NGU Report 2001.115

NGU Cruise 0104 with FF "Seisma" to Finneidfjord - cruise report

NGU
Norges geologiske undersøkelse
Geological Survey of Norway

Geological Survey of Norway
N-7441 Trondheim, Norway
Tel.: 47 73 90 40 00
Telefax 47 73 92 16 20

REPORT

Report no.: 2001.115	ISSN 0800-3416	Grading: Open

Title:
NGU Cruise 0104 with FF "Seisma" to Finneidfjord - cruise report

Authors:
Oddvar Longva and Aivo Lepland

Client:
NGU, UiB and COSTA

County:
Nordland

Commune:
Hemnes

Map-sheet name (M=1:250.000)
Bodø

Map-sheet no. and -name (M=1:50.000)

Deposit name and grid-reference:

Number of pages: 15
Map enclosures:

Price (NOK): 65,-

Fieldwork carried out:	Date of report:	Project no.:	Person responsible:
01.08-08.09.2001	15.12.2001	293100	Astrid Lysså

Summary:

This report is a contribution to the
COSTA Project

The Geological Survey of Norway, as a sub-contractor to the University of Bergen in the European Union's project COSTA (Continental Slope Stability; EVK3-CT-1999-00006), has performed a coring cruise with FF "Seisma" to the site of the 1996 slide in Finneidfjord. The main objective of the COSTA project is the assessment of continental slope stability along the European Continental Margin with respect to natural processes and human activity.
The cruise was split in two; 1th – 5th August and 7th – 8th September, due to technical breakdown of coring equipment. During the cruise, 26 stations were sampled and 21 vibra cores and 6 Niemistö cores retrieved.

Keywords: Cruise report	Marine geology	Slide
Sampling	Coring	Mass movement
Vibracoring	COSTA	

CONTENTS

FIGURES

TABLES

APPENDIX

1. INTRODUCTION

The Norwegian Geological Survey participates in the European Union's project COSTA (Continental Slope Stability; EVK3-CT-1999-00006) as a sub-contractor to the University of Bergen. The main objective of the COSTA project is the assessment of continental slope stability along the European Continental Margin with respect to natural processes and human activity. The sampling cruise to the site of the 1996 slide in Finneidfjord, Sørfjorden in Hemnes commune, Nordland County is a contribution by the Geological Survey of Norway to COSTA.

The present knowledge of the frequency and causes of Holocene slope failures is limited. The triggering mechanisms and future environmental impacts of slope failures can be better understood and predicted if controlling factors such as the morphology and dynamic characteristics of individual failures, physical properties of slip planes, the role of gas hydrates on slope stability, and pore pressure distributions are studied and quantified. The importance of these factors must be understood both individually and integrated in order to significantly improve our knowledge about continental slope stability, a necessity for a sustainable development of offshore and coastal regions. Progress in resolving these major issues is highly dependent on a thorough understanding of the internal structure and textural characteristics of sedimentary systems. These major objectives will be achieved through detailed investigations in areas prone to sliding combined with cataloguing of past sediment failures extending from prehistoric to recent times.

The slide that occurred in Finneidfjord in 1996 offers a unique prospect for slide characterisation and evaluation of triggering mechanisms. The protected fjord setting, shallow water depth make these slide deposits easily accessible, and provide conditions for comprehensive survey and sampling. The Finneidfjord slide can be used as a test site for characterisation of failure planes and for modelling of submarine slides. Well constrained geometry of the slide will provide important information for sedimentological and geotechnical interpretations.

2. OBJECTIVES OF NGU CRUISE 0104

The cruise objectives were:

1. Obtain sediment cores from the slide and from the slide's outrunnerblocks for stratigraphical, geotechnical and sedimentological investigations.
2. Collect material for dating.
3. Retrieve short cores across the trace of an outrunner block with the purpose of studying the impact of hydroplaning blocks.

