NORSK POLARINSTITUTT

RAPPORTSERIE

NR. 81 - OSLO 1993

Anders Solheim

THE CRUISE OF R/V "GEOLOG FERSMAN" 23/8 - 20/9, 1992 REPORT ON THE NORWEGIAN PARTICIPATION

Russian - Norwegian cooperation program on Arctic Geology: "The Northern Barents Sea Geotraverse"

NORSK POLARINSTITUTT

RAPPORTSERIE

NR. 81 - OSLO 1993

Anders Solheim

THE CRUISE OF R/V "GEOLOG FERSMAN" 23/8 - 20/9, 1992 REPORT ON THE NORWEGIAN PARTICIPATION

Russian - Norwegian cooperation program on Arctic Geology: "The Northern Barents Sea Geotraverse"

Norwegian Polar Research Institute
Postboks 158
N-1330 Oslo Lufthavn
Norway

ISBN 82-7666-050-9
Printed March 1993

Cruise background and organisation:

The Norwegian participation in the cruise forms a part of the Russian - Norwegian cooperation program "Geological Evolution and Correlation between Franz Josef Land and Eastern Svalbard - The Northern Barents Sea Geotraverse". This program forms a part of a wider agreement on Russian - Norwegian scientific cooperation in the Arctic, which was initiated in 1988, and was originally organized between the Norwegian Research Council for Science and the Humanities (NAVF) and the Soviet State Committee for Science and Technology (now Russian).

The Russian partner on the "Geotraverse Project" is the VNIIOkeangeologia in St. Petersburg, which forms a part of the larger federal structure Sevmorgeologia. VNIIOkeangeologia were carrying out two cruises with mainly "geo-ecological" objectives; in the Kara Sea in 1991 and in the Barents Sea, including the area between Svalbard and Franz Josef Land, in 1992. The Geotraverse Project was therefore offered participation in the 1992 cruise by VNIIOkeangeologia. Through several meetings, an agreement was made stating that 7-10 days of shiptime were allocated exclusively for the Geotraverse Program. In addition, a joint Norwegian - Russian program in physical oceanography (SNOP) was offered participation with one Norwegian scientist and a small program running CTD measurements on selected stations throughout the cruise. The total price for the Norwegian participation was set to USD 15,000. The cruise was considered important for reconnaissance studiess prior to possibly more extensive marine operations in the future.

Relatively late in the planning process, the Geological Survey of Canada (GSC) was also addressed by VNIIOkeangeologia and invited to participate. GSC agreed to participate with one person carrying out a geochemical sampling program using mainly Russian sediment core and grab samples.

The cruise was organized as two legs (Table 1). During the first leg, the main working area was in the western Barents Sea and around Svalbard, although some work was also carried out in the southeastern Barents Sea. During the second leg, the work was concentrated to the Geotraverse area between Svalbard and Franz Josef Land, as well as off Novaya Zemlja.

Table 1.

Leg	Dates	Route	Foreign participation
1	20/7-22/8	M-NZ-S-M	Norw. phys. ocanographic program.
2	23/8-20/9	M-FJL-KKL-FJL-NZ-M	Norw. Geotraverse Program, Canadian geochemical program. (*)

M: Murmansk, NZ: Novaya Zemlja, FJL: Franz Josef Land, KKL: Kong Karls Land, S: Svalbard.
(*) Physical ocanography program was continued by the Geotraverse group during leg2.

After the last port call in Murmansk, some additional Russian work was carried out off the coast of Finmark, Northern Norway, during the ship's return to St. Petersburg.

Three Russian institutions were represented aboard the vessel: a) the Polar Geological Expedition, who were the owners of the vessel and most on-board equipment, b) VNIIOkeangeologia, who were responsible for the scientific program, and c) the Arctic and Antarctic Research Institute. The two former institutions are both parts of the larger structure Sevmorgeologia. All institutions are situated in St. Petersburg. Chief Scientist was Dr. Vladimir Gurevich of VNIIOkeangeologia.

The Geotraverse program

Objectives:

The main objectives of this program is to investigate the post-paleozoic geology of this region and to understand differences in the geological evolution between the archipelagos of Svalbard and Franz Josef Land. The objectives of the Norwegian work on this cruise were two-fold:

1. To get a better understanding of the geological structure and distribution of rock units in the upper approximately 500 meters of the subcropping bedrock (down to the first water-bottom multiple).
2. To carry out reconnaissance studies for the location of potential drill sites for future shallow (<10m) rock core drilling.

Participants:

Anders Solheim, Geologist, Norwegian Polar Research Institute, Oslo.
Alf K. Nilsen, Technician, Dept. of Geology, University of Oslo.
Finn B. Gustavsen, Student, Dept. of Geology, University of Oslo.

The Canadian participant, Ken Saunders, participated in the Norwegian program when time permitted him to. This was a valuable addition to the group.

Methods and equipment:

The basic idea is that clast material in basal tills are representative for the underlying geology within an area of not more than approximately 30 - 40 km from the sampling site. Basal tills in Norway have been shown rarely to have experienced transport distances exceeding this. Therefore, the methods used were to map the structure of the upper geology by single channel, high resolution seismic profiling, and to map the upper part of the unlithified Quaternary cover by low frequency (3.5 kHz) echosounding. The latter would then identify the thickness of postglacial sediments and the presence of till reachable by standard gravity coring devices.

Seismic equipment:

The seismic source used consisted of 2 x 40 cubic inch sleeve guns fired simultaneously. The guns were suspended in a frame and towed approximately 20 m behind the ship, at a depth of 3 meters. Air of 100-140 kg/cm^2 pressure was supplied from two CompAir Reavell Model 5417 water cooled compressors. Recording was done through a single channel streamer, Benthos Mod. 25/50, with 50 elements over an active length of 7.5 meters. The data were filtered in the passband of 70 - 500 Hz and recorded on an analogue EPC Mod. 4800 recorder. Additionally, parts of the unfiltered data were recorded on analogue tape, for possible later digitalization and digital processing. (A PC-based digital acquisition package was brought on board, but because of a broken computer board, this package could not be used during the cruise.)

Low frequency echosounder:

A system consisting of four O.R.E. Mod. 136 transducers in a towfish and a Mod. 140 tranceiver, was rented from Geo-Acoustics Ltd., England, and brought by the Norwegian group. However, due to a termination failure in the tow cable, the equipment worked only for 5 hours. Most of the cruise was therefore run using the ship's hull-mounted O.R.E. 5.6 kHz echo sounder system, which provided excellent data during most of its operation.

