Week 7 Drilling and Scientific Report for IODP Expedition 347 Baltic Sea Paleoenvironment

25th October 2013 – 31st October 2013

1. Hole summary

Hole	M0065B	M0065C	M0066A	M0066B	M0067A	M0067B	M0059D	M0059E
Latitude	55°28.104' N	55°28.084' N	55°27.769' N	55°27.773' N	55°8.141' N	55°8.151' N	55°0.305' N	55°0.285' N
Longitude	15°28.638' E	15°28.624' E	15°29.556' E	15°29.539' E	9°48.030' E	9°48.029' E	10°6.483' E	10°6.499' E
First core	October 24th 23:10	October 25th 11:20	October 26th 08:45	October 26th 20:10	October 28th 09:45	October 28th 22:10	October 29th 04:55	October 30th 01:00
Last core	October 25th 10:10	October 26th 00:10	October 26th 18:45	October 27th 03:10	October 28th 12:20	October 28th 00:20	October 29th 23:15	October 31st 12:45
Cores recovered	15	14	18	13	7	5	28	37
Drilled length (Coring)	41m	45.9m	26.66m	25.25m	9.3m	6.4m	86.57m	100.80m
Drilled Length (Open Hole)	2m	2m	3.12	2m	0	4.5m	0	0
Recovered length	42.72m	48.59m	21.27m	22.51m	5.24m	8.17m	92.54m	95.35m
Core recovery	102.42%	105.86%	79.78%	89.15%	56.34%	127.66%	106.90%	94.59%
Final depth	49.3m	105.86m	79.78m	89.15m	56.34m	127.66m	106.90m	94.59m
Hole recovery	86.65%	101.44%	75.96%	82.61%	56.34%	74.95%	106.90%	94.59%

2. Science

At the beginning of the week we started to drill the second paleo-hole, Hole M0065B, in the Bornholm Basin. The sequence of sediments was very similar to Hole M0065A, with black to greenish-gray Holocene gyttja-clay down to14 mbsf where it changed to light-brown glacial clay. The clay was uniform with no detectable varves. Below 40 mbsf it changed to sandy clay and at 46 mbsf we encountered hard sand. A 1-m long piston core and then a hammer core were retrieved from the sand and samples were taken for OSL dating.

The first analyses of methane and interstitial water chemistry were now available from Hole M0065A. Interestingly, while methane was highly super-saturated in the Holocene mud it dropped to near-zero in the middle of the glacial clay. The methane profile did not resemble a simple downward progressing diffusion front but rather seemed to indicate a sink for methane within the iron-rich clay. Further chemical and microbiological studies are required to determine the mechanism of methane removal.

After Hole M0065B was completed we moved 40m to a new position for the microbiology hole, Hole M0065C. The uppermost 2 metres of sediments were washed down before the actual sampling commenced. As the coring rate was guided by the possibility to process the microbiological sampling, the sampling program went very smoothly without bottlenecks or long delays in processing core.

The general stratigraphy on site BSB-7C was repeated from the two previous holes with a Holocene dark greenish grey gyttja-clay down to c. 10 mbsf followed by a 3 metres thick sequence of homogeneous dark bluish-grey clay. Below these sediments brown glacial clay was recorded, at some levels varved and at others homogeneous. The last core taken for microbiology was from 38 to 40 mbsf. Then the sediment changed from glacial sandy clay to permeable silt and fine sand and it was no longer possible to obtain uncontaminated microbiology samples. The hole ended with two piston cores for OSL dating going down to 46 mbsf.

After a transit from the Bornholm Basin, the *Greatship Manisha* arrived at Station BSB-4 in the Little Belt and prepared for coring. The first piston core collected clayey sand and sand with small stones, organic fragments, benthic foraminifera and ostracods. The next core was only 0.5 m and collected coarse sand with shell fragments. From this level, and down to 8 mbsf, six short cores collected well sorted gravel with a down-core decreasing grain size. After this coring, a sudden extreme increase in wind made further coring impossible. The drill pipe was tripped as fast as possible. Wind speeds of up to 98 knots were measured on the bridge and the *Greatship Manisha* stayed on position for the following eight hours waiting on weather.

We recommenced with piston coring of BSB-4B, Hole M0067B, and the upper few metres were clayey sand, again with some gravel, organic fragments, charcoal and benthic foraminifera. Interestingly, most of the foraminifera in this hole were agglutinated species. Below the top core, the sediment was sand and then well sorted gravel. The grain size became finer again with depth and at 11 mbsf fine sand with stones was recovered. Due to the continuation of loose gravel and sand, however, the hole was evaluated to become too unstable and drilling was stopped.