The general location of the Finneidfjord is shown on Figure 1. Figure 2 features the sampling program, showing the coring sites on an multibeam swath bathymetry image of the seafloor.

Due to technical problems with the coring equipment the sampling cruise was run during two periods in August and September 2001.

3. CREW DURING THE CRUISE

Aivo Lepland	NGU	Scientist
Eilif Danielsen	NGU	Skipper
Oddbjørn Totland	NGU	Engineer, data responsible
John Anders Dahl	NGU	Engineer, data technician

4. FUNDING

Funding of the cruise was through the COSTA project and NGU (Geological Survey of Norway).

5. VESSEL

NGU's research vessel FF "Seisma" was used for the cruise. "Seisma" is a 55 foot vessel designed for seismic and sampling surveys in coastal waters. Appendix 1 gives further details.

6. METHODES

6.1 Navigation and sounding

The ship's main navigation system, a Simrad CP40 DGPS map plotter with external digital port, was used for location of coring stations. The GPS antenna was placed on top of the crane used for handling the corer to get as exact positions as possible. The positions, datum WGS 84 and UTM zone 32, were logged on a PC with the Software S-Log developed at NGU.

Waterdepths were logged with a Simrad EA 400, 2 channels; 200 kHz / 7°, 38 kHz / 13°. 27 cores were aquired during the cruise (Tables 1 and 2). The locations of these are shown in Figs. 1 and 2.

6.2 Corers

Stratigraphic coring at locations 1 to 20 was done with a battery assisted, hydraulically driven vibracorer **(HYBAV)** (Fig. 3), that has recently been developed at NGU. The corer is powered by two 12V, 60 Ah lead accumulators assembled to give 24 V. The batteries are kept in an aluminum container designed to endure depths of more than 600 m. In a similar container sits a DC/AC inverter which transforms the electrical field to 220V, a 3-phase frequency modifier, a 3-phase electric motor and a hydraulic pump with cables from the container to the vibrators on top of the corer head. The corer is fitted with 3 m long plastic liners. The corer sits on a frame that stabilizes the equipment on the sea bottom. The vibrators starts when the corer hits the bottom and run for a predestined time or until the barrel has penetrated its full length. Locations 21 – 26 were cored with a **Niemistö** gravity corer.

6.3 Performance

There was a breakdown on the vibra-corer power supply and the supply had to be replaced. The remaining part of the work was done after a break of four weeks.
One problem that was faced was a general misfit between the penetration as observed on the outside of the corer and the length of the retrieved cores. The cores were almost every time shorter than the penetration would indicate. This may either be because the surface sediments were to soft to be sampled or the friction between the entrance of the core barrel and the sediment was too high.
However, in total, the cruise was successful. The core program was fulfilled and a first X-Ray scan of the cores indicates that the quality is good and suitable for achiving the objectives of the cruise.

