Week 4 Drilling and Scientific Report for IODP Expedition 347 Baltic Sea Paleoenvironment

4th October 2013 – 10th October 2013

1. Hole summary

Hole	M0061A	M0061B	M0061C	M0062A	M0062B	M0062C	M0062D	M0063A
Latitude	62°46.700' N	62°46.706' N	62°46.722' N	62°57.350' N	62°57.357' N	62°57.343' N	62°57.358' N	58°37.340' N
Longitude	18°2.950' E	18°2.930' E	18°2.982' E	17°47.700' E	17°47.682' E	17°47.718' E	17°47.716' E	18°15.250' E
First core	October 4th 12:30	October 5th 00:15	October 5th 07:40	October 5th 19:50	October 6th 04:45	October 6th 09:40	October 6th 10:35	October 6th 10:35
Last core	October 4th 22:35	October 5th 06:30	October 5th 12:00	October 6th 03:00	October 6th 08:25	October 6th 09:40	October 6th 14:15	October 11th 01:20
Cores recovered	11	9	7	13	8	1	7	37
Drilled length (Coring)	25.15m	28.7m	23.1m	35.4m	23.1m	3.3m	21.0m	101.26m
Drilled Length (Open Hole)	N/A	N/A	N/A	0.5m	1.0m	N/A	1.5	5.0m
Recovered length	26.36m	28.46m	23.12m	34.97m	23.3m	3.43m	19.99m	101.52m
Core recovery	104.81m	99.16%	100.9%	98.6%	100.87%	103.94%	102.51%	100.26%
Final depth	25.15m	28.7m	23.1m	35.9m	24.1m	3.3m	21.0m	105.8m
Hole recovery	104.81%	99.16%	100.90%	97.41%	96.68%	103.94%	95.19%	95.95%

2. Science

Following our drilling in the Kattegat, the *Greatship Manisha* left Station BSB-1 on 1st October and started the 3-day long transit south of Sweden and up through the Baltic Sea. We arrived at our next coring site at the mouth of the Ångermanälvenriver at 62°N on the Swedish Bothnian Sea coast. This estuary offered beautiful sceneries during the following sunny days, with a hilly landscape covered by fir woods and with the bright orange and yellow colours of birch trees advertising the fall season.

The primary objective of Site BSB-10 and BSB-11 in the Ångermanälven river was to core varved Holocene and Late Glacial clays and thereby contribute with a long time series to the Swedish high-resolution varve chronology. The watershed area of Ångermanälven is representative of the climate and precipitation in central Sweden, and the systematics of varve thicknesses will expectedly reflect annual variations in rainfall and snowmelt. The upper meters of clay at the more marine BSB-10 were black with indistinct varves due to diagenetic sulfidization but turned into more distinctly varved, gray clay below 5 mbsf. From 13 mbsf the sediment became increasingly rich in silt grading to pure, well-sorted, fine sand below 20 mbsf. As varves were no longer visible drilling stopped at 25 mbsf. Two more holes for varve chronology were drilled at BSB-10, reaching down to 29 and 23 mbsf, respectively. Both holes showed a very similar sedimentology as the first hole.

We then moved up the river to Site BSB-11. At this site the uppermost half meter of sediment was intentionally not cored as it is contaminated and may constitute a health risk due to long-term discharge of toxic waste (in particular of heavy metals such as mercury) from the local paper industry. All necessary safety measures were taken to deal with this sediment and very good cores were obtained from depths beneath 0.5 mbsf. Similar to Station BSB-10, the sediment down to 15 mbsf was varved Holocene clay. Below that depth it became coarser, varying from clayey silt to silty sand. Drilling continued down to 36 mbsf in the first hole to see whether there were deeper clay deposits. None were found. Samples for OSL dating were taken in black bags at regular intervals down through the silt and sand, carefully avoiding exposure of the cores to light. The lacking half-meter deep surface interval was cored towards the end of this station by Rumohr coring. Again using all necessary safety measures, two 1-m long cores were obtained. These were sealed, bagged and will be brought back intact to the core repository in Bremen.

After this calm and picturesque experience in the north we steamed down along the Swedish coast to the next station, Site BSB-9, in the Landsort Deep northeast of Gotland. With a water depth of 437 m, this site is the deepest during Expedition 347 and also the deepest area in the Baltic Sea. It is permanently stratified, anoxic and sulfidic and has expectedly been so far back in Baltic Sea history. The anticipated sediment thickness is 160 m. At this exposed site the wind picked up and coring over the following two days took place in a seastate that was, in periods, only achievable due to the relatively great water depth.

The first piston cores brought back a black gyttja strongly smelling of sulfide and with fine laminas that were difficult to distinguish in the surface core due to the strong sulfidization and the very fluid sediment. But laminas became very distinct below. The gyttja was highly charged with methane gas and developed large bubbles, cracks and voids in the cores. Some sediment was even lost out of the core liner after it was opened on the deck due to a virtual eruption of black gyttja. It could later be sampled from the clothes of the nearest people! The gyttja contained foraminifera, diatoms and pollen grains in varying densities. Below ca. 18 mbsf the sediment changed into a dark greenish gyttja with a small amount of silt. From 30 mbsf varves were no longer recognizable and below 40 mbsf the sediment was gray, homogenous clay without foraminifera, typical for sediments deposited in the Ancylus Lake. Below 50 mbsf the clay was light brownish and thinly varved. The varves became more variable and thicker, 1-5 cm, in the deep glacial clay sequence below which had no detectable foraminifera or other microfossils. At 90 mbsf the sediment became slightly coarser and a horizon of clayey sand was found. A tentative estimate based on the visible varve thicknesses points towards a sequence of glacially varved clay that represents ca. 2200 years of varve deposition. This varve deposition took place during the Baltic Ice Lake and Yoldia Sea stages of the Baltic Sea.