We then decided to return to BSB-3 and drill a second complete hole for paleoceanography in order to ensure a good continuous depth record. Also a second hole for microbiology was planned. Consequently the *Greatship Manisha* left Station BSB-4 and sailed the short distance to BSB-3 further south in the Little Belt. Hole M0059D was started in the early morning and cored down through black, gyttja-clay. Already from 1 mbsf gas bubbles developed in the cores on the deck and the following cores were increasingly rich in gas. Yet, the gas escaped from the cores on deck and expansion was modest.

This type of black gyttja-clay was present at this site down to 50 mbsf where it gradually converted into a homogeneous dark greenish-grey gyttja-clay. The black gyttja-clay was relatively rich in fossils such as benthic foraminifera, bivalve shells and organic matter in the upper part but showed a decreasing trend in fossils down core. From 51 mbsf, homogeneous clay with no detected fossils was recorded which turned into greyish-brown glacial clay at c. 60 mbsf recording only reworked foraminifera. The glacial clay unit, at some levels with visible varves, extended down to the bottom of this hole. A piston core going down to 86 mbsf brought back well sorted sand and thereby terminated the almost 30 m deep sequence of glacial clay.

We then moved to the last hole of this expedition, Hole M0059E, which was dedicated to microbiology and geochemistry. By ending the cruise with this microbiology hole we ensured that live samples were kept as fresh as possible for experiments once they arrived at the receiving laboratories. The coring of a second microbiology hole at Station BSB-3 provided a replication with a different focus on sampling depths in intervals of particular interest. Such intervals were the transition from greyish-brown glacial clay to black gyttja-clay at ca 50 mbsf, indicating a transition from lacustrine to marine conditions, and a conspicuous diffusion front at 60 mbsf.

We cored down through about 50 m of methane-rich Holocene gyttja-clay. The lithological change, where greyish non-varved glacial clay was met, was recorded at the anticipated depth. Coring continued through glacial clay and the entire hole was intensively sampled. From 85 mbsf the sediment changed to sand and microbiology sampling stopped. However, coring continued for studies of glacial sand and till layers with samples taken at regular intervals for OSL dating. The remaining part of this hole was thus drilled for paleoceanographic purposes.

A lithology of alternating sand layers and diamicton, in the lower part a very hard and compacted diamicton, was recorded down to 100 mbsf where a collapsing layer of sand prevented further coring of this hole. This was the last hole to be drilled and after tripping the pipe the *Greatship Manisha* steamed to port in Kiel where the offshore phase of Expedition 347 officially ends.

3. HSE and Environmental Activities

N/A

4. Figures

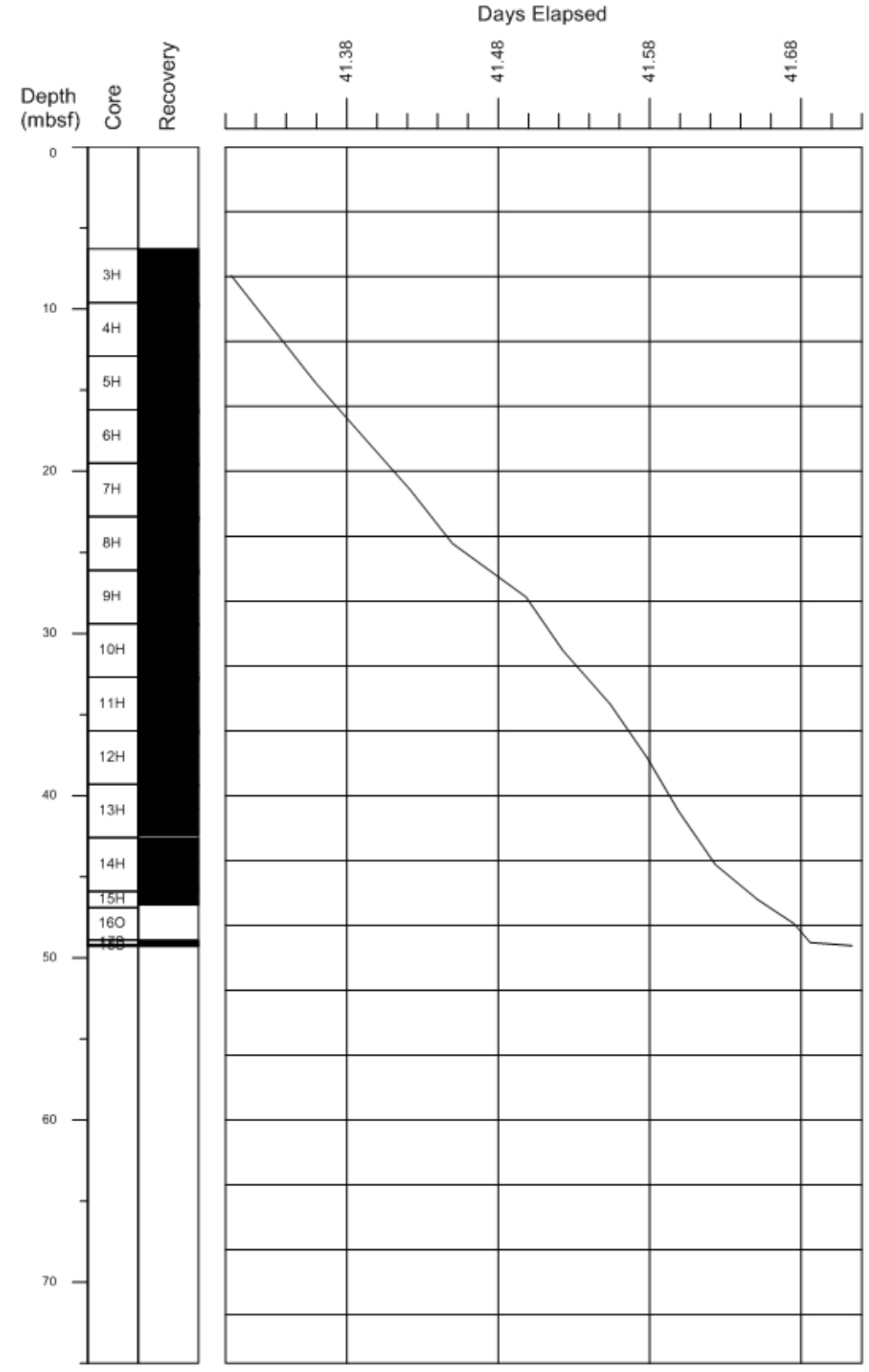
Figure 1 – Recovery and depth versus time plot at Hole M0065B