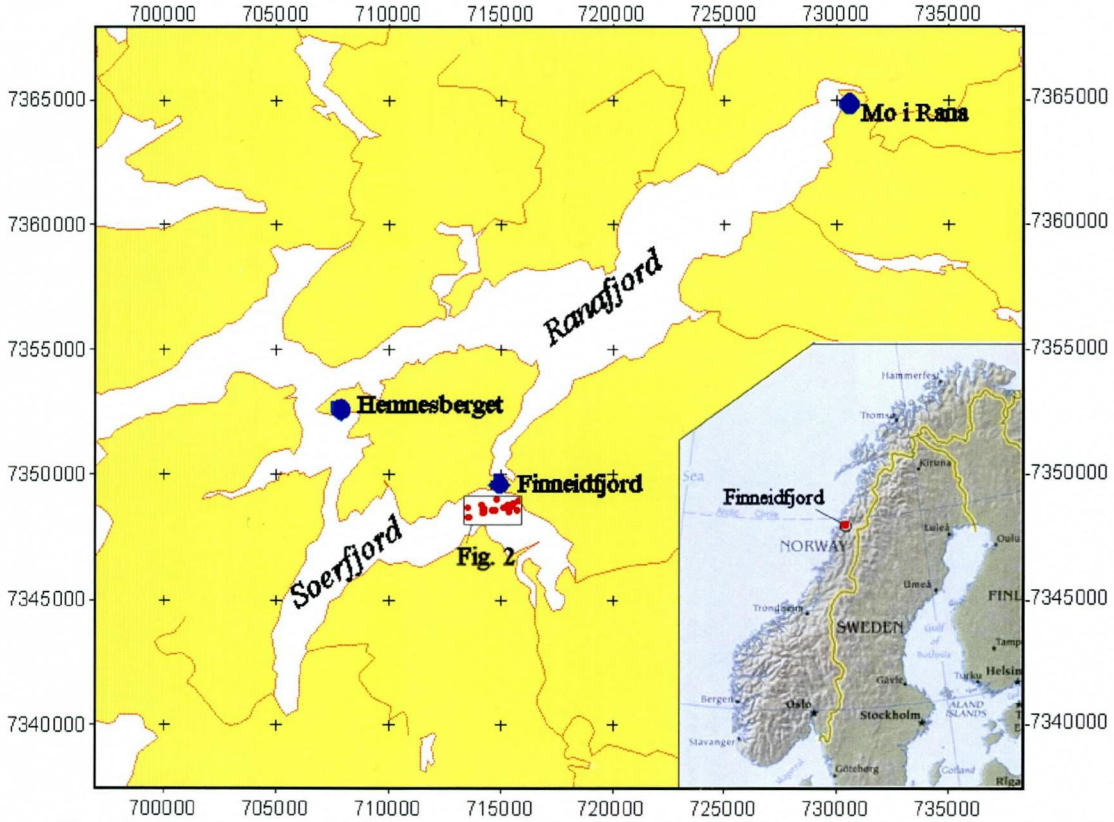

Fig. 1. Location map of the Finneidfjord area with actual core sites as red circles. Inset map of Norway shows the approximate location of Finneidfjord.