A clayey, sandy, and gravely diamicton was present from 92 to 102 mbsf below which the sediment turned into well sorted silt with a light brown colour. We continued down into hard very well sorted gravel by open-holing with intermittent hammer coring. At 106 mbsf and 116 mbsf hammer coring brought up only a small amount of well sorted gravel with no fines. This probably represents glacio-fluvial gravel resulting from a strong flow of melt water from the ice sheet. Due to the risk of getting stuck in the unstable gravel, Hole M0063A was terminated at a depth of 116 mbsf. It was subsequently logged.

3. HSE and Environmental Activities

N/A

4. Figures

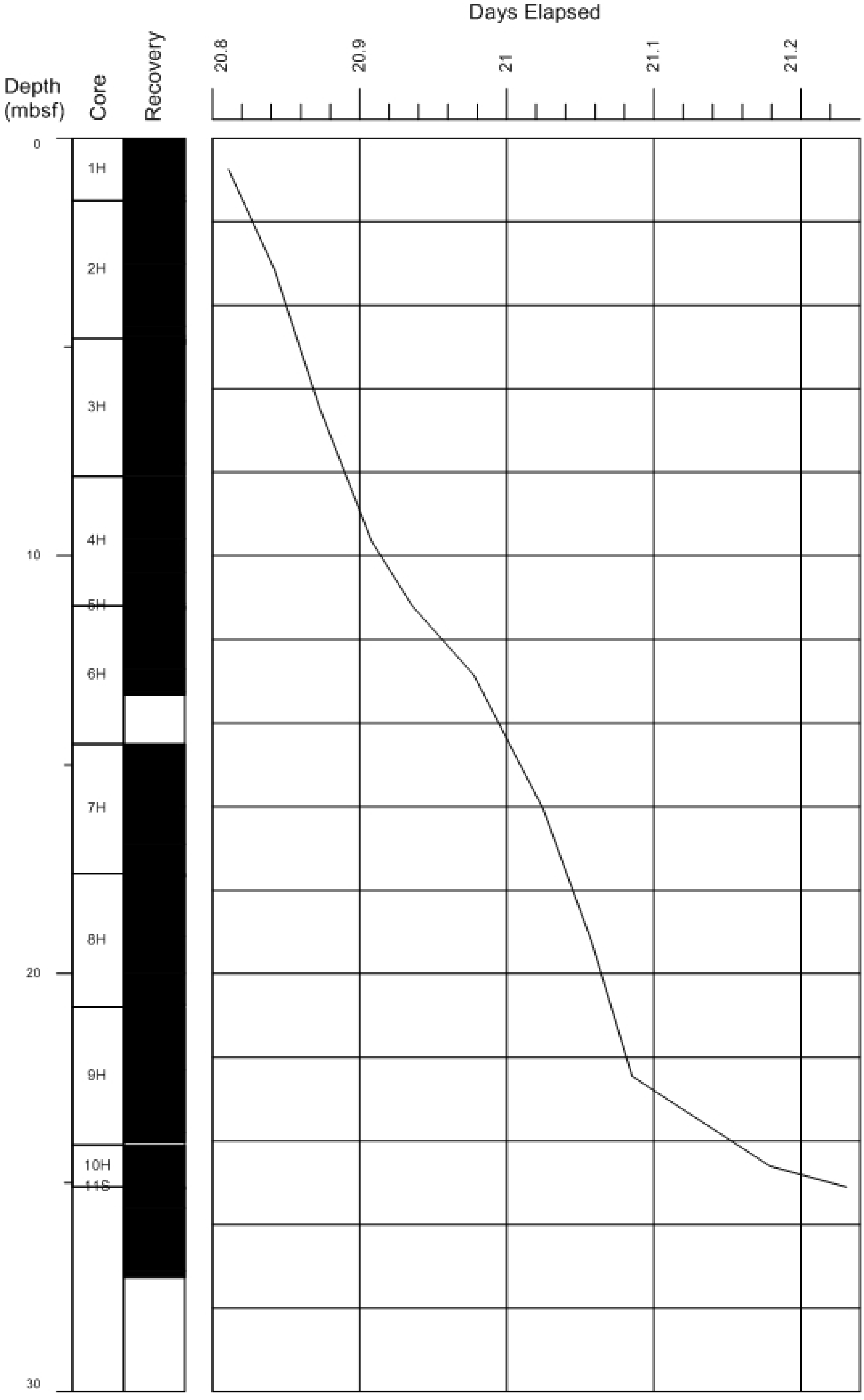
Figure 1 – Recovery and depth versus time plot at Hole M0061A
Figure 2 – Recovery and depth versus time plot at Hole M0061B
Figure 3 – Recovery and depth versus time plot at Hole M0061C
Figure 4 – Recovery and depth versus time plot at Hole M0062A
Figure 5 – Recovery and depth versus time plot at Hole M0062B
Figure 6 – Recovery and depth versus time plot at Hole M0062C
Figure 7– Recovery and depth versus time plot at Hole M0062D
Figure 8 – Recovery and depth versus time plot at Hole M0063A
Figure 9. Breakdown of hours, up to 24:00 hrs on 10thth October.