Figure 2 – Recovery and depth versus time plot at Hole M0065C

IODP Expedition 347

Hole 65B progress summary

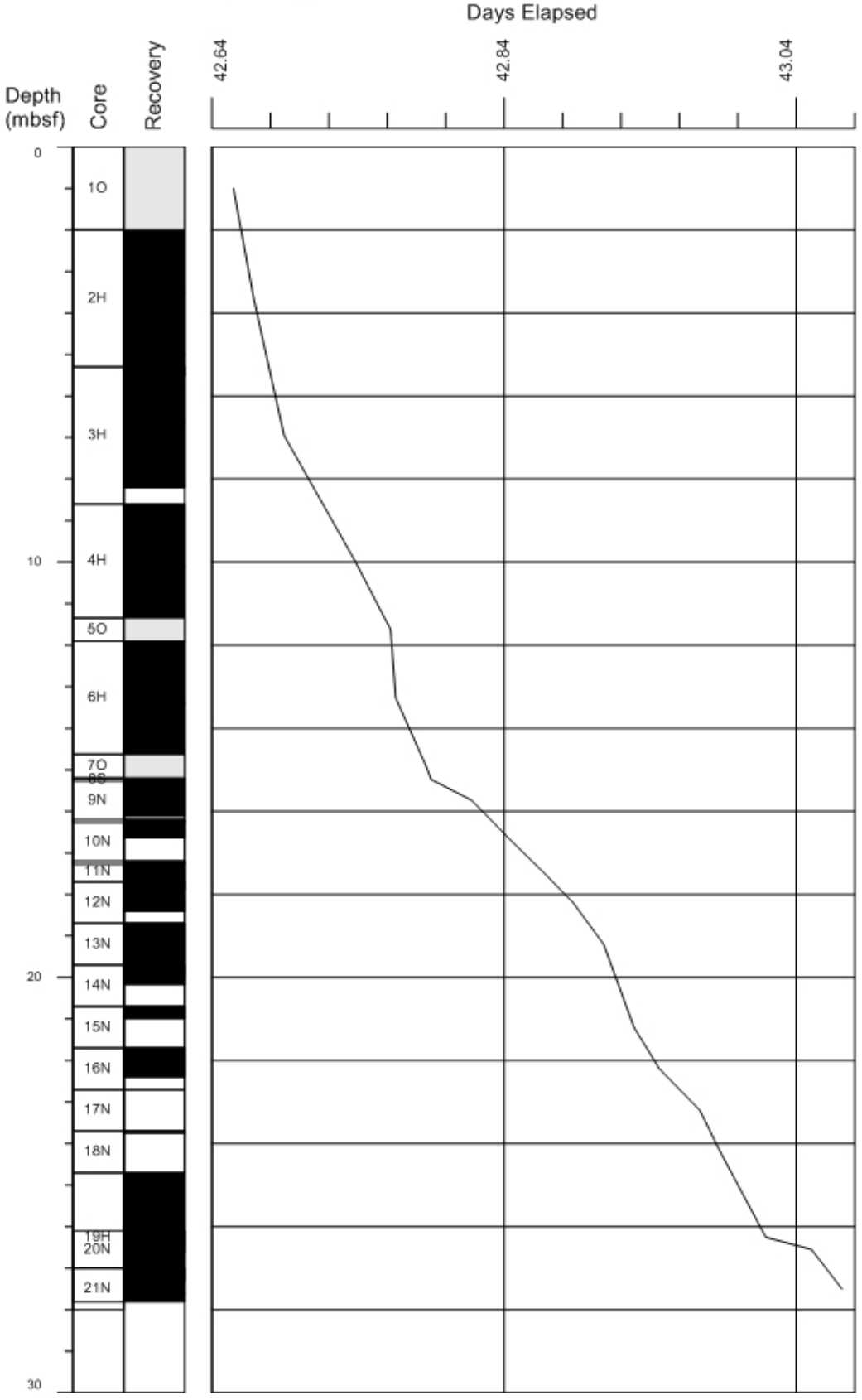
Latitude: 55° 28.104 N
Longitude: 15° 28.638 E
Water depth: 84.3 m