Magnetometer:

A Geometrics Model G-826A Base station magnetometer, supported by a graphical recorder and a marine sensor towed approximately 150 m behind the vessel, provided total magnetic field intensity measurements throughout the profiling. The main purpose of this was to identify igneous rocks, which are widespread both on Franz Josef Land and on eastern Svalbard.

Corer:

A standard gravity corer with 3 m and 6 m barrels, 110 mm diameter, was used. As the coring sites were selected at locations with the least cover of soft sediments, the 3 m barrel was used at all sites in the region between Franz Josef Land and Svalbard, while the 6 m barrel was used only once, in the deep St. Anna Trough, where the main purpose was to obtain a record of the late / post-glacial stratigraphy.

Bottom photography:

Bottom photography was carried out with a Benthos Model 371 Camera and Mod. 381 Flash, mounted in a frame with a bottom contact switch.

Navigation:

The ship's navigation is based on the Transit satellite system, and data are not recorded continuously. The Norwegian group therefore brought two Trimble GPS systems, one of which was placed on the bridge and set to log data every minute during the profiling. The other system was used for display in the seismic laboratory.

<u>Cruise summary</u>

Due to harbour problems in Murmansk, both the loading of the Norwegian equipment and the departure was delayed. The ship did not leave Murmansk until Wednesday 26th of August, at about 12.00 GMT (all times used in this report refer to GMT).

The first five days were used for Russian station work between Murmansk and Franz Josef Land. The Norwegian group spent these days to get the equipment operational. There were no ice problems, and the southern part of Franz Josef Land was easily reached. Based on this experience and the latest ice maps, a relatively optimistic grid of seismic lines was planned, between western Franz Josef Land and Kvitøya - Kong Karls Land on the Svalbard side, mainly between 79° and 80° north. This original plan included initial 5 - 6 days of seismic profiling and approximately 2 days of coring, with site selections based on the seismic records.

The Geotraverse Program started on the 31. of August, with seismic profiling northwards along the southwest coast of Franz Josef Land. However, it was soon obvious that the ice situation would not permit us to carry out the originally planned program. Therefore, we turned southwards and followed the edge of a southeasterly trending tongue of ice, before we could turn westwards. During this part of the cruise, severe technical problems were also faced (see below), and the profiling proceeded very slowly. The first line, 92-78, ended up being a relatively winding and interrupted line, roughly running at 78° 50' N (Fig.1). We intended to run the line as close as possible to the shore of Kong Karls Land, but due to heavy ice, the line was stopped at approximately 32° E.

Because of the long time spent on this first line, it was decided to switch between periods of profiling and periods of coring on the way back towards Franz Josef Land. The main eastward line (92-79) was placed along 78° N, with N-S trending tie lines along 40°E (92-80) and 45°E (92-81) and a NNE trending line at 48-49° E (92-82) (Fig.1, Table 2). Coring was mainly concentrated to two periods, with continuous profiling between these periods. Due to relatively stable ice conditions, we were able to tie the two E-W lines along lines 92-80 and 92-81, while 92-82 had to be ended less than 5 miles off line 92-78. Apparently this is close enough to tie reflectors from one line to the other. The Geotraverse Program was ended with coring at station 92-144 on September 9 (Figs.1 & 2, Tables 2 & 3).

There were plans to cross the deep St.Anna Trough east of Franz Josef Land during the last part of the cruise. This trough is of major importance for the understanding of the late Cenozoic paleooceanographic and paleoclimatic evolution of the European Arctic, and the Norwegian group was given shiptime for seismic profiling and coring in this area. However, the ice conditions did not permit any crossing of the trough until immediately to the northeast of Novaya Zemlya. Two seismic lines were run, 92-83 and 92-84, on the western flank of the trough at approximately 79° 50' N and crossing the trough at approximately 77° N, respectively (Table 2). Three gravity cores were also taken in this region, one of which, station 161, is in the deepest part of the trough, at 76° 55' N (Fig.2).

The Norwegian group also carried out smaller programs for other research groups in Norway. The CTD work started during the first leg of the cruise was continued by during the second leg. The Norwegian CTD system was run on nearly all Russian CTD stations. Additional to this, a water sampling program was carried out on request from Dr. Eystein Jansen of the University of Bergen, Norway. Surface and bottom water samples have been taken from a selection of the Russian water sampling stations. For most of the cruise, this was kindly done by the Russian chemical oceanography group. Colour bottom photography have also been carried out at a number of stations, mainly as a support to the

Russian geo-ecological program (see below). All Norwegian station activities during leg 2 are summarized in table 4.

Equipment performance

Seismic:

There were initial compressor problems, which caused considerable delay during the first part of the profiling. Most likely this was caused by insufficient power from the vessel. These problems were taken care of by the ship's electricians, and after that the compressors performed without problems.

During the first couple of days of profiling, the guns had to be taken up numerous times for repair. The main problem was broken cables and hoses, as well as damage to the frame. With help from the ship's engineers, the frame was strengthned. Furthermore, the air pressure was reduced to 110-120 kg/cm^2, and for the rest of the cruise there were only minor problems with the sleeve guns. Icing in air hoses as well as in the solenoid caused problems a couple of times.

The 3 kJ E.G.&G. sparker equipment brought as a back-up system, was mounted, but never used.

3.5 kHz echosounder (PDR):

The O.R.E. Mod. 136 towed transducer system, rented for the cruise, never performed properly. After about 5 hours of profiling, with the tow fish at approximately 50 m depth, all signals were lost, and we were not able to get the system operational again within the time allotted for the Geotraverse Program. As mentioned above, however, the ship's hull mounted 5.6 kHz echo sounder provided good data throughout the remaining part of the profiling.

Magnetometer:

The magnetometer performed well throughout the cruise. Only analogue paper recording is possible, and the records have been manually digitized during the cruise.

Navigation:

The two Trimble GPS systems caused no problems during the profiling. Logging failed during some shorter periods, but for those periods data from the ship's Transit system will be used.

