Cruise report

HM2025009006

E. Darelius

1. Cruise overview

The cruise was organized as part of the course GEOF337 at the Geophysical Institute, UiB, and we visited Masfjorden, Lurefjorden and Osterfjorden to do hydrographic work, collect water samples and recover moorings.

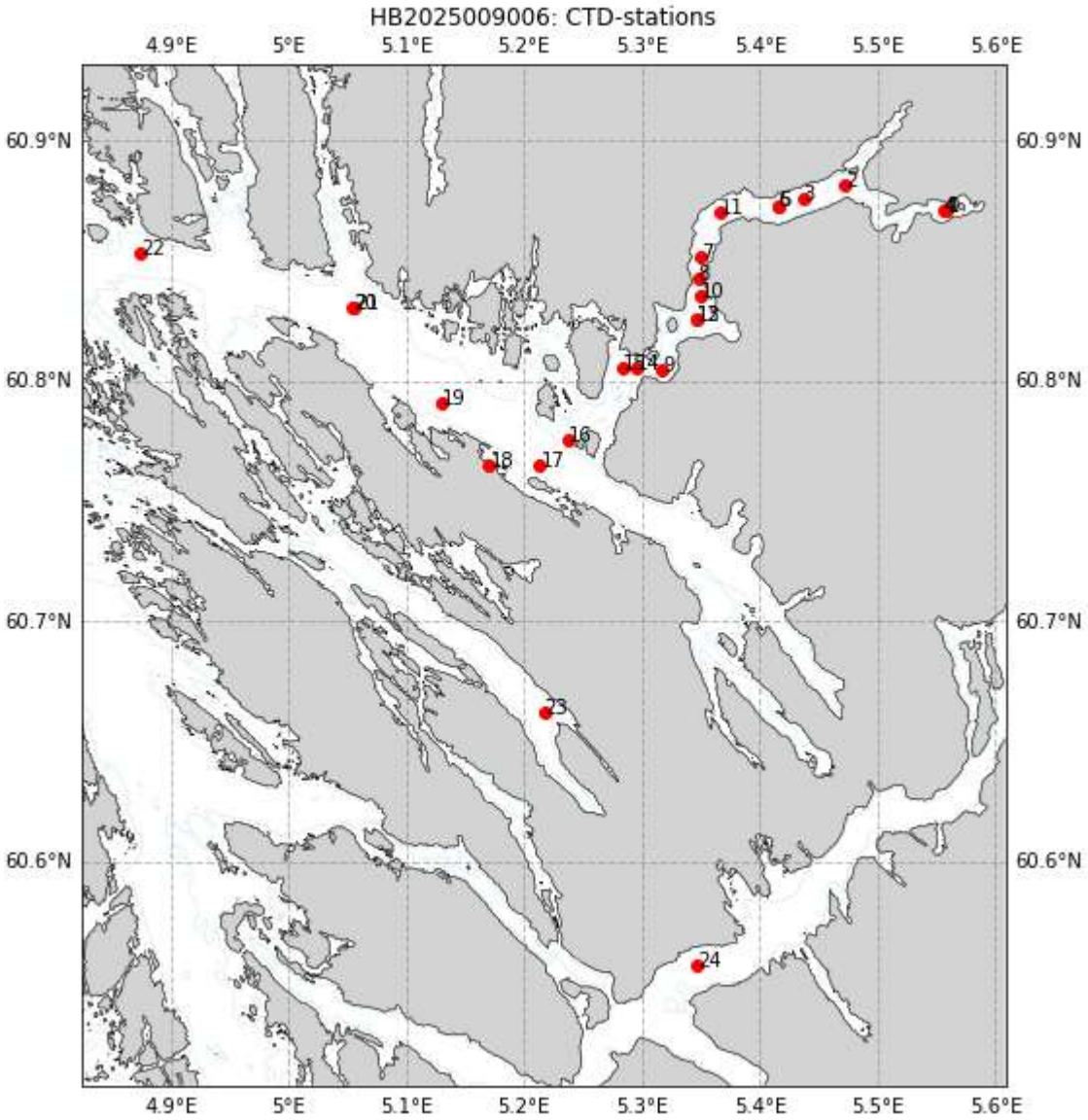

Figure 1: Map over the study area. CTD-stations are indicated by numbered red dots.