IODP Expedition 347

Hole 66A progress summary

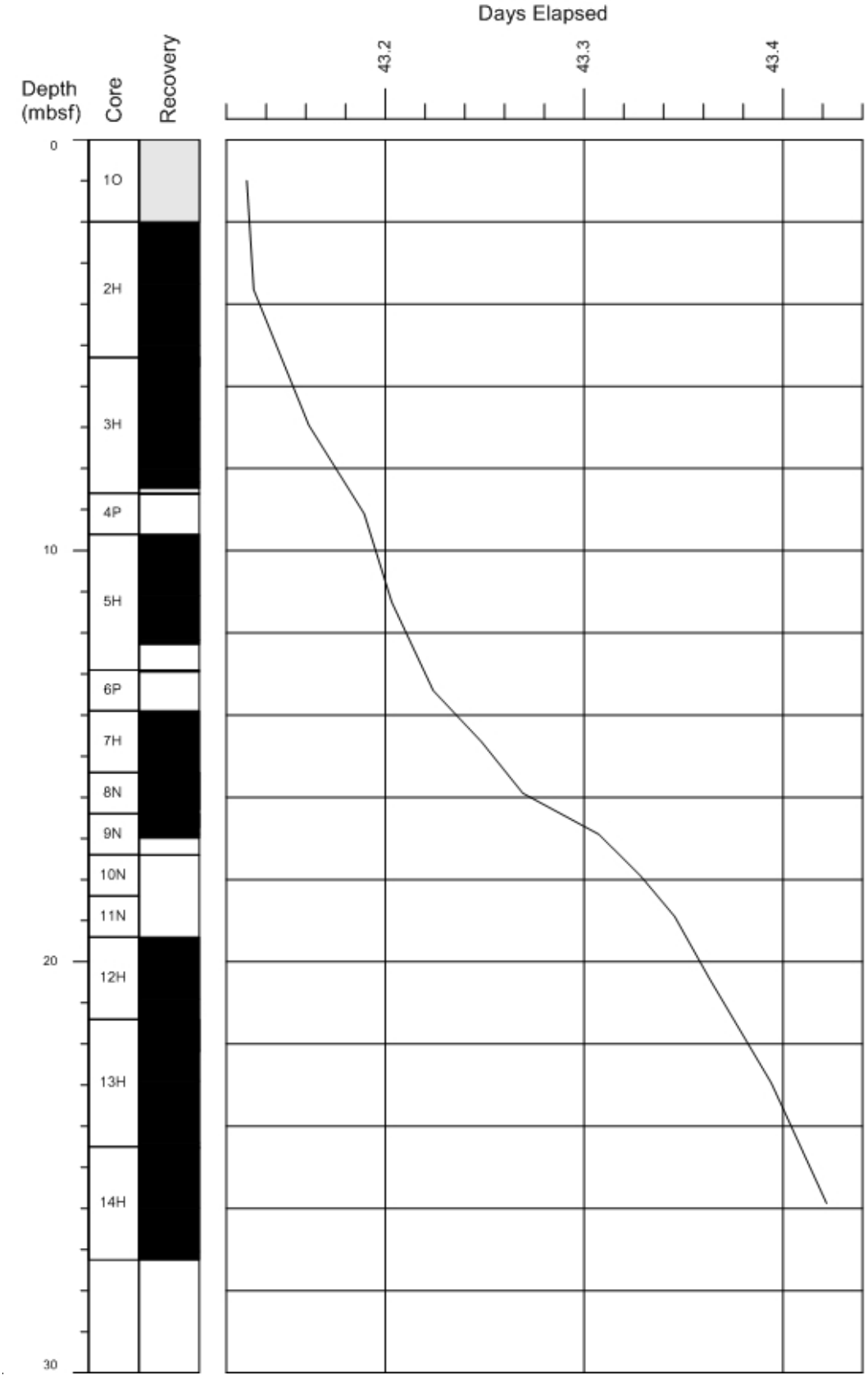
Latitude: 55° 27.769 N
Longitude: 15° 29.556 E
Water depth: 84.3 m