Photos of the week.

IODP Expedition 347

Hole 61A progress summary

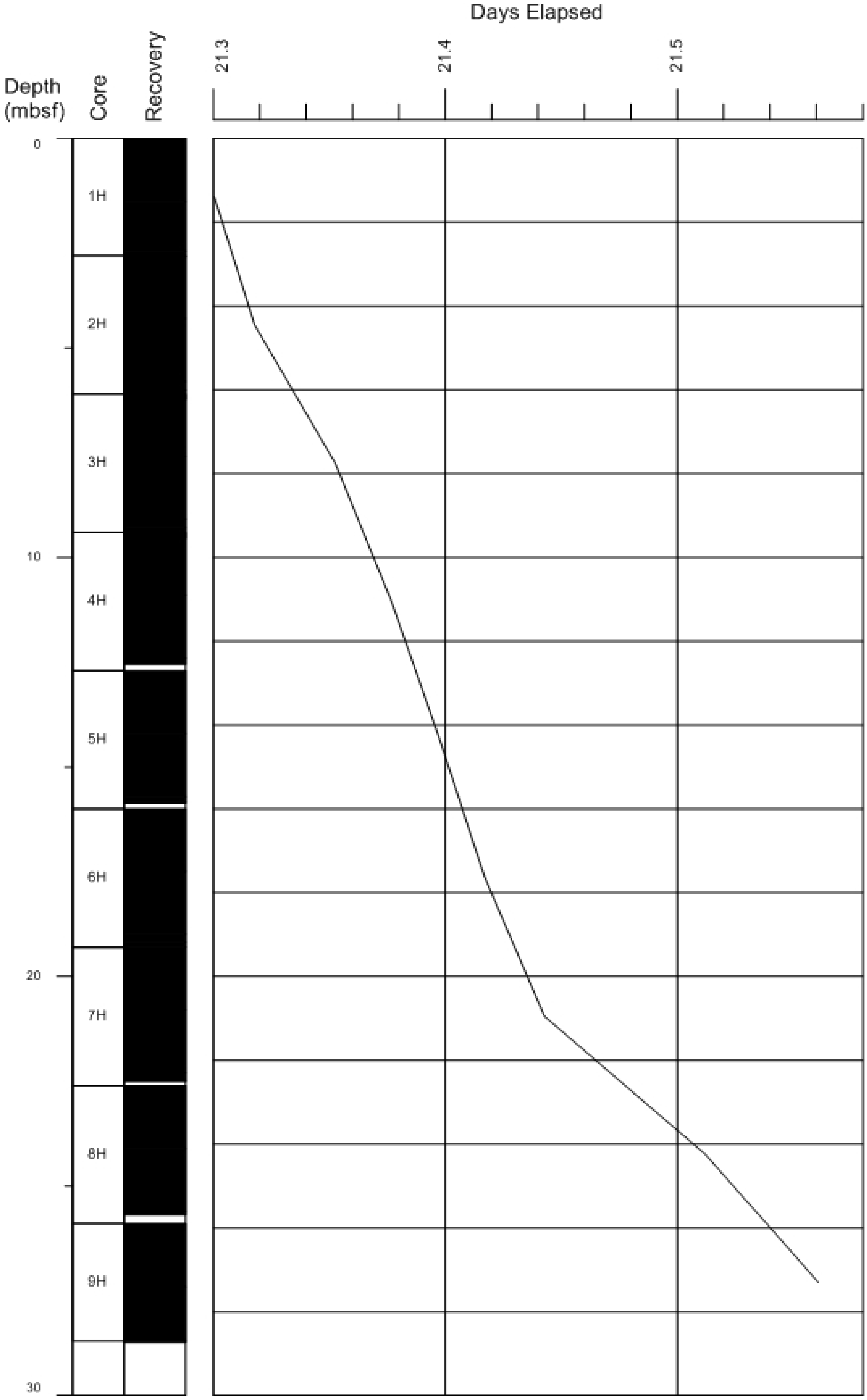
Latitude: 62° 46.700 N
Longitude: 18° 2.950 E
Water depth: 89.4 m