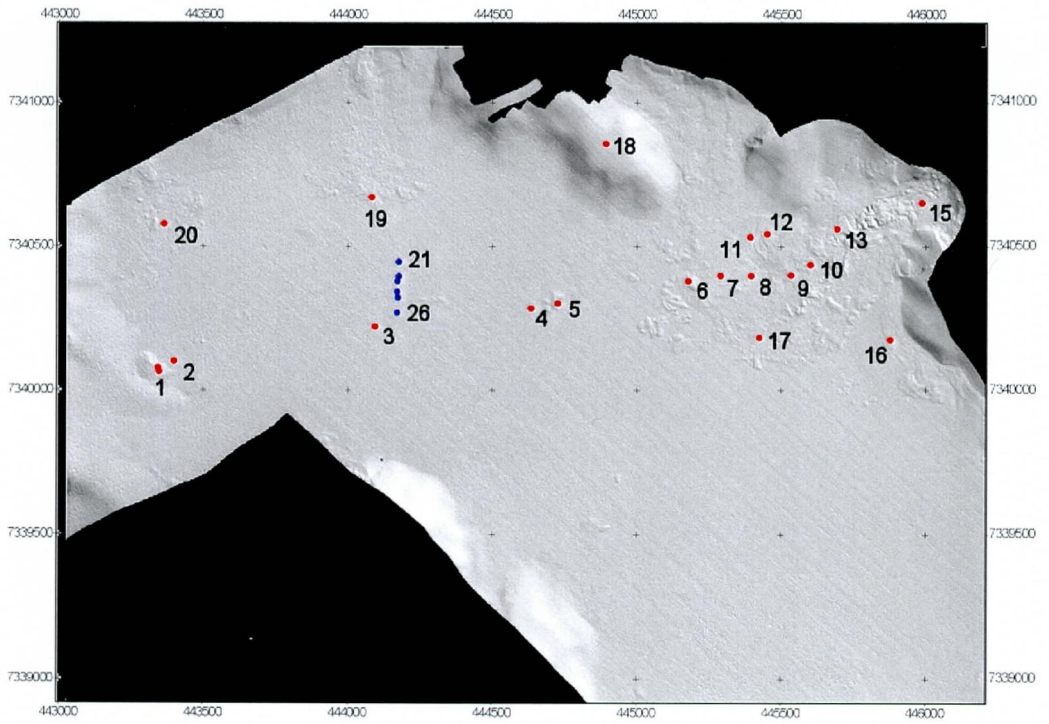

Fig. 2. Image of the sea-floor batymetry outside Finneidfjord with slide morphology and coring stations. Table 2 gives corresponding core numbers, waterdepths etc. Red circles are vibracores, blue Niemistö cores.

Fig. 3. The vibracorer HYBAV operated from FF "Seisma" (Photo: John Howe)

7. REFERENCES

Longva, O., Blikra, L. H., Mauring, E., Thorsnes, T. & Reither, E. 1999: Testprosjekt Finneidfjord; integrert skredfarekartlegging - metodevurdering. NGU Rapport 1999.051, 62 pp.

Janbu, N. 1996: En samlet vurdering av forholdene før, under og etter skredet i Finneidfjord 20. juni 1996. Årsaksvurdering. Rapport nr, rev. 1, 18. Nov. 96. 41 pp.

Table 1: Cruise log

Date	Time of action	Station	Longi-tude	Lati-tude	Water depth (m)	Coring device	Core ID	Core length	Lithology in upper part of core	Lithology in lower prt of core	Remarks
01082001	7:45										F/F Seisma leaves Trondheim for sampling cruise in Finneidfjord.
	21:45										Arrival to Vik for overnight.
02082001	7:45										Departure from Vik .
	15:00										Arrival to Finneidfjord; set-up for sampling.
	18:15	1	13 44.52	66 10.62	61	HYBAV					Two attempts at 0104001; no sample - corer down sidewise due to strong wind and drift.
	19:15										Arrival to Hemnesberget for overnight.
03082001	8:00										Departure from Hemnesberget
	9:00	1	13 44.52	66 10.62	61	HYBAV	P0104001	1.05	Cohesive, grey, silty sandy clay	Bluish grey clay, stiff, FeS/organic mm-scale pockets	Third attempt at 0104001. This site was revisited later (see below 0104101), and additional core was obtained.
	9:55	2	13 44.58	66 10.63	64	HYBAV	P0104002	1.35	Bluish grey clay	Bluish grey clay	
	11:00	3	13 45.39	66 10.69	59	HYBAV	P0104003	1.80	Grey, silty sandy clay	Bluish grey clay	
	12:50	4	13 46.01	66 10.73	56	HYBAV	P0104004	1.70		Bluish grey clay	
	13:50	5	13 46.11	66 10.74	54	HYBAV	P0104005	1.45	Grey silty sandy clay with minor gravel	Grey silty clay, homogeneous	
	14:40	6	13 46.65	66 10.78	50	HYBAV	P0104006	1.25	Sandy silty clay with minor gravel	Silty clay	Penetration stopped in sandy layer; this layer is not represented in core, was observed in core catcher only.
	18:30	7	13 46.75	66 10.79	49	HYBAV	P0104007	0.85		Clayey silt, stiff	Altogether 3 attempts were given at 0104007, 1st and 2nd gave shorter, up to 0.8m cores and were discarded. Description of discarded cores: clayey sandy silt with mm-scale sandy interlayers.