IODP Expedition 347

Hole 66B progress summary

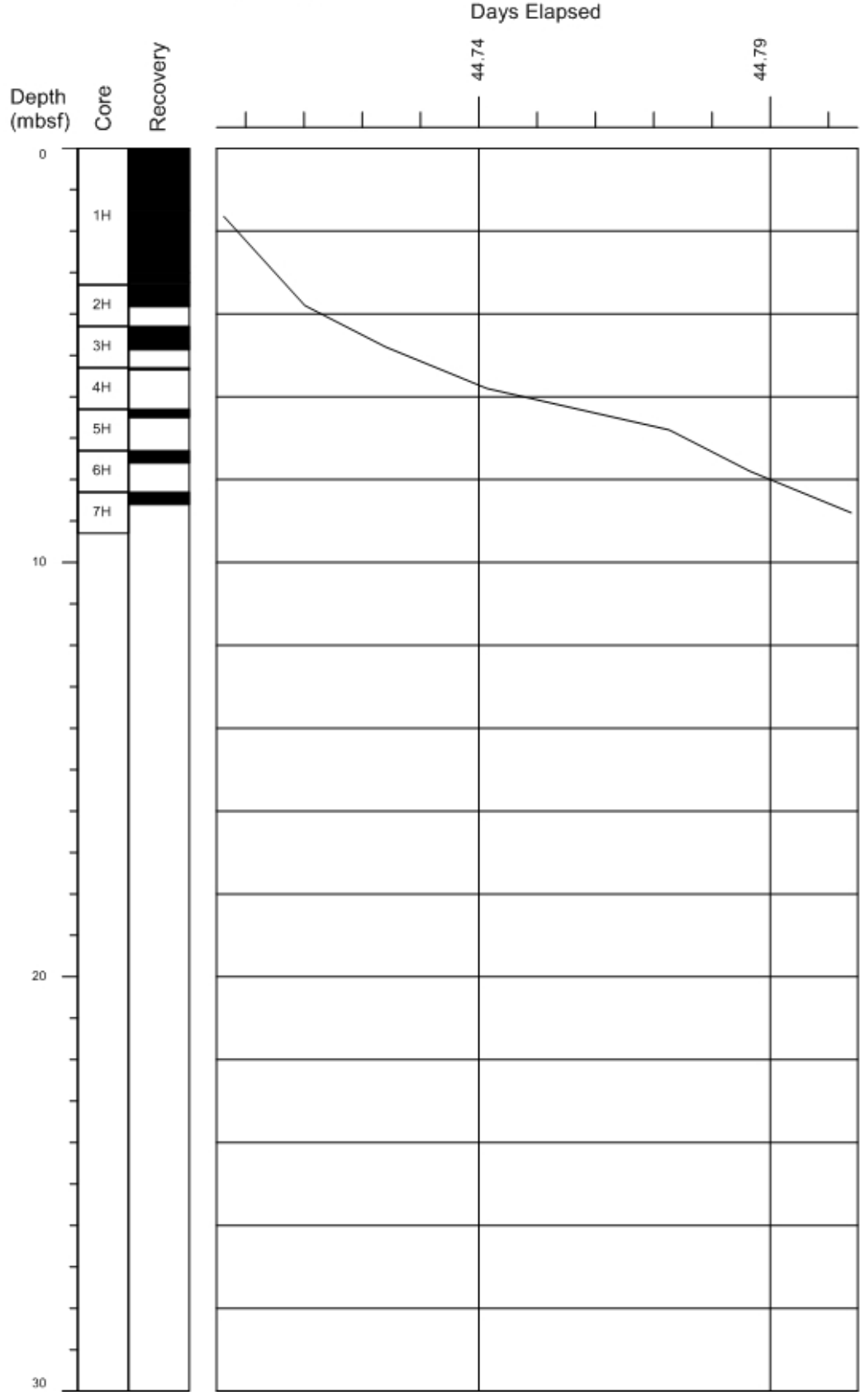
Latitude: 55° 27.773 N
Longitude: 15° 29.539 E
Water depth: 84.3 m