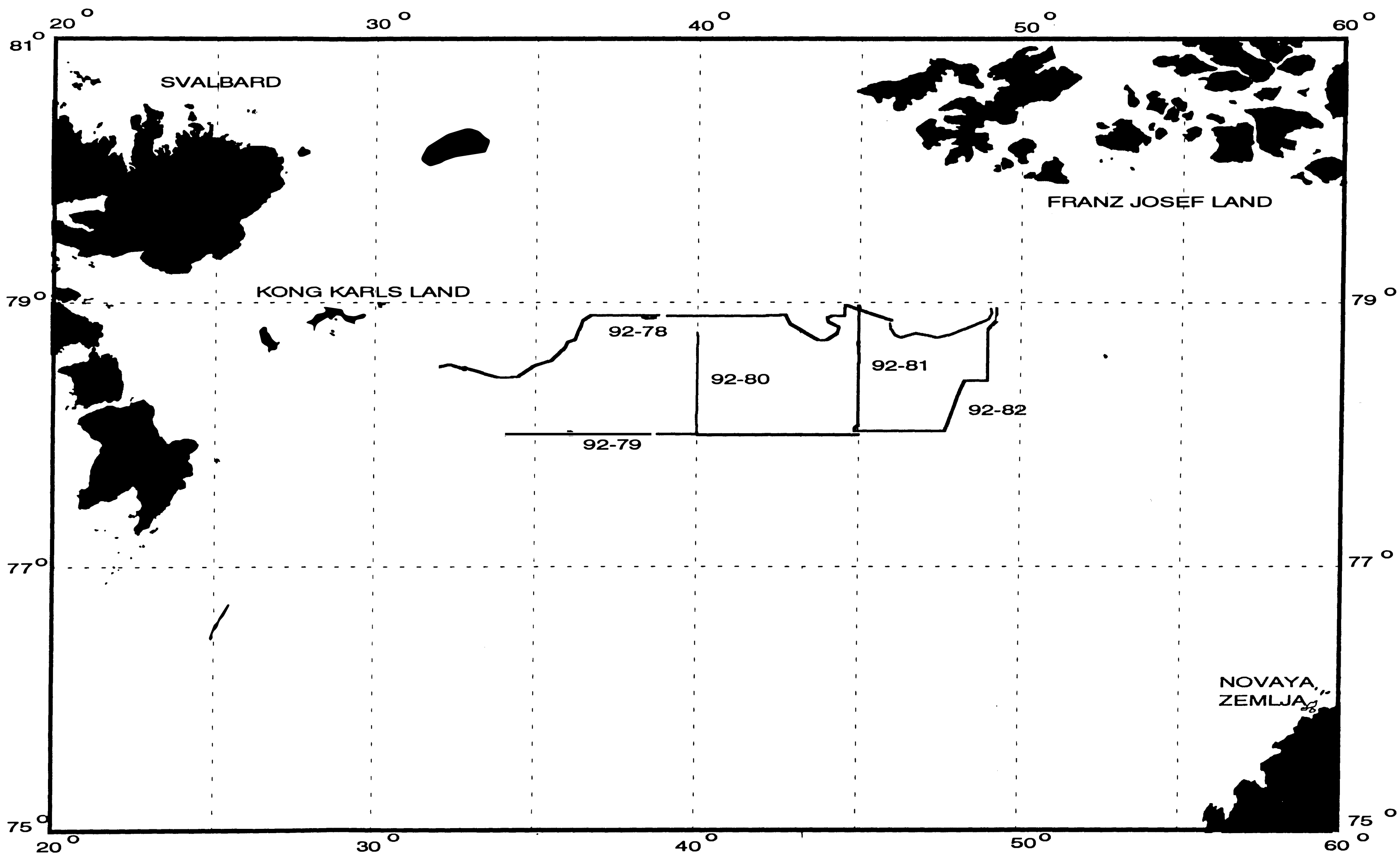

Figure 1. Seismic lines (2x40 cu.inch sleeve guns) run in the "Geotraverse area" during Leg 2.