Date	Time of action	Station	Longi-tude	Lati-tude	Water depth (m)	Coring device	Core ID	Core length	Lithology in upper part of core	Lithology in lower prt of core	Remarks
	19:45										Arrival to Hemnesberget for overnight.
04082001	8:00										Departure from Hemnesberget.
	9:45	1	13 44.52	66 10.61	61	HYBAV	P0104101	1.90	Silty sandy clay, shell fragments	Silty clay	0104101 is forth attempt at 0104001. Earlier obtained 1,05m core was considered too short. NB there are 2 cores from 0104001.
	12:55	8	13 46.90	66 10.79	47	HYBAV	P0104008	1.00	Clayey silt, stiff	Clayey silt, stiff	3 attempts were given at 010400, 1st and 2nd gave shorter, up to 0.85m cores and were discarded. Description of discarded cores: structrureless clayey silt.
	13:45	9	13 47.06□	66 10.80□	45	HYBAV	P0104009	1.55	Clayey silt with sand and gravel	Seemingly stratified clayey silt and silty sand	Ca. 5 cm form core catcher was placed into the bottom of tube.
	15:30	10	13 47.14	66 10.81	42	HYBAV					2 tries were given, no good sample obtained this time.
	16:40		13 45.48	66 10.80	56	Niemisto	P0104021	0.50		Silty clay, minor sand	
	17:15	22	13 45.48	66 10.78	57	Niemisto	P0104022	0.35		Silty clay	
	17:30	23	13 45.48	66 10.77	57	Niemisto	P0104023	0.50		Silty clay	
	17:50	24	13 45.47	66 10.75	58	Niemisto	P0104024	0.25		Silty clay, minor sand and gravel	
	18:05	25	13 45.48	66 10.74	57	Niemisto	P0104025	0.36		Silty clay	
	18:05	26	13 45.47	66 10.72	57	Niemisto	P0104026	0.30		Silty clay	
	20:00										Arrival to Hemnesberget for overnight.
05082001	8:00										Departure from Hemnesberget
	10:00	10	13 47.14	66 10.81	42	HYBAV	P0104010	1.20	Clayey silty sand	Clayey silt, black FeS/organic pockets	This was 3rd try at this station; 1st and 2nd were on the day before.
	11:00	11	13 46.90	66 10.85	46	HYBAV	P0104011	1.80	Clayey sandy silt	Clayey silt	
	11:50	12	13 46.96	66 10.86	45	HYBAV	P0104012	1.60	Clayey sandy silt	Silty clay	
	14:20	13	13.47.29	66.10.86	37	HYBAV					No sample – technical problems.
	17:15	14	13.47.37	66.10.88	36	HYBAV					No sample – technical problems.
	18:30										Arrival to Hemnesberget for

Date	Time of action	Station	Longi-tude	Lati-tude	Water depth (m)	Coring device	Core ID	Core length	Lithology in upper part of core	Lithology in lower prt of core	Remarks
											technical inspection of corer and for overnight.
07092001	8:00										Departure from Nesna.
	11:45	20	13.44.53	66.10.85	58	HYBAV	P0104020	1.45	Clayey silt	Sandy clayey silt, black FeS/org pockets	This was 2rd try at this station; 1st try gave 0.4 m core that was discarded.
	13:30	19	13.45.36	66.10.90	56	HYBAV	P0104019	1.80	Silty clay	Silty clay	
	14:15	18	13.46.30	66.11.00	16	HYBAV	P0104018	1.55	Clayey silt	Clayey silt	
	16:10	17	13.46.95	66.10.69	47	HYBAV					Three attempts were given; due to hard bottom and tube bending no sample was obtained. Station revisited – see below.
	16:50	16	13.47.46	66.10.69	41	HYBAV	P0104016	1.15	Clayey silt	Clayey silt	
	17:30	15	13.47.58 024	66.10.91 309	35	HYBAV	P0104015	0.90	Sandy silt	Sandy silt	
	18:18										Arrival to Hemnesberget for overnight.
08092001	8:00										Departure from Hemnesberget.
	9:50	14	13.47.37	66.10.88	33						Two attempts were given; no sample due to hard bottom.
	10:50	13	13.47.24	66.10.87	38	HYBAV	P0104013	0.40	Sandy clayey silt	Clayey silt	Location of sample is slightly shifted from original position.
	12:05	17	13.46.94	66.10.69	46	HYBAV	P0104017	0.20	Clayey silt, stiff	Clayey silt, stiff	Location of sample is slightly shifted from original position. This was 4th try; three on previous day – see above.
	12:10										Departure for sampling 0105.