IODP Expedition 347

Hole 67A progress summary

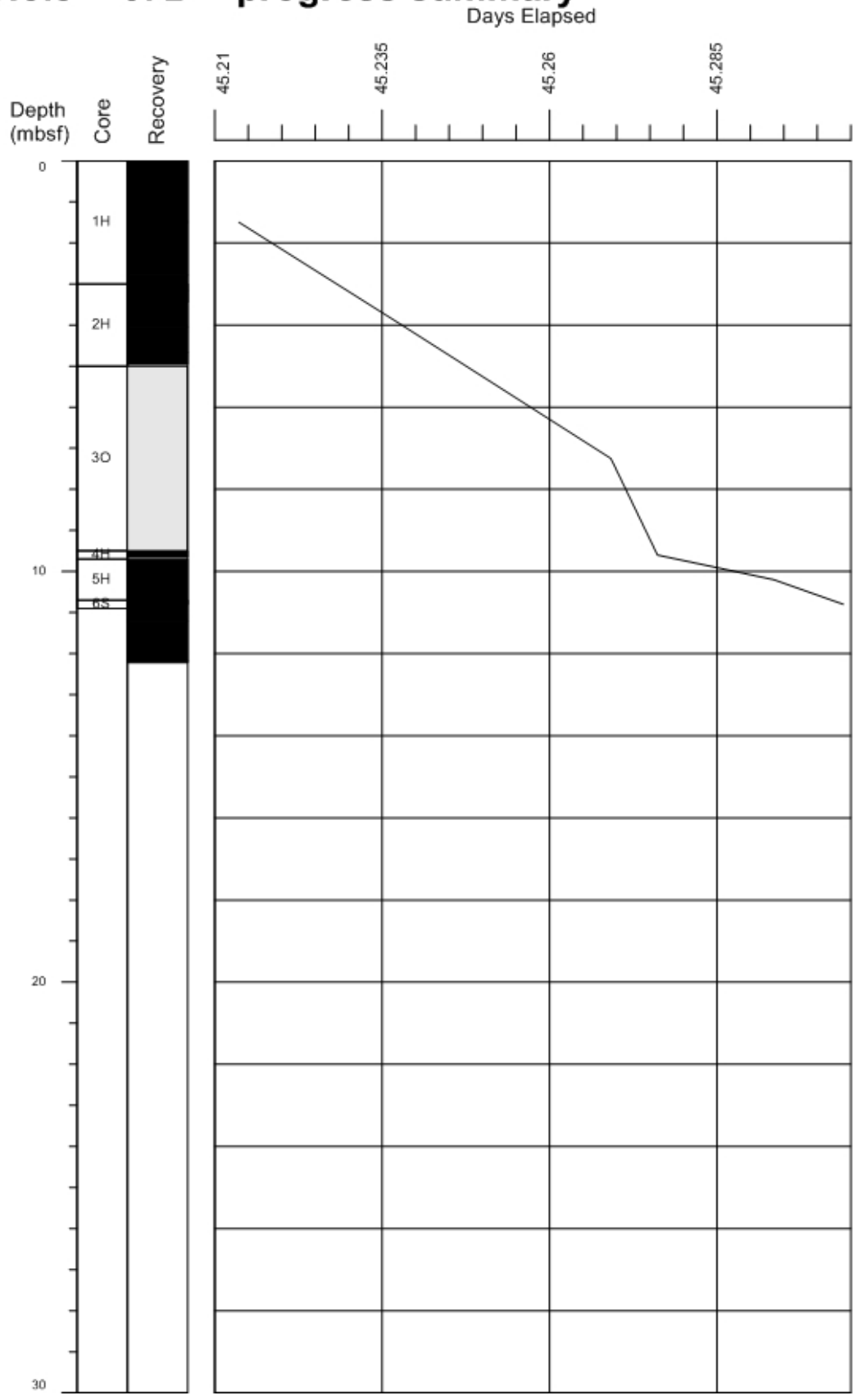
Latitude: 55° 8.141 N
Longitude: 9° 48.030 E
Water depth: 23.1 m