2. Cruise participants

Elin Darelius
Ingrid Sælemyr (PhD-candidate, teaching assistant)
Angela Barbara Muhmenthaler (student)
Lilli Viktoria Weninger (student)

CTD

We occupied a total of 24 CTD-casts during the cruise using the RBR Concerto sn 204473 available onboard. The conductivity, temperature and pressure sensor were last calibrated in June, 2020, while the oxygen sensor was last calibrated in April, 2000.

The stations are listed in Table 2.

Several of the stations were occupied twice, with one cast to the bottom followed by a shallower cast to collect water samples from the upper part of the water column.

We forgot to take the protection cap off the oxygen sensor for cast 0-2, so oxygen measurements from these profiles were discarded. We returned to M35, where water samples were collected during cast 0-1, to obtain an oxygen profile from that station (cast 4).

3. Water sampling

Water samples were obtained from the Rosette available onboard during the upcast. As CTD data cannot be viewed live, sample depths had to be chosen beforehand. Sample depths are listed in Table 3, where the depths are the depths given by the pressure sensor of the Rosette.

In addition, samples from the surface were collected using a separate water sampler. These samples were collected using a messenger with the sampler about 0.5 m below the surface.

The ship lost connection to the water sampler during the first cast in Lurefjorden, 13/2 and the work in the fjord was aborted. Surface samples were collected at two locations in Lurefjorden (see Table 2).

Winkler titration

Samples for measuring dissolved oxygen were collected using a tube, ensuring each sample was as bubble-free and exposed to air as little as possible. Draw temp was measured before we added 1 mL MnCl2 and 1 mL NaOH/NaI to the sample and put a cap on the flask. The sample was then shaken for about 20 sec, and stored dark and cool until Winkler titration started.

Winkler titration was carried out onboard by I. Sælemyr and the students using the semi-manual titration system.

a) Dissolved Inorganic Carbon / Alkalinity, and nutrients

Samples for carbon analysis (dissolved inorganic carbon and alkalinity) were collected using a tube, adding a drop (ca 0.02 mL) of mercury to the sampled bottles. Samples were kept cool and dark, and brought back to GFI for analysis.

Samples for nutrients were collected by rinsing the flasks three times, then adding a drop of chloroform to the sample. Samples were stored in the fridge, and sent to IMR for analysis.

Samples for NH4 were collected after rinsing the bottle three times, and the samples were placed in the freezer.

b) Salinity

The samples were collected following standard procedures, i.e., the bottles were rinsed three times and then brought back to GFI, where they were analyzed in the lab by the students, supervised by K. Jackson-Misje.

4. Mooring recovery

Moorings "MF_outer" and "MF_sill", deployed in March 2024 were recovered without any problems (See Table 1). There were considerable errors in the drawing of MF_outer. The drawings were updated and are included here (Figure 5-6)

We had planned to recover a third mooring, MF_inner, but it did not release. It answered promptly when being interrogated and returned reasonable distances - but then did not release. This has happened earlier – we thought that moving the release further from the bottom would resolve the issue, but it did not make any difference.

Table 1: Mooring details

	Lon	Lat	Date in	Date out	Depth	CTD
MF_sill	5° 17.875' E	60°48.231′ N	2024.03.07 14:00	2025.02.12 11:30	84 m	13-14
MF_outer	5° 20.587' E	60°49.480′ N	2024.03.07 16:00	2025.02.12 10:00	299 m	11

NOTES:

1) The Aquadopp had not recorded data, probably because of one of the batteries malfunctioning.
2) The RBR had been deployed with the wrong type of battery, this resulted in the O2-sensor malfunctioning and an overall gappy data set. We needed help from RBR to read / clean the datafile
3) The pressure record on the RBR shows a sudden 5 m change in depth in September, suggesting that the mooring has been dragged by e.g. a fishing boat.