IODP Expedition 347

Hole 61B progress summary

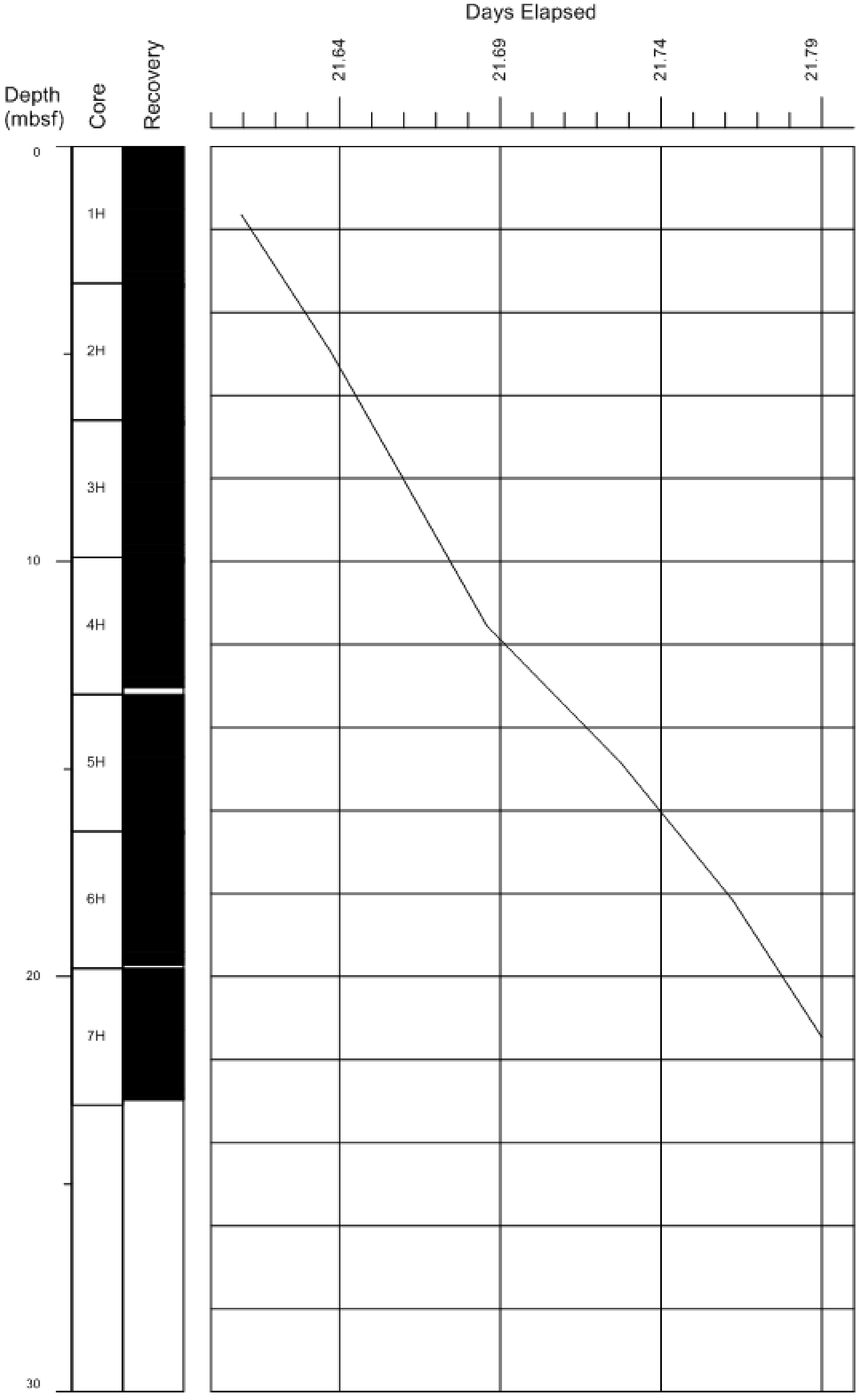
Latitude: 62° 46.706 N
Longitude: 18° 2.930 E
Water depth: 89.4 m