IODP Expedition 347

Hole 67B progress summary

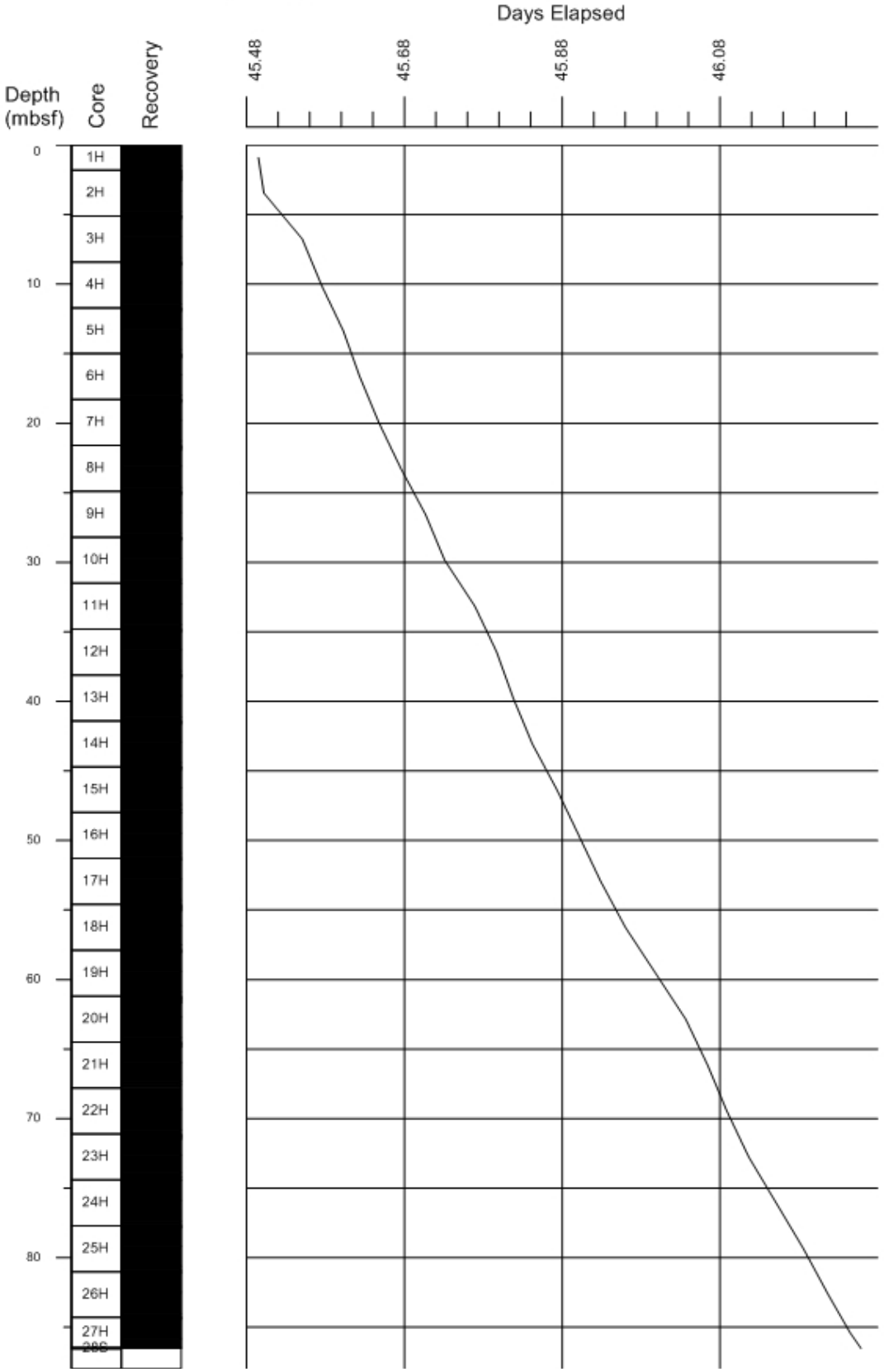
Latitude: 55° 8.151 N
Longitude: 9° 48.029 E
Water depth: 23.1 m