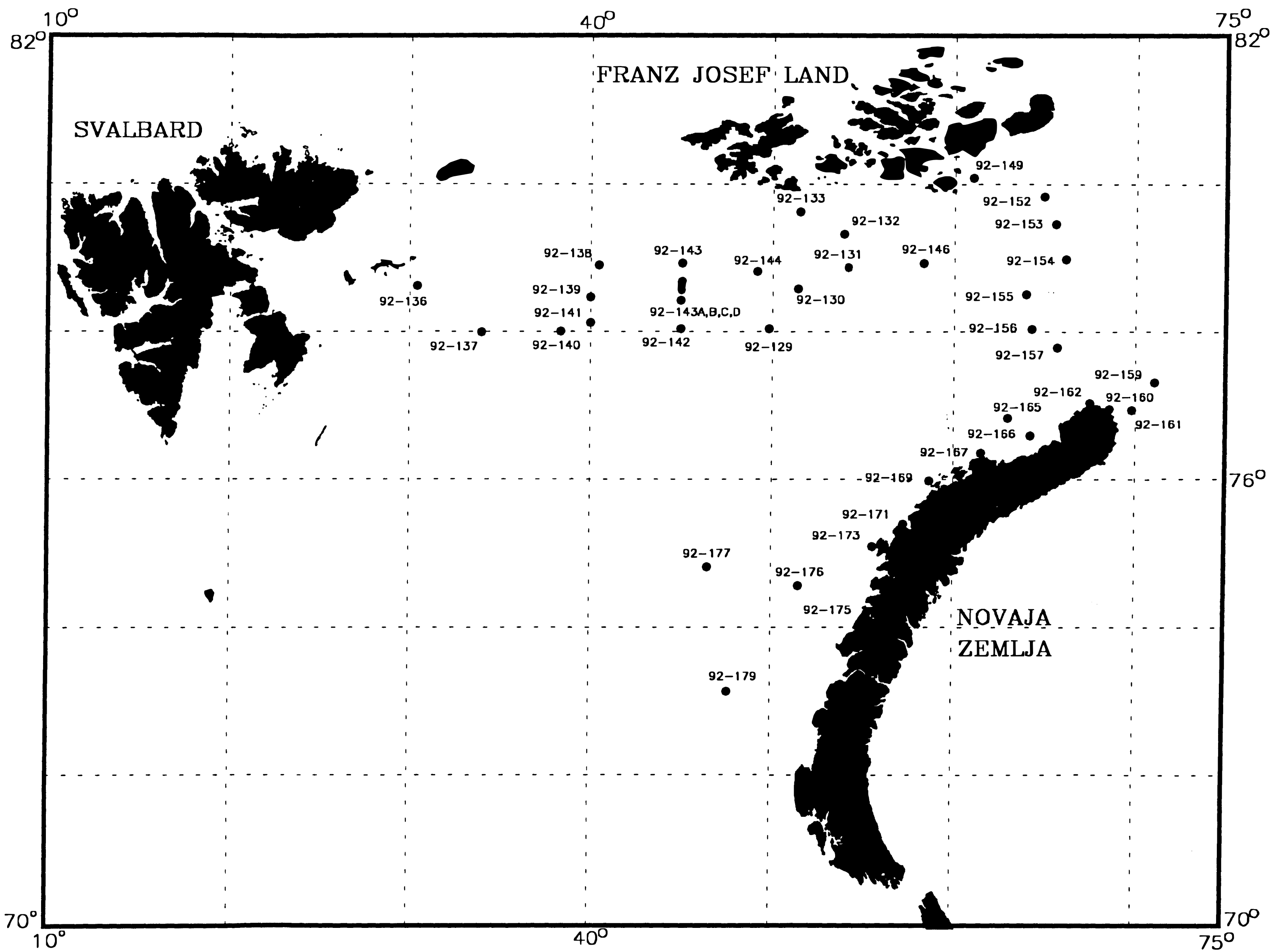

Figure 2. Stations with Norwegian operations during Leg 2. See table 2 for details.

TABLE 2. SEISMIC LINES RUN DURING THE SECOND LEG OF R/V "GEOLOG FERSMAN" CRUISE NO.12,.

	START:				STOP:				
LINE NO.	DATE	GMT	LAT.	LON.	DATE	GMT	LAT.	LON.	COMM.
92-78	01.09.92	05:56	79 52' 02"	48 20' 02'	04.09.92	06:49	78 29' 28"	31 30' 22"	Winding line, ice and technical problems.
92-79A	05.09.92	01:38	77 59' 59"	33 59' 10'	05.09.92	15:33	77 59' 59"	39 59' 24"	
92-79B	06.09.92	20:04	77 59' 55"	40 00' 51'	07.09.92	06:42	78 00' 21"	44 59' 43"	
92-79C	08.09.92	09:31	77 59' 55"	44 55' 10'	08.09.92	15:23	78 00' 04"	47 26' 45"	
92-80	05.09.92	15:35	78 00' 04"	40 00' 08'	06.09.92	00:38	78 54' 25"	40 00' 50"	
92-81	07.09.92	06:50	78 00' 21"	44 59' 43'	07.09.92	16:20	78 57' 01"	45 00' 04"	
92-82	08.09.92	15:24	78 00' 04"	47 27' 10'	09.09.92	03:00	78 55' 22"	49 15' 07"	
92-83	11.09.92	00:10	79 50' 13"	64 46' 51"	11.09.92	05:30	79 27' 34"	65 33' 50"	
92-84	12.09.92	22:32	77 19' 21"	70 56' 09"	13.09.92	05:23	76 56' 25"	68 38' 25"	Poor navigation.

TABLE 3. NORWEGIAN GRAVITY CORES DURING LEG 2 OF R/V "GEOLOG FERSMAN" CRUISE 12,

STATION	LAT.	LON	DEPTH	RECOVERY	COMMENTS
92-137	77 59' 54"	34 01' 37"	227m	0.85m	Stiff, gravelly mud (till?). Core cutter badly damaged
92-138	78 53' 49"	40 25'12"	242m	0.19 m + c/c	0-19cm: soft, Holocene clay. Cutter/catch.: stiff, sandy clay.
92-139	78 27' 32"	39 59' 10"	292m	0.49 m.	Relatively firm clay in bottom.
92-140	77 59' 59"	38 22' 32"	212m	0.78m +c/c	Top: Holocene, Norm. cons. glacial marine in bottom.
92-141	78 06' 47"	39 58' 31"	232m	0.80m + c/c	Firm clay in the bottom.
92-142	78 02' 24"	44 59' 09"	346m	c/c.	Bedrock in cutter! Dark gray clay/silt-stone.
92-143	78 55' 19"	45 00' 20"	148m	c/c	
92-143A	78 40' 12"	45 00' 32"	226m	0.99m + catcher	Soft clay in core. Relatively firm in catcher. Took some stone material from bio.-dredge.
92-143B	78 37' 08"	45 00' 00"	244m	0.98m +c/c	Soft, brownish mud in core top. Firm, dark grey in cutter.
92-143C	78 33' 30"	44 59' 56"	246m	0.77m + catcher.	Normally consolidated glacial marine sandy mud.
92-143D	78 25' 32"	44 59' 29"	288m	0.38 m + catcher	Soft clay. Probably bedrock immediately below.
92-144	78 48' 34"	49 08' 34"	326m	0.80m + c/c	
92-152	79 49'40"	64 53'25"	276m	1.00m + c/c	
92-153	79 27' 25"	65 34' 27"	470m	0.79m	
92-156	78 01' 52"	64 17' 06"	380m	1.34m	
92-159	77 18' 36"	71 05' 20"	280m	0m	Sampled Russian core (2.5m) in 20-30 cm intervals. Soft mud w/ few-no dropstones. Sandy in bottom.
92-161	76 55' 57"	69 49' 32"	520m	GC1: 2.0m, GC2: 1.3	Dark gey sandy, silty clay. Dropstones.

