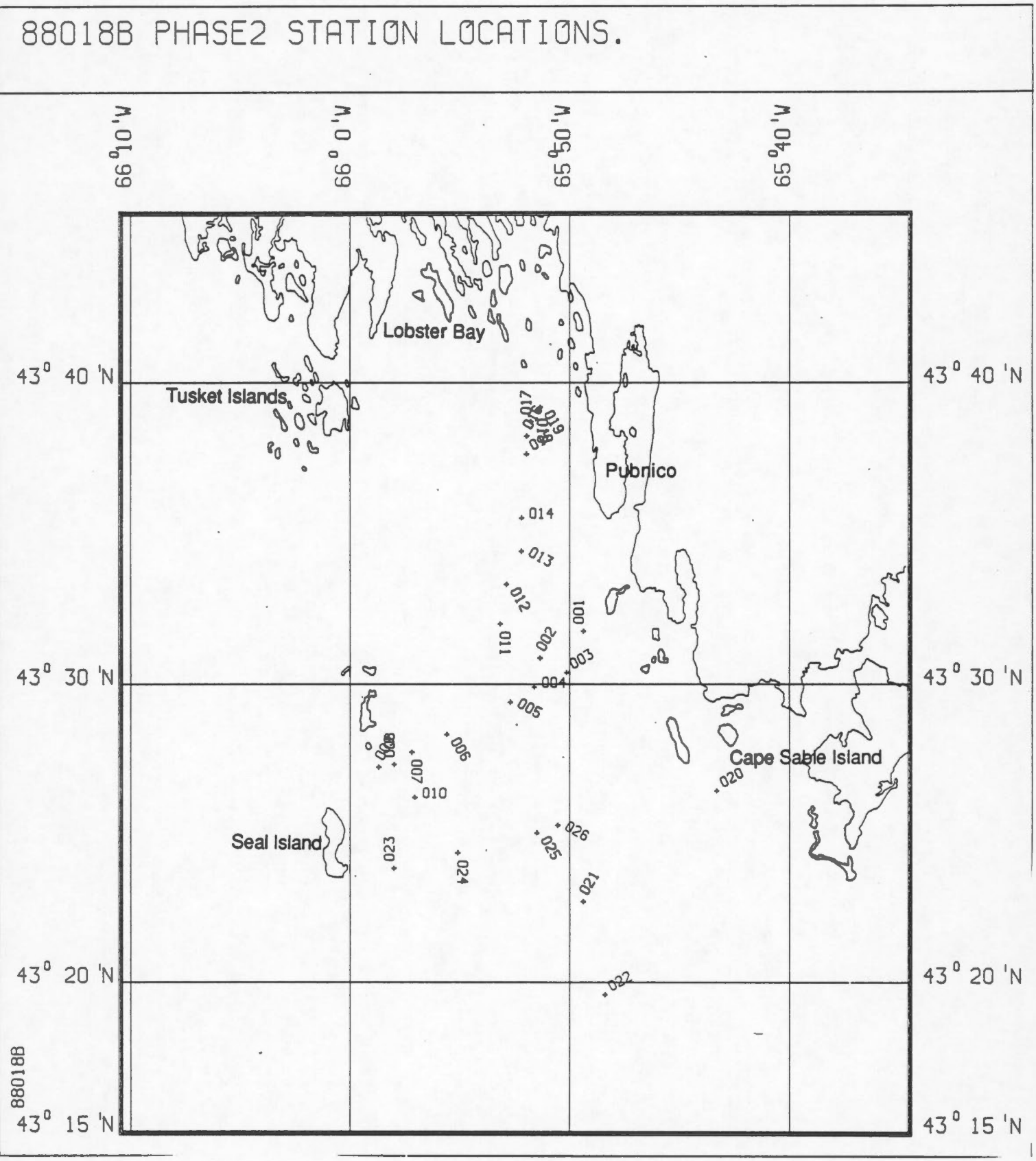
Table 12: Magnetics Records 88-018(B) Phase 3

Roll #	Start Day/ Time	Stop Day/ Time	Line #	Geographic Location	Recorder
001	1631600	1672020	1-2-3	Yarmouth North	HP 7155