IODP Expedition 347

Hole 59D progress summary

Latitude: 55° 0.305 N
Longitude: 10° 6.483 W
Water depth: 37.1 m



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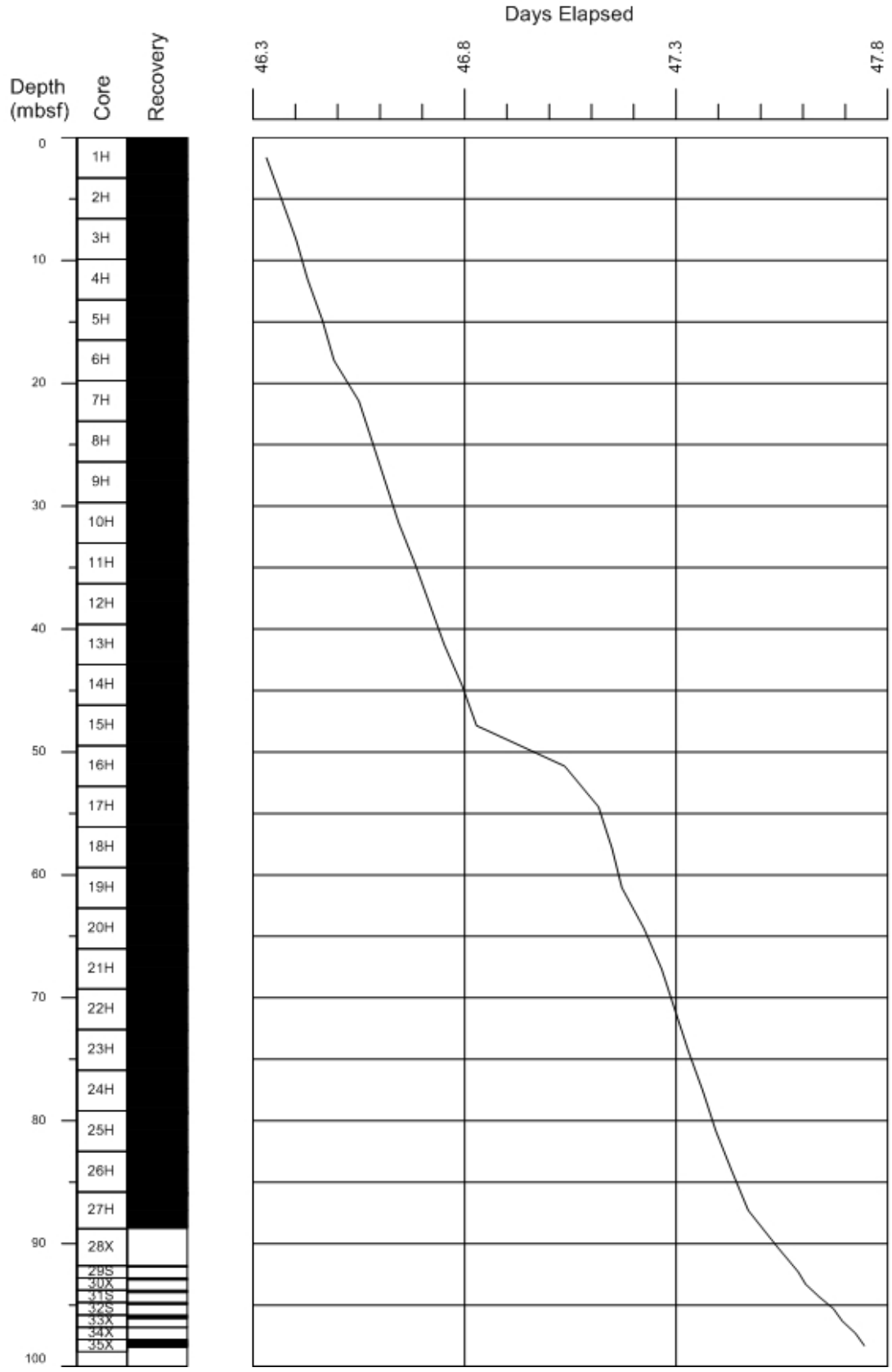
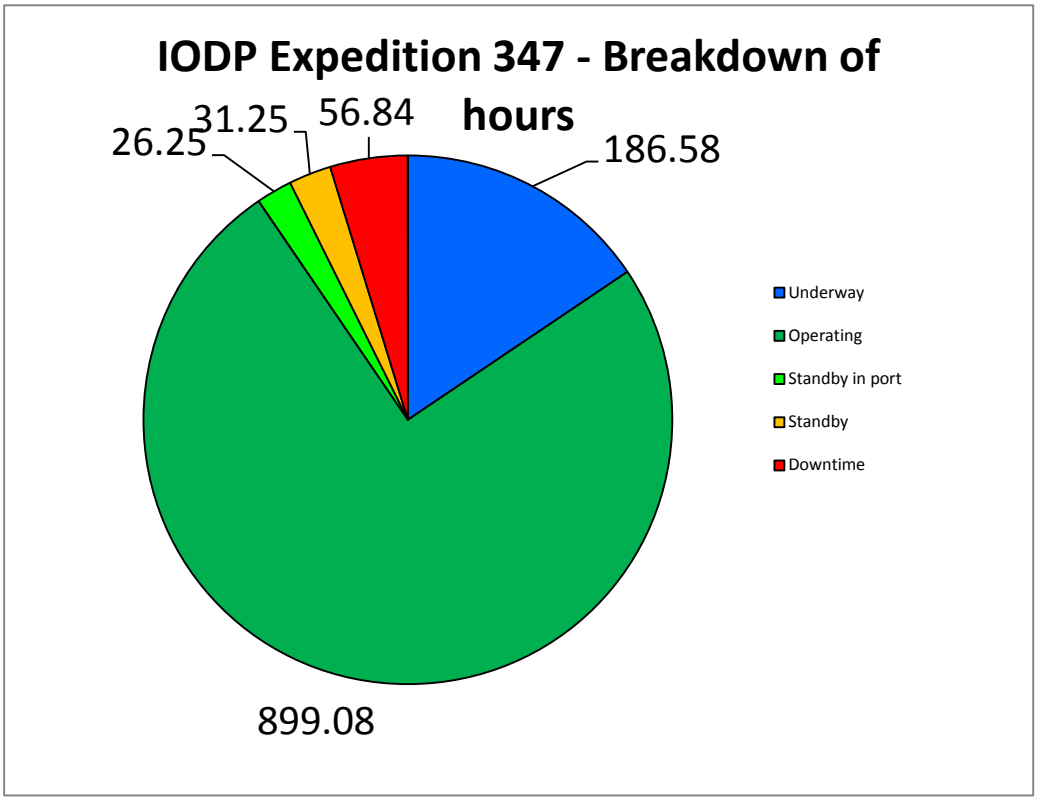
Hole 59E progress summary

Latitude: 55° 0.285 N
Longitude: 10° 6.499 W
Water depth: 37.1 m





Photos of the week

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