TABLE 4. NORWEGIAN STATION WORK DURING LEG 2 OF R/V "GEOLOG FERSMAN" CRUISE 12.									
STATION	DATE	GMT	LAT.	LON	DEPTH	CORE	CTD	PHOTO	WATER
92-129	30.08.92	07:10	78 01' 55"	49 50' 00"	190m				X
92-130	30.08.92	12:15	78 34' 48"	51 24' 26"	246m		X		
92-131	30.08.92	18:15	78 51' 44"	54 09' 04"	226m		X		
92-132	30.08.92	19:48	79 18' 38"	53 53' 17"	177m		X		X
92-133	31.08.92	01:12	79 36' 43"	51 32' 21"	456m		X		
92-136	04.09.92	09:35	78 36' 50"	30 25' 35"	224m				X
92-137	05.09.92	19:00	77 59' 54"	34 01' 37"	227m	X	X		
92-138	06.09.92	04:03	78 53' 49"	40 25'12"	242m	X	X		X
92-139	06.09.92	07:47	78 27' 32"	39 59' 10"	292m	X	X		
92-140	06.09.92	12:35	77 59' 59"	38 22' 32"	212m	X			
92-141	06.09.92	17:55	78 06' 47"	39 58' 31"	232m	X	X		X
92-142	08.09.92	07:50	78 02' 24"	44 59' 09"	346m	X	X		X
92-143	07.09.92	17:50	78 55' 19"	45 00' 20"	148m	X	X		X
92-143A	07.09.92	22:35	78 40' 12"	45 00' 32"	226m	X			
92-143B	07.09.92	23:54	78 37' 08"	45 00' 00"	244m	X			
92-143C	08.09.92	00:43	78 33' 30"	44 59' 56"	246m	X			
92-143D	08.09.92	02:05	78 25' 32"	44 59' 29"	288m	X			
92-144	09.09.92	05:00	78 48' 34"	49 08' 34"	326m	X	X		X
92-146	09.09.92	21:57	79 55' 23"	58 19' 31"	43m				X
92-149	10.09.92	08:40	80 05' 00"	61 01' 00"	380m		X	X	X
92-152	10.09.92	20:30	79 49'40"	64 53'25"	276m	X	X	X	X
92-153	11.09.92	06:50	79 27' 25"	65 34' 27"	470m	X			
92-154	11.09.92	12:40	78 58' 27"	66 10' 13"	385m		X	X	X
92-155	11.09.92	19:50	78 30' 04"	63 56' 41"	362m			X	
92-156	12.09.92	02:17	78 01' 52"	64 17' 06"	380m	X	X	X	X
92-157	12.09.92	07:30	77 47' 15"	65 43' 17"	327m			X	
92-159	12.09.92	18:11	77 18' 36"	71 05' 20"	280m	X	X	X	X
92-160	13.09.92	06:00	76 56' 45"	68 36' 56"	38m			X	X
92-161	13.09.92	12:22	76 55' 57"	69 49' 32"	520m	X	X	X	X
92-162	13.09.92	03:36	77 02' 05"	67 31' 23"	62m			X	
92-165	14.09.92	05:30	76 50' 21"	62 59' 26"	248m		X		
92-166	14.09.92	09:15	76 34'58"	64 12' 44"	40m			X	
92-167	14.09.92	14:20	76 21' 05"	61 31' 40"	71m		X	X	
92-169	14.09.92	22:05	75 58' 59"	58 40' 32"	36m			X	
92-171	15.09.92	06:45	75 23' 16"	57 17' 38"	56m		X	X	
92-173	15.09.92	18:00	75 05' 06"	55 34' 53"	39m			X	
92-175	16.09.92	01:50	74 11' 03"	55 17' 14"	77m		X		
92-176	16.09.92	08:47	74 33' 12"	51 33' 11"	167m		X		
92-177	16.09.92	18:45	74 48' 08"	46 30' 56"	230m		X		
92-179	17.09.92	08:00	73 07' 47"	44 37' 23"	356m		X		

Coring, bottom photography, CTD and water sampling:

With the exception of a relatively low core recovery, all these programs experienced few technical problems.

Preliminary results.

Due to good weather conditions throughout the time for the Norwegian operations, the seismic data are generally of good quality. The ice conditions prevented work north of 79° N in the area between Svalbard and Franz Josef Land, but a regional seismic grid was obtained between 78° N and 79° N, consisting of two long east - west trending lines, and three north - south bearing tie-lines (Fig.1, Table 2). Penetration of the seismic system is mostly limited to the first water bottom multiple, but with good data quality above the multiple over most of the surveyed area.

Although detailed analysis of the acquired data has not been carried out, a first inspection of the seismic data shows that the area can roughly be divided in two zones of different seismic character. In the northwestern part of the studied area, the character appears chaotic, with discontinuous reflectors that often show steep dips and numerous faults. In the eastern and southeastern part, on the other hand, the character is that of a well layered sequence with a gentle southeastwards dip. The lower boundary of these layered sequences seems to be a relatively wide band of reflections, which is mapped to outcrop at four locations in the data set (Fig.3). The outcrop follows a NE-SW trend. Although a good tie to the shallow seismic grid in the western Barents Sea is not yet established, there are clear indications that the layered sequence form the eastern and northeastern continuation of the upper Jurrassic - lower Cretaceous Olga Basin, mapped in the western Barents Sea by Elverhøi et al. (1988) andAntonsen et al. (1991). Volcanic intrusives in the form of dykes, are mapped at three locations, all north of the outcropping boundary for the layered sequence. In one area these form distinctive sea floor topographic features, while in another they are eroded lavel with the sea floor.

Based on the acoustic data, 12 locations were chosen for coring Table 3). The results of this effort remains to be seen, but in-situ bedrock was recovered in the core catcher from one location, within the seismically layered sequence, while at least two other had stiff material, most likely basal till, in the bottom of the core. This should give a reasonable possibility for a first approximation of the bedrock distribution in the region. The coarse fraction of the remaining cores will also be studied for rock provenance. Preliminary inspection of the palynomorphs in the in-situ sample indicate an early Cretaceous age. This is compatible with the assumption that the layered sequence represents rock of the Olga Basin or equivalent rocks.