5. Calibration of CTD sensors

a) Salinity

The salinity of the water samples was determined by K. Jackson using a portasal. 22 samples were collected.

The mean offset (Bottle-CTD) for samples collected deeper than 80 dbar is -0.006. This includes 17.0 samples. Samples that are more than 2 standard deviations off are removed; this procedure was repeated 2 times. 5.0 samples were removed.

.

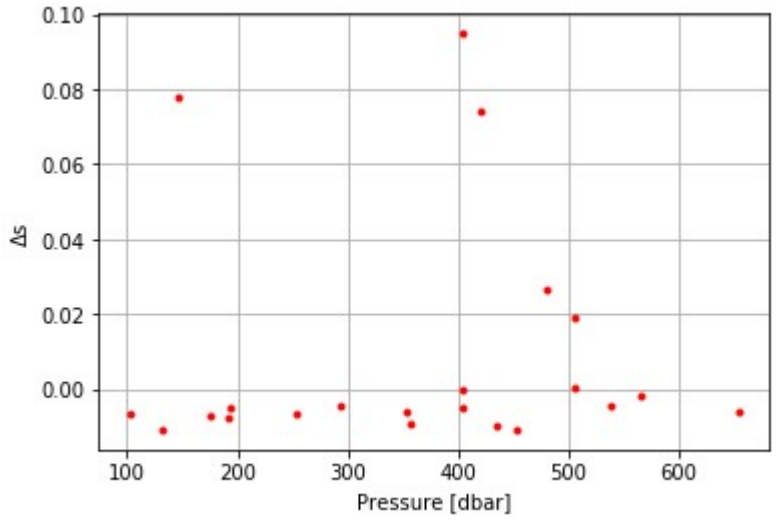

Figure 2: Difference between the salinity observed with the CTD and the salinity from the water samples as a function of pressure.

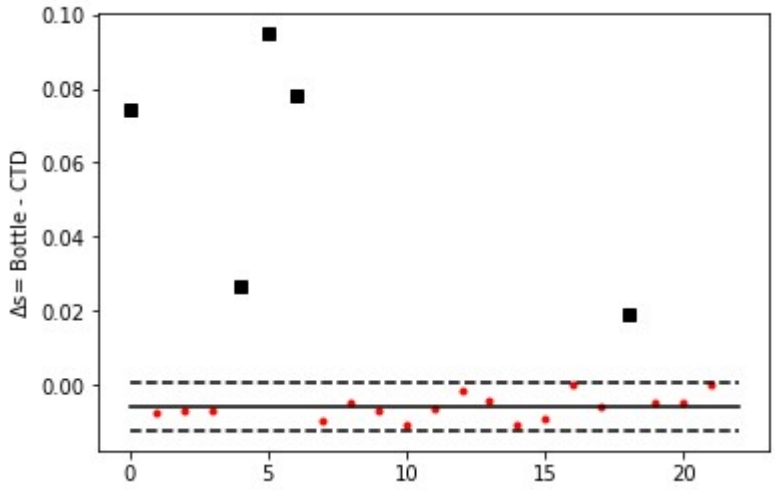

Figure 3: Salinity difference between the salinity value from bottles and the CTD. The black line shows the mean value, and the dashed lines show the mean value +/—2 times the standard deviation. Outliers are marked with black squares.

b) Dissolved Oxygen

Oxygen concentrations observed by the CTD and those determined through manual Winkler titration were converted to [umol/kg] and compared.

No sample was flagged as bad during the analysis. When the difference between doubles (samples taken from the same depth and station, but not necessarily the same Niskin) was lower than 3 umol/kg, the mean value was retained. If the value was higher than 3 umol/kg both samples were removed. No doubles were removed.

We fitted a line to the data using linear regression, and samples with an error larger than 2.5 times the root mean square error were removed. This procedure was repeated until either no more samples were removed, or the root means square error of the remaining samples was smaller than 2 umol/kg.

A total of 21 samples were included in the regression analysis, and 20 samples were included in the final regression (Figure 4).