Table 2: Cores retrieved during NGU Cruise 0104

Station	Water depth	Core ID	Longitude	Latitude	Core length	Lithology in upper part of core	Lithology in lower part of core
1	61	P0104001	13 44.51694	66 10.61920	1.05	Cohesive, grey, silty sandy clay	Bluish grey clay, stiff, FeS/organic mm-scale pockets
1	61	P0104101	13 44.52106	66 10.61234	1.90	Silty sandy clay, shell fragments	Silty clay
2	64	P0104002	13 44.58006	66 10.62973	1.35	Bluish grey clay	Bluish grey clay
3	59	P0104003	13 45.38910	66 10.69382	1.80	Grey, silty sandy clay	Bluish grey clay
4	56	P0104004	13 46.01406	66 10.72906	1.70		Bluish grey clay
5	54	P0104005	13 46.11200	66 10.73800	1.45	Grey silty sandy clay with minor gravel	Grey silty clay, homogeneous
6	50	P0104006	13 46.64572	66 10.77805	1.25	Sandy silty clay with minor gravel	Silty clay
7	49	P0104006	13 46.77561	66 10.78812	0.85		Clayey silt, stiff
8	47	P0104008	13 46.89772	66 10.78903	1.00	Clayey silt, stiff	Clayey silt, stiff
9	45	P0104009	13 47.05816	66 10.79086	1.55	Clayey silt with sand and gravel	Seemingly stratified clayey silt and silty sand
10	42	P0104010	13 47.13764	66 10.80826	1.2	Clayey silty sand	Clayey silt, black FeS/organic pockets
11	46	P0104011	13 46.89205	66 10.85175	1.8	Clayey sandy silt	Clayey silt
12	45	P0104012	13 46.95974	66 10.85770	1.6	Clayey sandy silt	Silty clay
13	38	P0104013	13.47.24173	66.10.86823	0.4	Sandy clayey silt	Clayey silt
15	35	P0104015	13.47.58024	66.10.91309	0.9	Sandy silt	Sandy silt
16	41	P0104016	13.47.46368	66.10.68970	1.15	Clayey silt	Clayey silt
17	46	P0104017	13.46.93588	66.10.68787	0.2	Clayey silt, stiff	Clayey silt, stiff
18	16	P0104018	13.46.30342	66.10.99960	1.55	Clayey silt	Clayey silt
19	56	P0104019	13.45.36352	66.10.90398	1.8	Silty clay	Silty clay
20	58	P0104020	13.44.52896	66.10.85312	1.45	Clayey silt	Sandy clayey silt, black FeS/org pockets
21	56	P0104021	13 45.47997	66 10.79956	0.5		Silty clay, minor sand
22	57	P0104022	13 45.48122	66 10.77621	0.35		Silty clay
23	57	P0104023	13 45.47453	66 10.76889	0.5		Silty clay
24	58	P0104024	13 45.47413	66 10.7515	0.25		Silty clay, minor sand and gravel
25	57	P0104025	13 45.47785	66 10.74142	0.36		Silty clay
26	57	P0104026	13 45.47436	66 10.71808	0.3		Silty clay

NGU
Norges geologiske undersøkelse

ORIENTERING OM NGUs FORSKNINGSFARTØY F/F "SEISMA"

Hovedspesifikasjoner:

Byggeår:	1985
Verft:	West Products A/S, 6718 Deknepollen
Materiale skrog/overbygg:	Sandwich/Divinycell
Lengde oa.:	16,8 m (55 fot)
Dypgang maks:	Ca. 1,5 m
Tonnasje:	34 brt.
Kallesignal:	JWOG
Hastighet under transport:	Ca. 16 knop
Hastighet under profilering:	4-6 knop
Aksjonsradius:	450-500 n.mil

Innredning:

Styrehus:	Arbeidsplass for føring av fartøy, automatisk navigasjon og kjøring av seismikk. Fri sikt 360 grader.
Arbeidsrom:	I plan med akterdekk, ca. 8 m².
Innkvartering:	3 stk. lugarer á 1 person, messe, pantry, WC, dusj (besetning 3 personer).
Akterdekk:	Ca. 24 m².