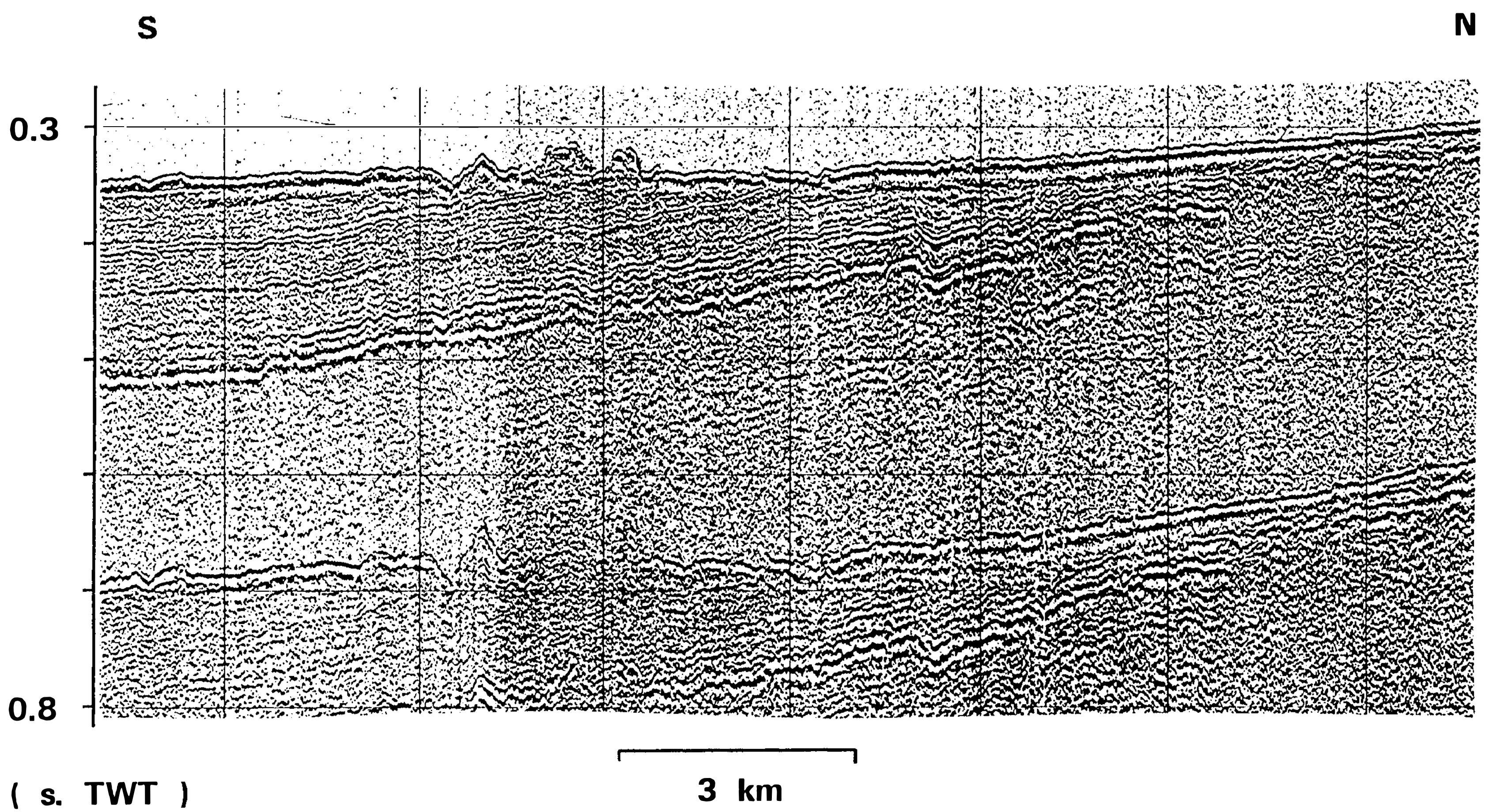

Figure 3. Part of seismic line 92-80 (2x40 cu.inch sleeve guns). Note the upper stratified sequence with its distinct lower boundary, shallowing towards the north.

With regards to reconnaissance for potential shallow drilling sites, most of the area studied has a sufficiently thin cover of Quaternary sediments to make this feasible. The data acquired during this cruise may form a good base for future proposals for shallow drilling.

In addition to the Geotraverse Program, two other seismic lines were run, one of which across the St. Anna Trough immediately east of the northern tip of Novaya Zemlja. Three locations were also cored, with Late Weichselian deglaciation history as the main objective. These data will be analysed as part of a cooperation between NPI, VNIIOkeangeologia and Ohio State University, USA.

All together approximately 1200 km of seismic profiling have been carried out during the cruise, and 17 locations have been cored (Table 4). CTD measurements have been carried out at 24 stations. Water samples have been recovered form 17 stations, and bottom photography has been carried out at 15 stations. The Norwegian participation in the cruise must be considered successful within the constraints given by the ice conditions and the time limitations.

The Russian geo-ecological program

The Russian program consisted mainly of station work, but included also 5.6 kHz acoustic profiling in selected areas. Stations were mainly selected by the chief scientist, who also determined the program to be carried out at each station. The Russian station program during the entire cruise (including both legs, but not including stations taken after the last port call in Murmansk) is shown in Table 5.

The main purpose of the Russian program was to investigate for possible antropoghenic pollutants in the water column, on the sea floor and in the upper sediments. Scientific groups included:

- Physical and chemical oceanography.
- Biology, focused on macro-benthos.
- Geology, sampling the upper sediments.
- Chemistry, mainly radionuclides and heavy metals.
- Sea floor photography.

In addition, there were more technically oriented groups:

- Hydrography, being responsible for navigation and echo sounder registration.
- Computer services.
- Electronics, doing all the acoustic profiling.

At oceanographic stations, CTD casts and water sampling were carried out. The ship was equipped with a Neil Brown CTD system and a winch for deep ocean operations. Water sampling was done using three bottles of a Niskinn-like type, mounted 8-12 m above the CTD sonde. The water samples were brought to the lab immediately after retrieval, analysed and sub-sampled for shore based studies.

Geological sampling was performed with a small grab and a 3 m gravity-corer. The grab was equippped with bottom camera, so all grab stations have black-and-white bottom photographs. The grab was briefly described and subsampled by the Russians on deck. The gravity corer had a wide diameter barrel (approximately 15 cm), steel weights of presumeably 3-400 kg, and seemed to perform relatively well in soft sediments. The sediments were enclosed in a plastic hose inside the barrel, but no plastic liners were used. This made storage of the core impossible, so after splitting, description and subsampling in the lab, the remaining sediments were thrown over board. The plastic hose system often caused problems during retrieval of the core from the barrel, and the core tops were often badly disturbed. Radiation was measured on all cores and grab samples. Radiation was also measured in the water column at most stations until the instrument was lost midway during leg 2. Furthermore, some samples were investigated for heavy minerals using a "gold-washing technique".

The acoustic profing was carried out using the ship's hull mounted O.R.E. profiling system tuned to a transmitter frequency of 5.6 kHz, which proved to give high quality results in soft sediments. With the exeption of the period of the Geotraverse program, continuous profing was not carried out.

The biological sampling was done with dredges of various sizes. The dredge content was wet sieved on deck, and living organisms sampled, the rest thrown over board.

Ship's navigation was performed using a Magnavox receiver for the Transit satellite system. The navigation was not automatically logged, but written down approximately every 15 min., for later entering into the computer system. The computer system was a relatively old Hungarian type (EC 1010), but presumeably had a reasonably high capacity. The ship was originally equippped for multichannel seismic operations, and the computer system was designed for these purposes. During this cruise it was mainly used for CTD data and navigation storage.