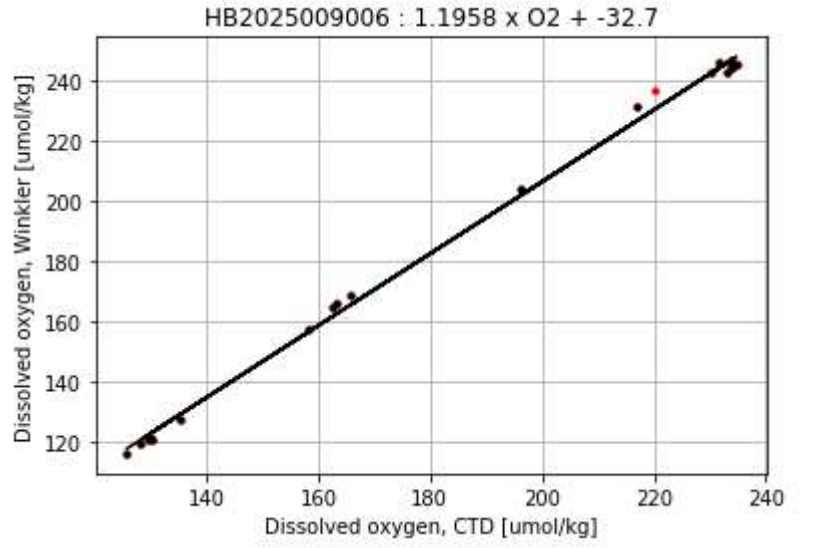

Figure 4: Dissolved oxygen concentration observed with the CTD versus that determined through Winkler titration. The black line shows the regression line used to correct the CTD data, and the black (red) dots are the samples included (not included) in the final regression analysis.

6. Cruise diary – not complete

11 February, 2025

08:00 Departure Bergen – sunny and cold

12:30 First station, M35. Niskin 5 & 6 leaked the first cast. Niskin 6 leaked also the second time. We took surface samples using the surface sampler – you have to through hard to get it to close. Quite chaotic!

14:00 Ice in Haugsværfjorden

15:00 Before statin M28 we discovered that the O2 – protection had been on… talked to Tobia and decided to go bak and take a CTD-cast.

15:08 Returned to M35 to do a cast with O2.

Continued with CTD-stations. Stopped for dinner at 17:30 (M20)

12 February

06:30 First CTD station.

Ingrid started oxygen analysis.

We tried release MF_inner at several locations. The mooring replies and gives a reasonable distance, but it does not release.

Mooring MF_outer and MF_sill released on the first attempt.

Instruments at MF_outer were not placed as in the drawing. Updated drawings are attached here.

We finished stations in Masfjorden and Fensfjorden and moved on to Lurefjorden. Arrived 18h. It took about 1h from the last station in Fensfjorden (F03) to Feste quai.

13 February

08:30 Started the first cast in Lurefjorden (LF07) but aborted at about 200 m as we discovered that there was no signal on the surface unit of the rosette. We changed batteries – but that did not resolve the issue. The problem could not be resolved at sea, and we decided to return to Bergen and end the cruise. On the way back, we took surface samples at L06 and L03, and a CTD-station in Osterfjord.

During the return, we cleaned the instruments from the moorings, downloaded data and finalized the DO-analysis.

<u>We had the following issues when downloading data:</u>

AQD: Did not manage to establish connection, probably because the instrument has run out of battery. We did not have the adaptor and could hence not use an external power supply.

SBE37IM: Neither the cable nor the modem was onboard, so we did not attempt to read the data

RBR – CTD: There was a warming in Ruskin when downloading the data stating that something was missing in the header. We tried a few times but always got the same error. We did not manage to convert the data from rsk to a readable format.

We left the ship around 16h.

Table 2: Details about CTD-stations occupied during HB2025009006. X = water samples from rosette, s=surface samples.