MASKINER, STRØMFORSYNING M.M.:

2 stk. Scania DSI 11 á 350 HK/2100 RPM, hver tilkoblet hydraulisk vridbare propeller.
Stamford Isuzu dieselaggregat, 18 kw 3-fase, 220 V/AC
Transformator for 380 V, 3-fase uttak
Frekvensomformer for variable turtall for el.motorer (380 V, 3-fase)
35 amp. generator, 24 V/DC (start)
35 amp. generator, 24 V/DC (forbruk)

Hydraulisk system for drift av:
Bauer høytrykkskompressor 600 l/min. 200 bar (luftkanon)
Tallmek baugpropell, 30 HK
Effer dekkskran 2.6 t/m med winch, 400 kg
Prøvetakingswinch m/spoleapparat og fri-fall, 5 tonn
Prøvetakingswinch, 1 tonn
Ankerwinch
Bunkers: Diesel 3.500 l
Ferskvann 1.000 l

NAVIGASJONSINSTRUMENTER

Simrad CP40 kartplotter
Anshütz gyrokompass m/AD converter for radar
Robertson AP9 autopilot
Furuno FCR 1411, fargeradar m/dagslysskjerm og 2 variable avstandsringer
Furuno FR 240, radar med en variabel avstandsring
Furuno fargeekkolodd
Hoccom Famita Good VHF-radio m/sel.call. nr. 90144.
Stornomatic NMT. Tlf. nr. 947 27052

SURVEY-INSTRUMENTER

Posisjonering:
Ashtech GPS12
Trimble Navbeacon radio med standard RTCM utgang, for mottak av referansedata fra Kartverkets SATREF-system sendt over Kystverkets radiofyr.
RDS -radio med RTCM utgang, for referansedata sendt over NRK P2.
PC m/software fra tidligere Kongsberg Diffstar

Vanndypsmåling
Simrad EA 400, 2 kanaler; 200 kHz / 7°, 38 kHz / 13°
Olex kartplotter med dybderegistrering

Magnetometer:
GSM-19M overhauser protonmagnetometer med 100m kabel

Seismikk
"Boomer"-kilde "High Resolution Sound Source", modell 5813 B, 280 Joule
Topas (Topographic Parametric Sonar), høyoppløselig skrogfestet kilde og hydrofon.
Sleevegun, 15-40 kubikktommer
Benthos hydrofonslanger, 7,5 m
4-kanals hydrofonslange, Fjord Instruments, 24 m
Analogt prosesserings-system m/int.trigg, bandpass-filter 20-2400 Hz. TVG og TVF funksjoner og lineær forsterkning 0-80 dB
Analogt bandpass filter, 1-9999 Hz, lineær forsterkning 10-70 dB
Digital logging av seismikk med posisjon og tid, i tillegg kontroller for Topas:
SUN Sparc 20 arbeidsstasjon m/ analog og digital filterenhet 4-kanaler.
DAT- tape stasjon for lagring av data på Topasformat eller S-SEGY format
EPC 3200, grafisk skriver
EPC 9800, termisk skriver
IBM kompatible 486-PC'er for logging av posisjoner, ekkolodd og magnetometer

Prøvetakingsutstyr
Gravitasjonsprøvetaker, 63 mm, vekt maks. 300 kg.
Modifisert Niemistöe prøvetaker, 63 mm
Vibrasjonsprøvetaker, 63 mm, 75 mm og 110 mm
Grabb, 70 kg