A list of all Russian station work carried out during both legs of the cruise is shown in table 4.

The Canadian program

The Canadian participant, Ken Saunders, sampled from nearly all the Russian grab and gravity cores (Tab. 5). The purpose is to investigate for both organic and inorganic pollutants, as well as radionuclides. The grabs and cores used in this program were carefully described, photographed and the top 20-30 cm sampled in 1 cm intervals if possible. 210Pb analyses of samples from selected cores will be carried out for age control. Further details on these investigations can be obtained from Dr. Ray Cranston at the Atlantic Geoscience Centre, Bedford Inst. of Oceanography, Darthmouth, Nova Scotia, Canada.

Acknowledgements

The Geotraverse Program was funded by the Norwegian Research Council for Science and the Humanities under grant no. 440.92/041. The necessary extra funding to allow cruise participation was kindly provided by Statoil. In addition, Norsk Polarinstitutt covered several unexpected expenses. Alf Nilsen and Finn Gustavsen worked hard throughout the cruise to ensure the good results. Ken Saunders provided valuable help to the Norwegian group. Chief scientist Vladimir Gurevich is acknowledged for his good cooperative spirit and sincere thanks go to the captain and crew of the Geolog Fersman, who provided all the help we needed.

References

Antonsen,P., Elverhøi,A., Dypvik,H. & Solheim,A., 1991: Shallow bedrock geology in the Olga Basin area, northwestern Barents Sea. American Association of Petroleum Geologists, Bull.,75, 1178-1194.

Elverhøi,A., Antonsen,P., Flood,B., Solheim,A. & Vullstad,A.A., 1988: The physical environment, western Barentrs Sea, 1:1.500.000, Shallow bedrock geology. Norsk Polarinstitutt Skrifter, 179 D.

TABLE 5. RUSSIAN STATION WORK DURING R/V "GEOLOG FERSMAN" CRUISE 12.

Station	Lat. deg.	Lat. min.	Lon. deg.	Lon. min.	Depth	CTD	Water	Grab	Photo	Core	Dredge
1	69	13.284	33	29.963	294	x	x	x	x		
2	69	14.136	33	31.386	128			x	x		
3	69	30.452	32	36.545	282	x	x	x	x		x
4	69	37.738	33	43.169	218			x	x		x
5	69	18.937	34	5.887	95	x	x	x	x		x
6	69	19.129	34	18.404				x	x		
7	69	27.523	34	3.520	120	x	x	x	x		
8	69	12.227	35	10.025	96	x	x	x	x		
10	68	48.273	37	18.813	37			x	x		x
11	68	45.082	37	29.577	70	x	x	x	x		x
12	68	23.969	38	25.395	95			x	x		
14	68	6.981	39	30.921	60	x	x	x	x	x	
15	68	11.440	39	46.588	114	x	x	x	x		
13	68	33.777	39	28.769	66	x	x	x	x		x
16	68	18.918	40	16.349	65			x	x		x
17	68	31.375	43	37.887	49	x	x	x	x		x
18	67	58.527	41	27.500	40			x	x		x
19	67	41.156	41	1.359	60	x	x	x	x		x
20	68	4.506	43	45.839	26			x	x		x
21	68	50.539	42	40.521	70	x	x	x	x		x
22	69	30.160	45	54.281	70	x		x	x		
23	69	32.434	49	7.416	23	x	x	x	x		x
24	70	7.660	52	2.157	112			x	x		
25	71	24.973	48	11.305	129	x	x	x	x		x
27	71	47.434	51	19.716	43	x	x	x	x		x
28	72	23.555	52	26.718	48	x	x	x	x		
29	72	58.633	52	50.964	42	x	x	x	x		x
30	73	17.840	52	18.935	70	x		x	x		
31	73	19.191	54	2.737	31	x	x	x	x		x
32	73	47.559	53	49.421	23	x		x	x		
33	73	47.938	51	8.221	145	x	x	x	x		x
34	72	49.406	49	19.554	225	x	x	x	x		
35	71	43.313	47	24.984	58	x	x	x	x		x
36	71	9.953	45	15.687	268	x	x	x	x		
37	70	31.008	42	0 470	75	x	x	x	x		x
38	70	2.656	39	33.761	220	x	x	x	x		
39	69	50.254	37	22.087	127	x	x	x	x		x
40	69	40.008	35	34.923	224	x	x	x	x		
41	69	57.555	33	26.874	145	x	x	x	x		
42	70	3.223	31	45.927	136	x		x	x		
43	69	47.227	31	35.209	176	x	x	x	x		x
44	69	42.906	31	29.972	100	x	x	x	x		
46	70	2.188	31	20.594	328	x		x	x	x	
47	70	31.031	32	11.177	258	x	x	x	x		x
49	71	50.418	29	46.306	324	x	x	x	x		x
50	72	37.301	29	38.052	300	x	x	x	x		
51	73	8.426	28	23.672		x	x	x	x		x
52	72	55.563	24	27.806	428	x	x	x	x		
53	73	36.359	20	59.802	500	x	x	x	x		x
54	73	8.000	16	45.788	468	x	x	x	x		x
55	73	56.625	14	20.793	154	x	x	x	x	x	x
56	74	17.129	16	37.677	268	x	x	x	x		
57	74	36.164	19	8.613	54	x	x	x	x		x
58	75	12.836	19	53.728	43	x	x	x	x		x
59	75	57.396	21	18.450	41	x	x	x	x		x
60	76	17.602	19	21.820	260	x	x	x	x		
61	76	1.038	16	7.108	368	x	x	x	x		x
62	76	29.875	16	14.265	30	x	x	x	x		x
63	76	52.420	14	5.106	32	x	x	x	x		x
65	77	41.786	11	51.500	120	x	x	x	x		
66a	77	48.832	9	47.792	806	x	x	x			
66b	77	48.918	9	48.724	860	x	x	x		x	
67	78	3.064	12	34.302	252	x	x	x			x
71	78	28.380	12	18.154	212	x		x			
68	78	4.099	14	10.734	140	x	x	x			
69	78	27.914	14	59.684	170	x	x	x			
70	78	38.883	16	25.789	49	x	x	x			