	St.name	Date			UTC	Depth	Latitude/ N		Longitude/ E		Salt	O2	CT/nutrients	Ammonium	Methane	
CAST		year	mon	day	hh:mm	m	deg	min	deg	min						
0	M35	2025	2	11	12:27	179	60	52,262	5	33.52	x	x	x	x	xs	bottle 5&6 leaked, changed rubber
1	M35	2025	2	11	13:10	179	60	52,260	5	33.52			x	x	x	bottle six leaked; changed O-ring
2	M31	2025	2	11	14:13	257	60	52,877	5	28.340	x	x				
3	M28	2025	2	11	14:36	422	60	52,537	5	26.205	x	x			s	O2 - protection was taken off before this station
4	M35	2025	2	11	15:08	179	60	52,255	5	33.34		x				Repeat - with O2
5	M26	2025	2	11	15:37	474	60	52,370	5	24.923	x	x	x	x	xs	
6	M26	2025	2	11	16:34	474	60	52,370	5	24.923			x	x	x	
7	M22	2025	2	11	16:54	405	60	51,073	5	21.013	x	x			s	
8	M20	2025	2	11	17:19	353	60	50,559	5	20.871	x	x				
9	M14	2025	2	12	6:43	149	60	48,253	5	19.028	x	x				
10	M18	2025	2	12	7:00	196	60	50,114	5	20.960	x	x				
11	M24	2025	2	12	7:20	441	60	52,210	5	21.985	x	x			s	
12	M16	2025	2	12	8:44	295	60	49,533	5	20.774	x	x	x	x	xs	Mooring recovery in betweem upper & lower part
13	M16	2025	2	12	10:21	296	60	49,520	5	20.743			x	x	x	
14	M12	2025	2	12	11:06	107	60	48,313	5	17.729	x	x				
15	M11	2025	2	12	11:43	197	60	48,332	5	17.016	x	x			s	
16	M07	2025	2	12	12:02	135	60	46,510	5	14,214	x	x				
17	M04	2025	2	12	12:20	655	60	45,898	5	12.799	x	x	x	x	xs	
18	M04	2025	2	12	13:37	656	60	45,890	5	10.221			x	x	x	
19	F03	2025	2	12	14:10	572	60	47,430	5	7.831	x	x			s	
20	F06	2025	2	12	15:02	540	60	49,812	5	3.236	x	x	x	x	xs	
21	F06	2025	2	12	15:52	540	60	49,800	5	03.330			x	x	x	
22	F03	2025	2	12	16:32	461	60	51,185	4	52.474	x	x			s	
23	L07	2025	2	13	7:33	308	60	39,723	5	13.024						Connection problems - cast aborted
24	O1	2025	2	13	10:18	618	60	33,401	5	20.819						

Table 2b: Stations with only surface samples

	L06	2025	2	13	08:15	415	60	41,107	5	10,363				s
	L03	2025	2	13	08:46	181	60	43,780	5	1,556				s

Table 3: Pressure (dbar) where the Niskin bottles were closed.

Cast	Station Name	Bottle 1	Bottle 2	Bottle 3	Bottle 4	Bottle 5	Bottle 6
0	M35	177	177	153	102		
1	M35	82	52	32	21	11	6
2	M31	255	255	255	255	255	255
3	M28	422	422	422	7	7	7
4	M26	481	481	406	305	254	204
5	M26	102	82	52	22	11	6
6	M22	405	405	304	304	304	304
7	M20	357	357	357	357	357	357
8	M14	147	147	147	147	147	147
9	M18	194	194	194	194	194	194
10	M24	435	435	405	405	254	254
11	M16	294	294	254	203	153	102
12	M16	83	52	22	17	12	7
13	M12	103	103	103	103	103	103
14	M11	193	193	193	193	193	193
15	M07	132	132	132	132	132	132
16	M04	655	655	506	355	254	204
17	M04	102	82	51	21	11	6
18	F08	567	567	506	506	405	405
19	F06	540	540	456	406	255	153
20	F06	103	83	52	22	12	7
21	F03	454	454	454	454	405	405

UNIVERSITETET I BERGEN
Geofysisk Institutt

Mooring name: MF Outer Recovered
Project: FJO2RD

Location: Masfjorden
Position: Lat 60°49.480' N
Lon 5° 20.587' E
Depth: 299 m
Deploy: 2024.03.07
Recover: 2025.02.12 10:00 UTC
Latest update: 25/03/2025