IODP Expedition 347

Hole 61C progress summary

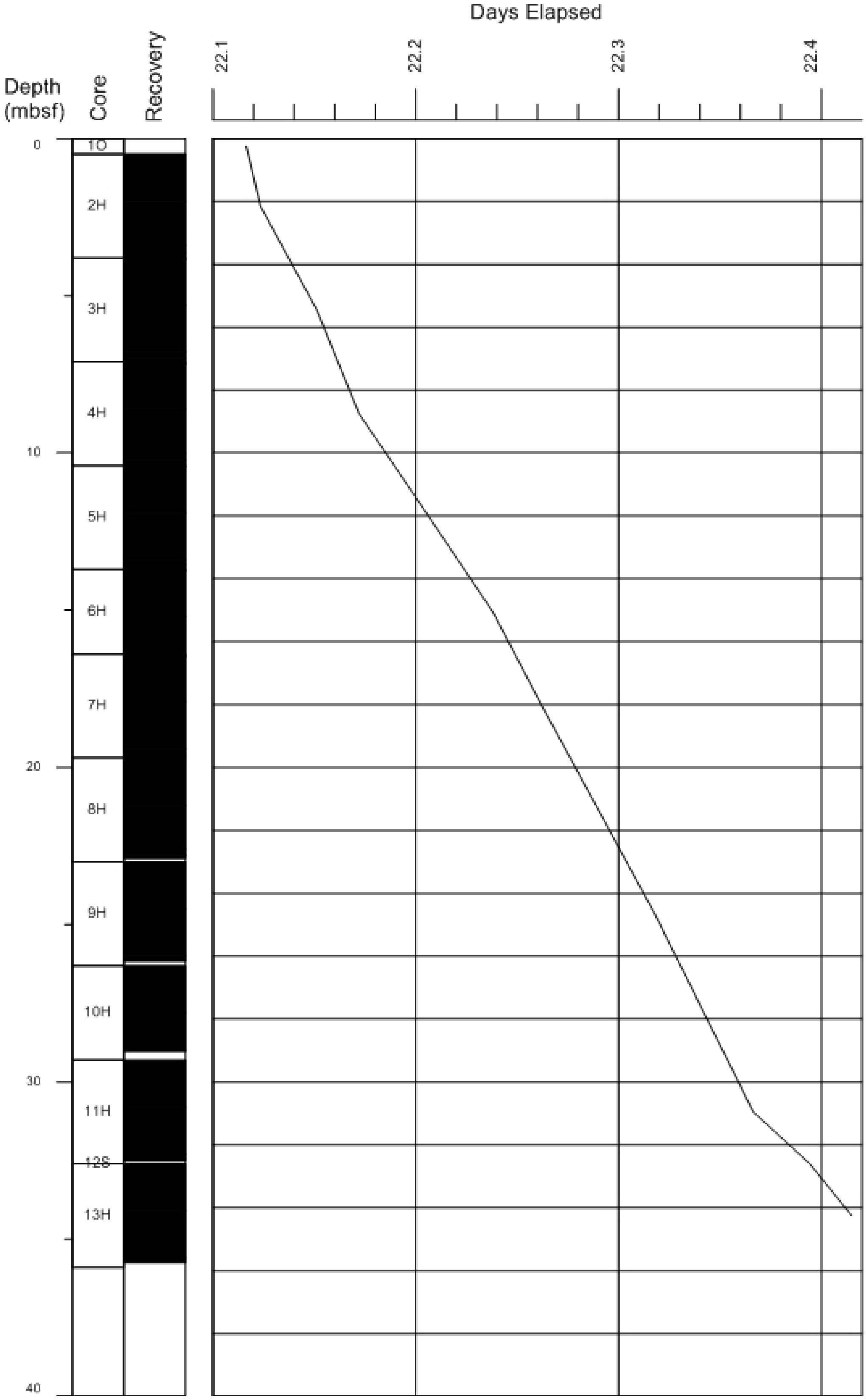
Latitude: 62° 46.722 N
Longitude: 18° 2.982 E
Water depth: 89.4 m