SHIP'S TRACKS

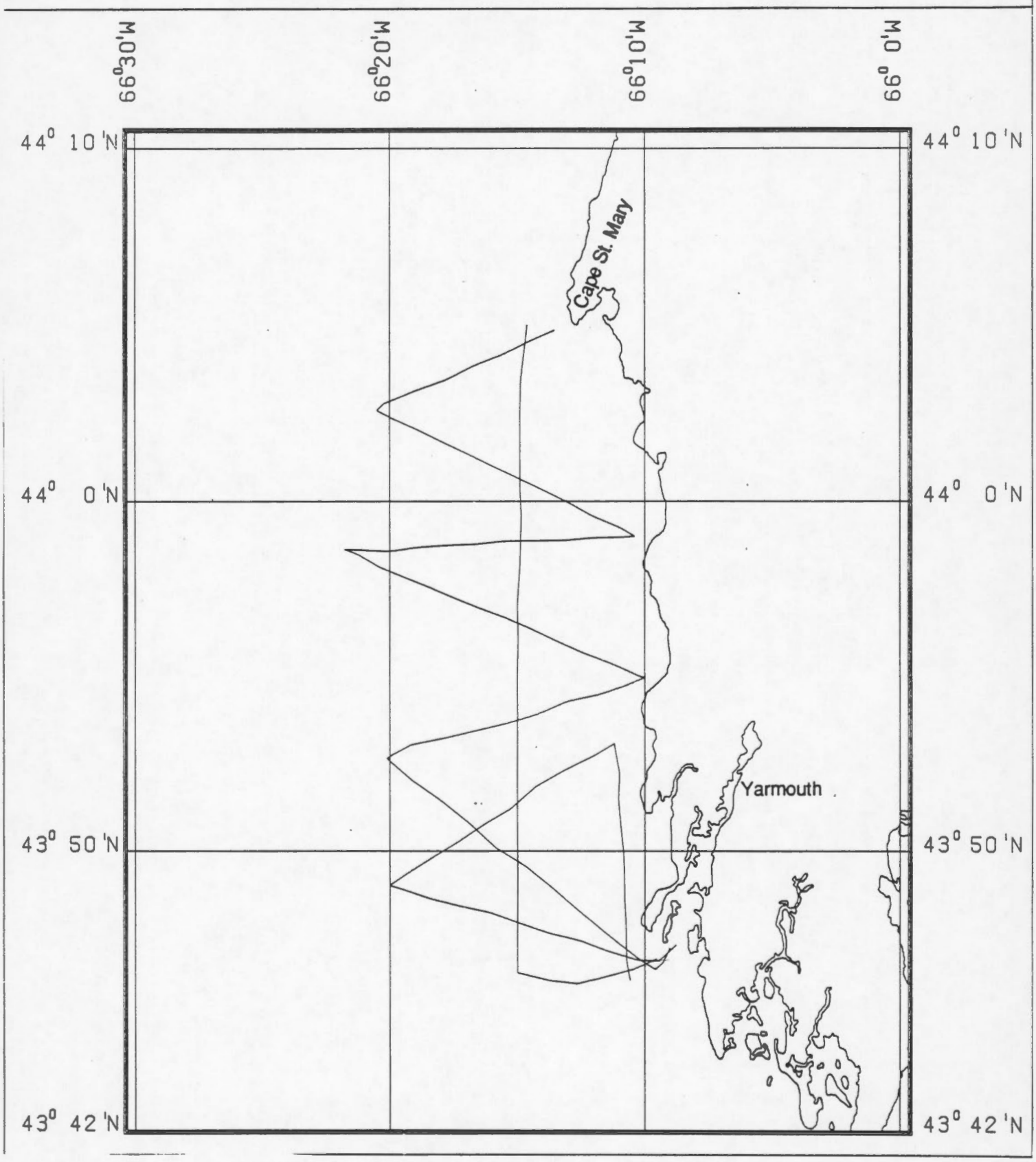
FIGURE 1



SAMPLE LOCATIONS

FIGURE 2

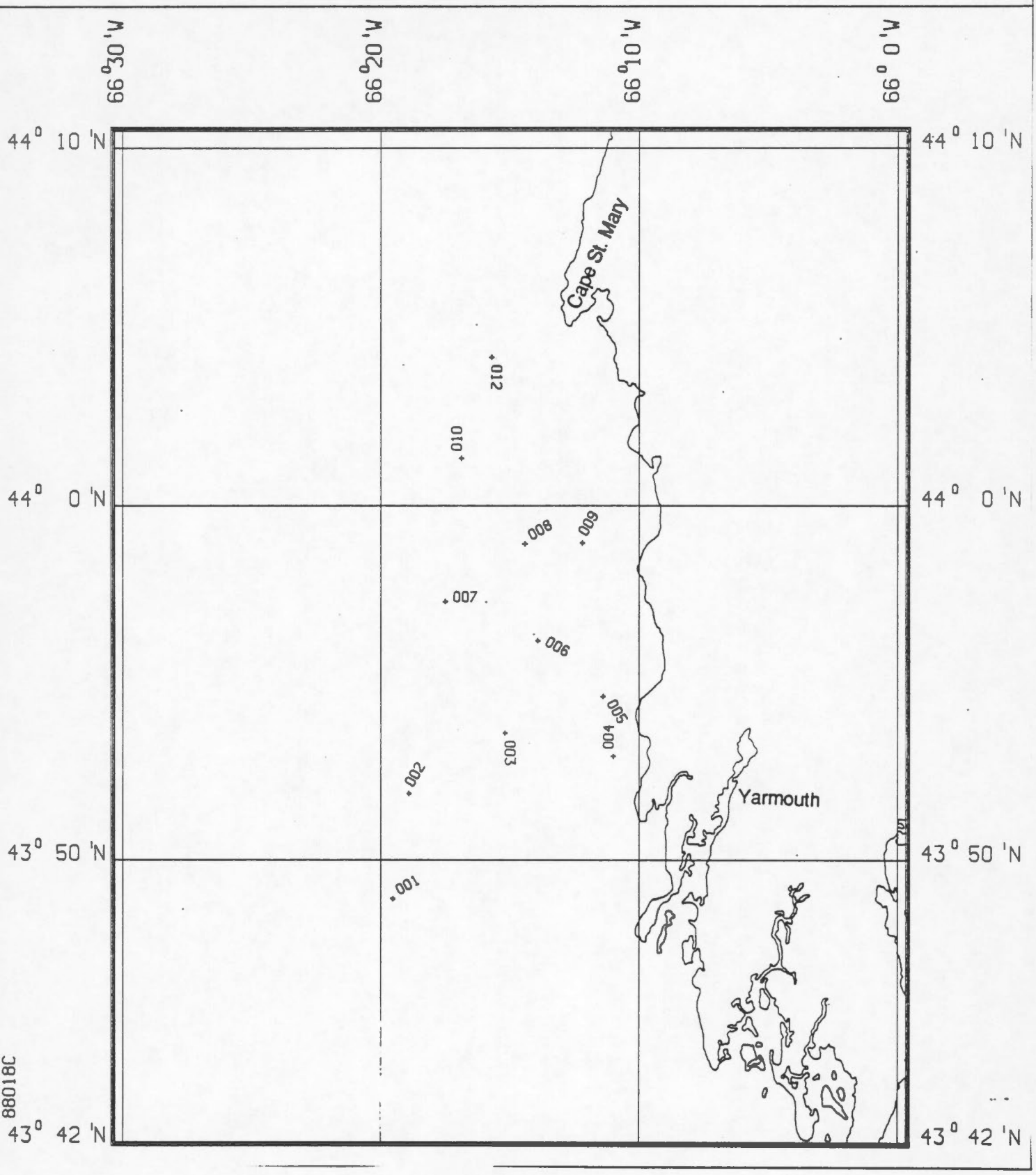
88-018 (B) PHASE 3 FRV NAVICULA



SHIP'S TRACKS

FIGURE 3

88018B PHASE3 SAMPLE LOCATIONS.



SAMPLE LOCATIONS

FIGURE 4