Notes: **Deployed from H. Brattström BH20240090015. Recovered from H. Brattström 12.Feb. 2025 Note: P sensor indicated that mooring was moved 5m vertically to unknown horisontal position (not triangulated) in September 2024.**

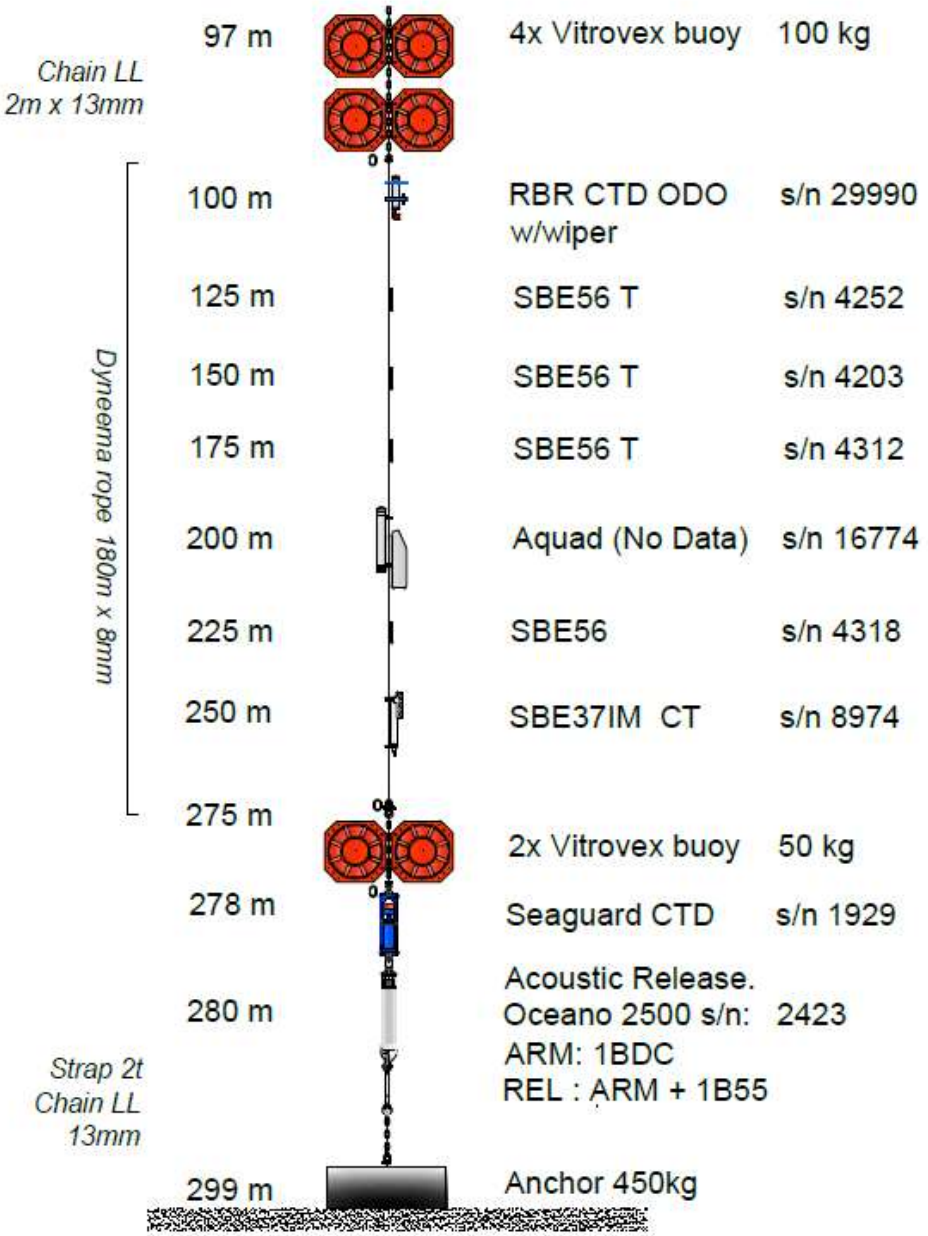

Figure 5: MF_outer. The mooring was recovered during the cruise.