IODP Expedition 347

Hole 62A progress summary

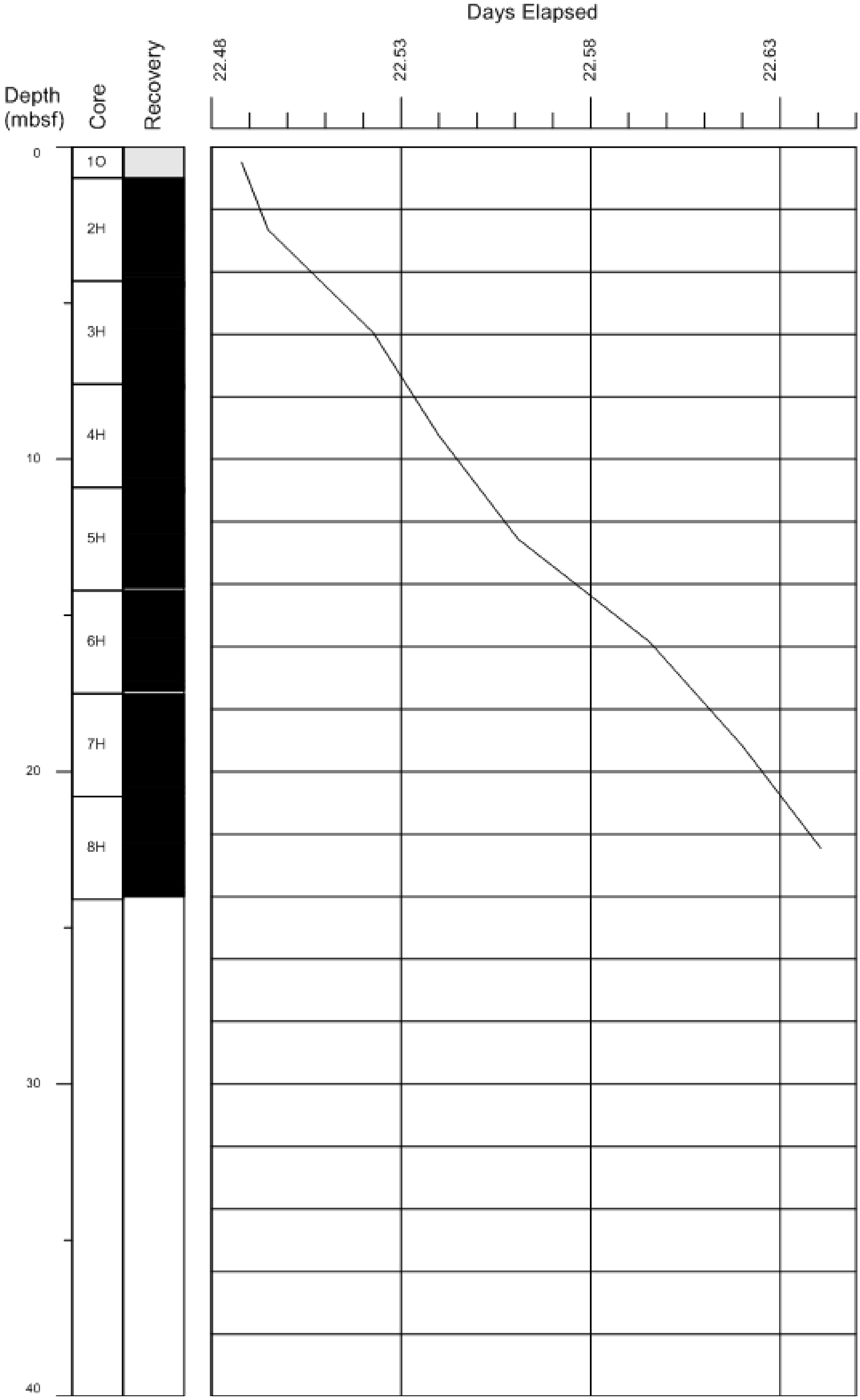
Latitude: 62° 57.350 N
Longitude: 17° 47.700 E
Water depth: 69.31 m