Station	Lat. deg.	Lat. min.	Lon. deg.	Lon. min.	Depth	CTD	Water	Grab	Photo	Core	Dredge
75	79	38.422	10	24.951	316			x	x		x
72	78	24.195	10	52.811	47	x		x			x
76	79	58.441	11	51.630	40	x	x	x			
77	79	27.434	13	23.208	58	x	x	x		x	x
78	80	5.942	14	24.413	25			x	x	x	
79	79	56.746	17	37.015	330	x	x	x			x
80	80	34.129	18	10.415	150			x	x		x
81	80	35.285	15	17.826	260	x	x	x			
82a	80	26.680	12	37.843	340	x		x		x	
82b	79	47.293	12	33.328	330	x	x	x			x
83	80	25.266	10	25924	512			x	x		x
84	80	4.221	8	32.146	502			x	x		x
85	79	20.723	8	20.941	192	x	x	x	x		x
86	78	43.484	8	55.891	490	x		x	x		
87	78	9.373	9	26.981	255	x	x	x			
89	76	27.590	14	33.977	410	x	x	x	x		
90	76	25.555	18	5.551	244	x		x	x		
92	76	57.664	20	7.075	130	x		x	x	x	
94	76	58.867	22	42.597	94	x	x	x	x	x	
95	76	39.141	24	37.998	22	x	x	x	x		x
96	77	8.867	24	52.993	76			x	x		
97	77	38.984	24	17.746	16			x	x		x
98	77	25.327	27	41.028	196	x	x	x	x		
100	78	6.949	32	17.604	192	x	x	x	x	x	x
101	78	4.941	35	21.580	91			x	x		x
102	77	36.570	33	39.865	180			x	x		
103	77	15.609	35	19.073	150			x	x		x
105	76	10.648	34	37.110	108	x	x	x	x		x
107	74	57.129	35	0 114	302			x	x		x
108	74	5.434	34	29.639	176			x	x		
109a	73	31.656	35	44.273	178	x	x	x	x		
109b	73	31.687	35	44.470	332	x	x	x	x		
110	73	6.938	34	23.378	260			x	x		x
112	71	34.043	34	45.090	220	x	x	x	x		x
113	70	50.797	35	27.746	164			x	x		x
114	70	19.328	33	50.742	238			x	x		x
115	69	41.184	32	10.072	36	x	x	x	x		x
116	70	10.633	35	26.649	191	x	x	x	x		
118	71	18.699	39	41.157	356			x	x	x	
119	72	12.781	39	39.313	320	x	x	x	x		x
121	74	3.984	40	55.998	222			x	x		
122	74	20.992	43	28.689	276	x	x	x	x		x
123	74	51.016	41	36.837	180			x	x		x
124	75	31.477	45	14.151	316	x		x	x	x	
125	76	2.765	49	9.943	224			x	x		
126	76	25.473	47	2.715	139	x	x	x	x		x
127	77	3.082	44	57.543	282			x	x		
128	77	40.240	47	3.825	225			x	x		
129	78	1.831	49	47.735	189	x	x	x	x		x
130	78	34.806	51	24 .838	250			x	x		
131	78	51.986	54	7 .942	228			x	x		
132	79	18.637	53	54.376	177	x	x	x	x		x
133	79	36.694	51	32.703	460			x	x	x	x
134	79	54.706	50	19.294	41			x	x		x
135	80	00.812	47	50.879	153	x	x	x	x		x
136	78	36.241	30	22.713	224	x	x	x	x	x	x
137A	77	59.989	34	1.846	180	x	x	x	x	x	x
138	78	53.620	40	23 .297	242	x	x	x	x	x	x
139	78	27.444	39	58.964	292					x	x
140	77	59.904	38	22.096	212			x	x	x	
141	78	6.598	39	57.404	232	x	x	x	x	x	x
143	78	55.293	45	00.509	147	x	x	x	x	x	x
143A	78	40.128	45	00.314	226					x	x
143B	78	36.657	44	59.707	244					x	
143C	78	33.419	45	00.657	246					x	
143D	78	25.757	45	01 .182	288					x	
142	78	2.394	44	58.278	356	x	x	x	x	x	x
144	78	48.834	49	7.549	315	x	x	x	x	x	x
145	79	34.563	54	59.496	358			x	x		x
146	79	55.383	58	19.514	43	x		x	x		x

Station	Lat. deg.	Lat. min.	Lon. deg.	Lon. min.	Depth	CTD	Water	Grab	Photo	Core	Dredge
149	80	4.817	61	3.203	380	x	x	x	x	x	x
150	79	58.669	63	55.254	107			x	x		x
152	79	49.507	64	56.248	276	x	x	x	x		x
153	79	27.234	65	33.895	468	x		x	x	x	
154	78	58.022	66	9.517	390	x	x	x	x		
155	78	30.320	63	56.284	366			x	x		
156	78	1.346	64	16.992	378	x	x	x	x	x	
157	77	47.845	65	43.041	326			x	x		x
158	77	18.112	66	55.712	190			x	x		
159	77	19.200	71	00.266	286	x	x	x	x	x	x
160	76	56.015	68	40.086	38	x	x	x	x		x
161	76	56.483	69	45.937	526	x	x	x		x	
162	77	2.082	67	31.377	62			x	x		x
163	77	8.397	65	40.082	98			x	x		x
164	77	7.490	63	25.137	83	x	x	x	x		x
165	76	47.292	63	4.667	248			x	x		
166	76	35.293	64	00.220	46			x	x		x
167	76	21.639	61	27.734	71	x	x	x	x		x
168	76	18.590	59	57.084	67			x	x		x
169	75	58.28	58	38.584	48			x	x		x
170	76	8.654	56	52.003	86			x	x		x
171	75	23.336	57	19.036	82	x	x	x	x	x	x
172	75	34.724	54	45.675	110			x	x		
173	75	5.325	55	34.280	41			x	x		x
174	74	40.588	55	40.058	108			x	x		x
175	74	10.884	55	14.600	193	x	x	x	x		x
176	74	33.898	51	33.485	152	x	x	x	x	x	x
177	74	48.239	46	31.917	226	x	x	x	x		
178	73	54.721	46	9.153	282			x	x		
179	73	8.312	44	39.152	364	x	x	x	x		
180	71	38.355	44	23.902	91	x	x	x	x		x
181	70	56.713	45	39.859	156			x	x		
182	70	40.859	45	20.573	125	x	x	x	x		