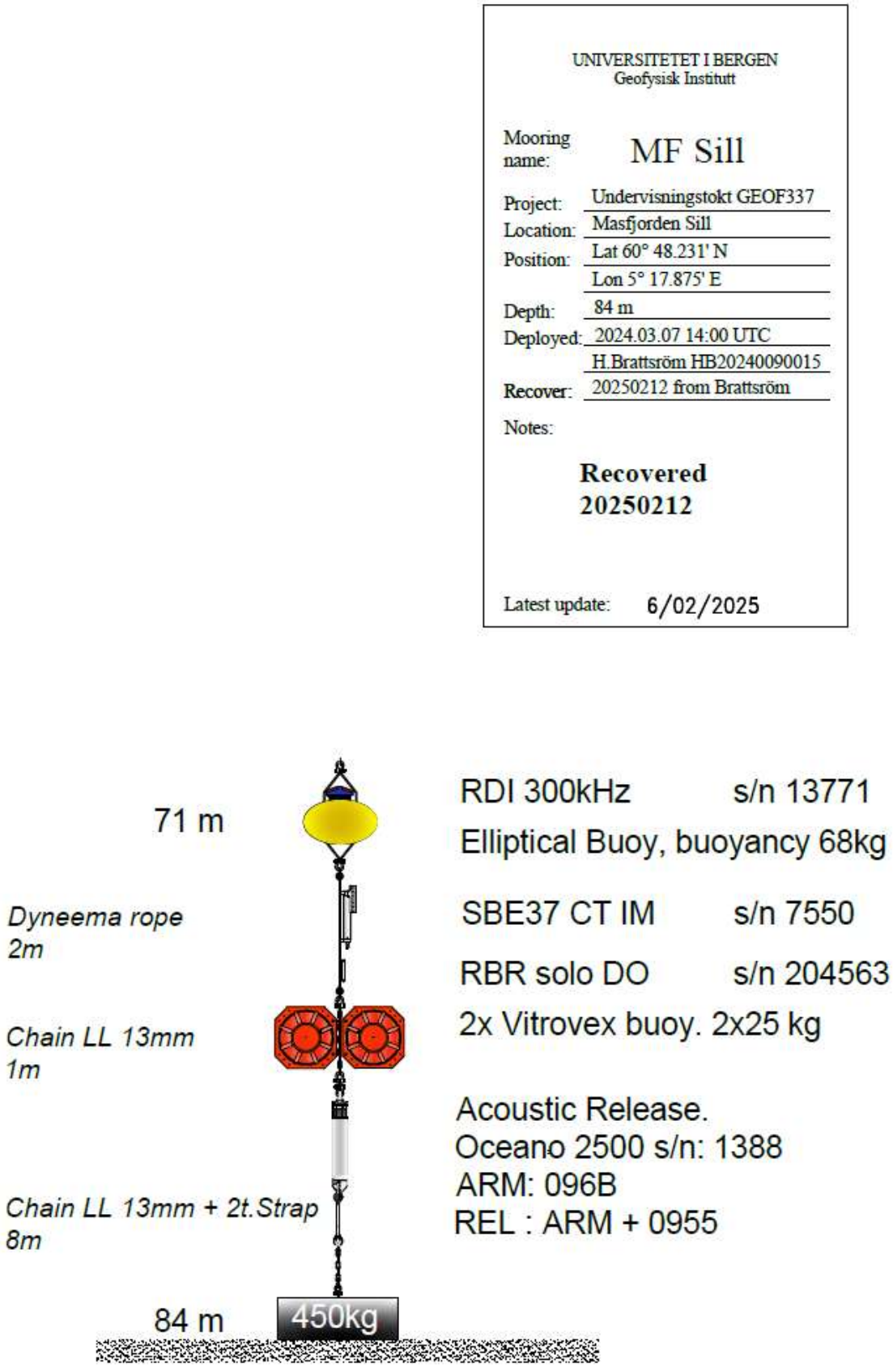

Figure 6: MF sill. Mooring recovered during the cruise.