IODP Expedition 347

Latitude: 62° 57.357 N
Longitude: 17° 47.682 E
Water depth: 69.31 m

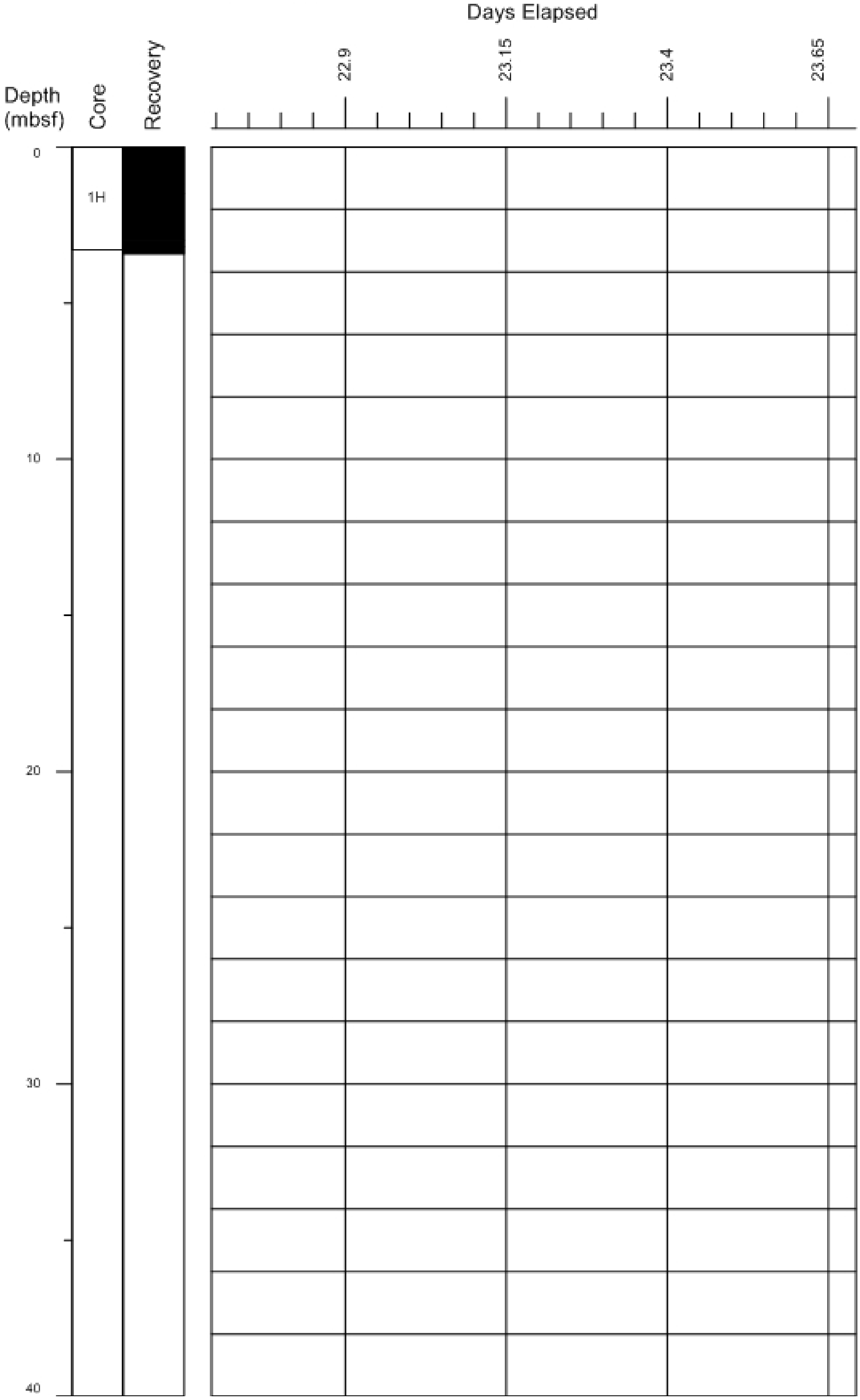
Hole 62B progress summary



IODP Expedition 347

Hole 62C progress summary

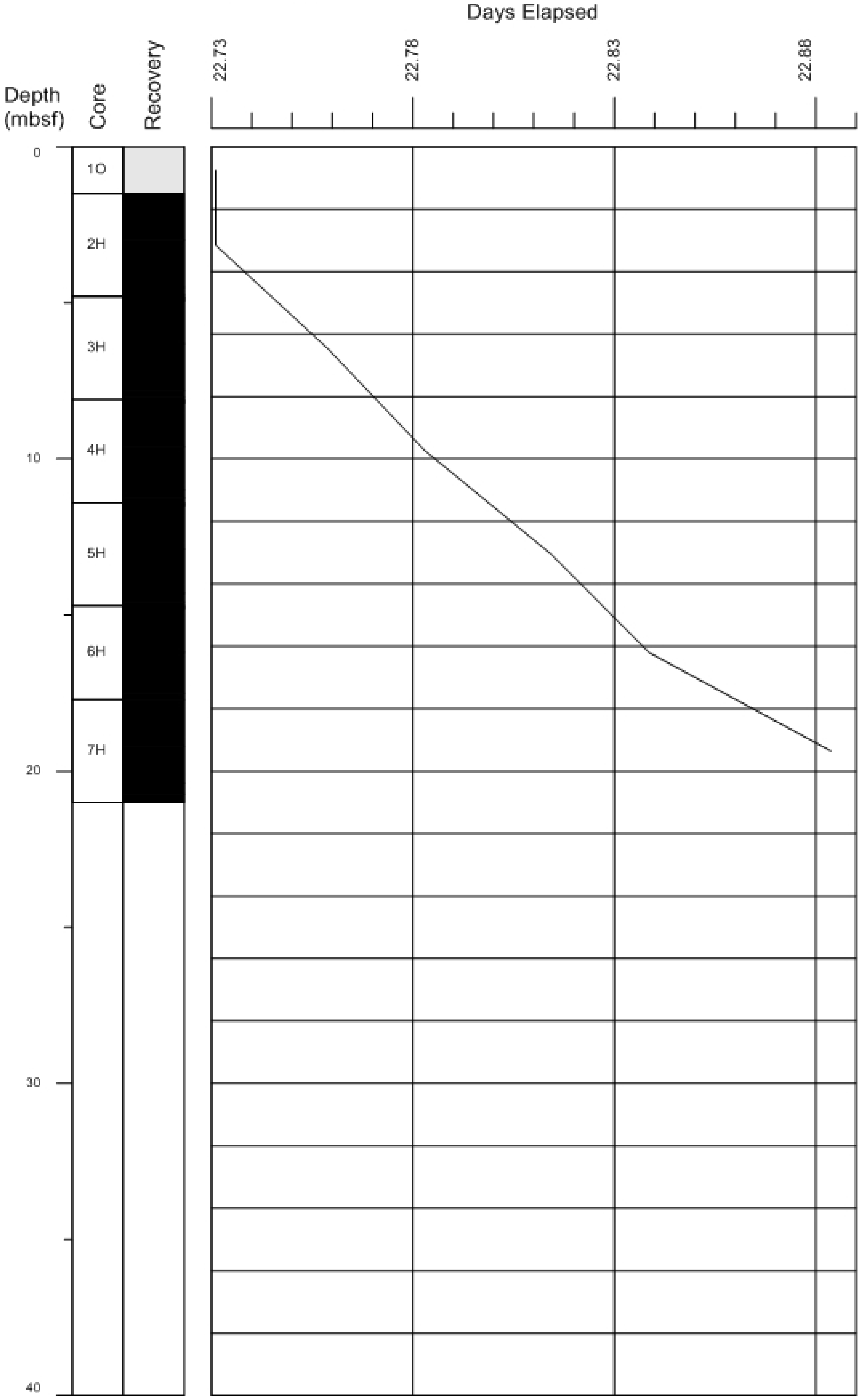
Latitude: 62° 57.343 N
Longitude: 17° 47.718 E
Water depth: 69.31 m



IODP Expedition 347

Latitude: 62° 57.357 N
Longitude: 17° 47.358 E
Water depth: 69.31 m

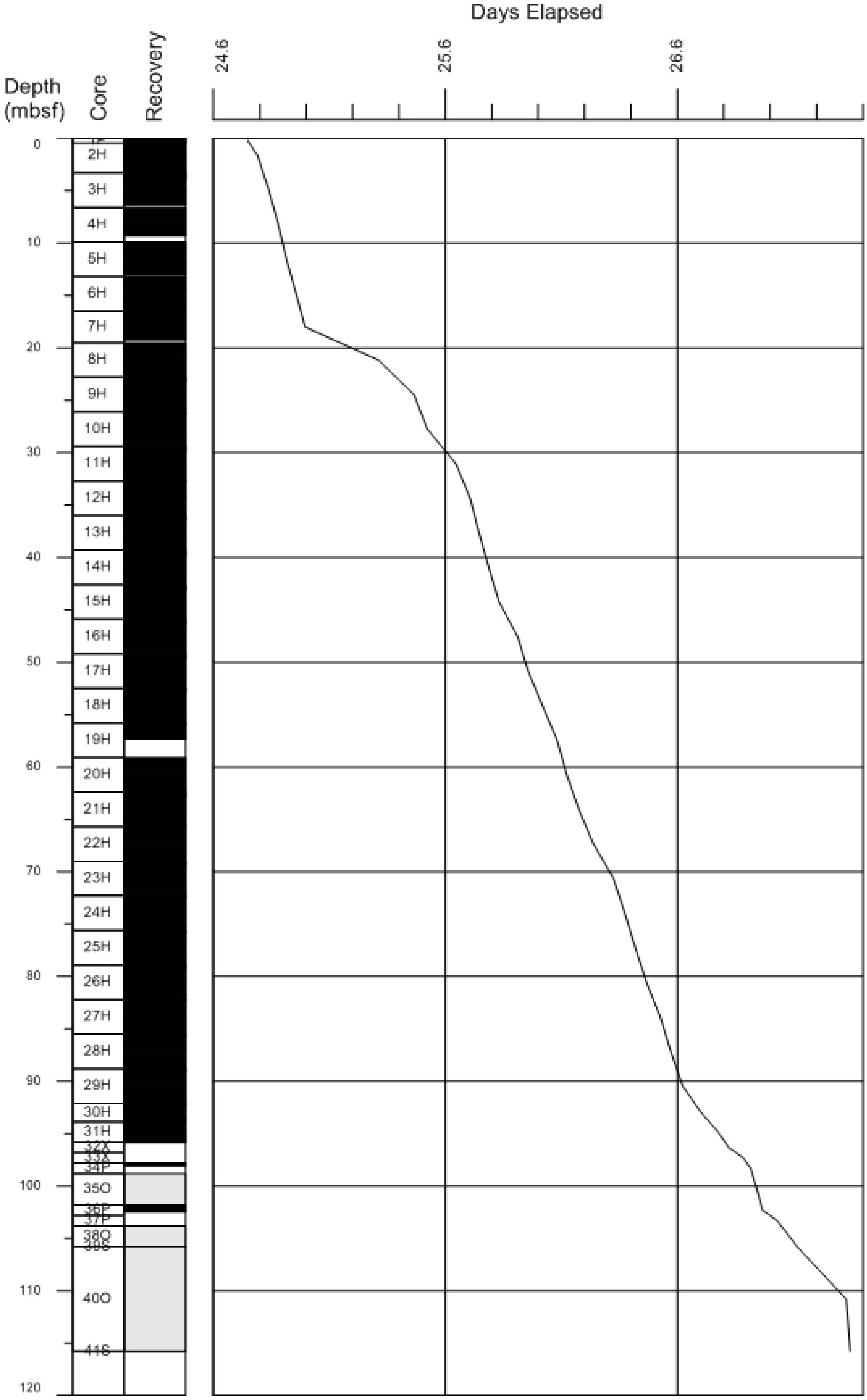
Hole 62D progress summary

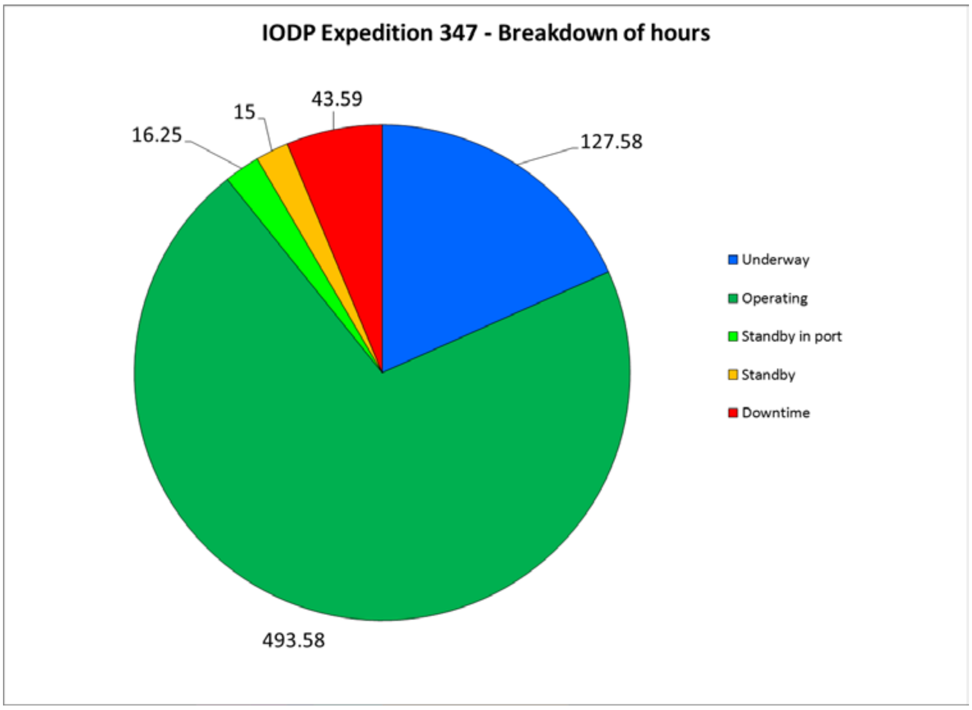


IODP Expedition 347

Latitude: 58° 37.340 N
Longitude: 18° 15.250 E
Water depth: 437.0 m

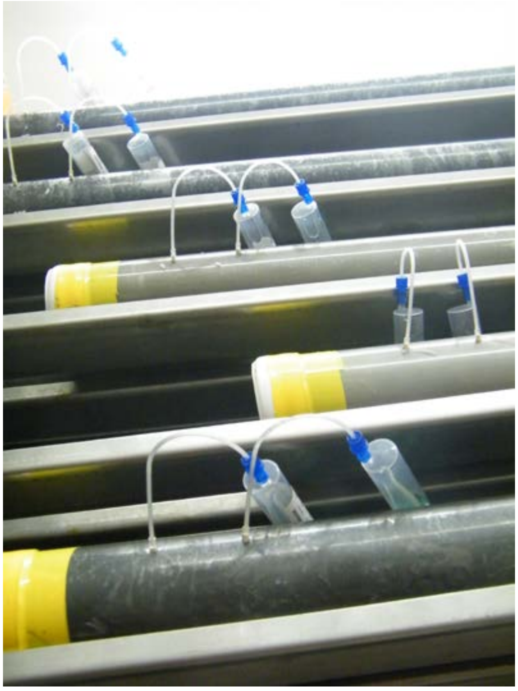
Hole 63A progress summary





New addition to the ‘Drilling Garden’ Carol Cotterill©ECORD_IODP

Ångermanälven River Estuary Carol Cotterill©ECORD_IODP


Pore water extraction Dalton Hardisty©ECORD_IODP


Core on deck! Aarno Kotilainen©ECORD_IODP