Scientific Report for IODP Expedition 386

Japan Trench Paleoseismology

Weekly Report

7th to 15th of March 2022

1. Location

D/V Chikyu, Shimizu Port, Japan

Onshore Science Party (OSP)

2. Activity Summary

The final week of the Hybrid OSP saw the core scanning, description and sampling work completed ahead of schedule onboard the Chikyu, and the remote Science Party continuing to make good progress analysing and interpreting the data generated by the Japanese team. At the same time the reporting gathered pace, with an efficient and productive report writing system now firmly in place, overseen by the Co Chiefs, EPMs and TAMU staff.

By the evening of the 7th of March, work on site M0093 cores A and B had been completed and the team onboard Chikyu had started scanning, describing and sampling M0087 A and B. The *Chikyu* team continued throughout the week to complete splitting, scanning, description and sampling of all cores (see table below), totalling 263 core sections and 546 samples from the cores, between the 7th and 11th of March. Analytical activities continued alongside visual core description, with line scanning, RGB, color reflectance, paleomagnetics, moisture and density, and cation analysis all taking place at the same time.

Science Party member Toshiya Kanamatsu disembarked on 9th of March. We are extremely grateful to Kanamatsu-san for his contribution to the expedition, both during the OSP and on board the *Kaimei* during the offshore phase– hontoni arigato gozaimasu!

A photo competition was held on board on the 10th and 11th of March, with prizes given, and a blog published in both Japanese and English by Tomohiro Takebayashi describing the Expedition and how it will inform STEM education efforts in Japan.

Data continues to flow from the *Chikyu* to ESO in Europe and to remote Science Party members worldwide for quality assessment and data entry, before being shared with the entire Science Party. The Science Party are also feeding back their observations and comments to the operators and the *Chikyu* team.

This week the ESO BCR/MARUM team continued processing OSP samples received from Japan (SedGC), and the ESO EPC team in Leicester continued processing P-Wave samples.

By 2400hrs JST on Monday the 14th of March, the team aboard the *Chikyu* had split, scanned, described and analysed all 831m of core from IODP holes M0081 to M0095. The remote

sedimentologists continued to compile and complement the onboard descriptions and enter final descriptions into the DIS. The other members of the remote Science Party have continued working with the new OSP datasets in parallel with the existing offshore datasets, and are busy producing written content for the Expedition Report. The final full Science Party of the OSP meeting was held on the 14th.

3. Activities for Next Week (15th of March)

The *Chikyu* team will disembark on the morning of the 15th of March. Remote participants and ESO staff will continue to update offshore VCD descriptions, analyse offshore and OSP data, and continue Expedition reporting. OSP geochemistry and physical properties measurements will continue at BCR/MARUM and EPC Leicester. Meeting schedules have been revised to allow continued communication within the Science Party following the ending of the OSP, enabling ongoing construction of the Expedition Report.

4. Current Status

Hole	Total Core Length (m)	Split Core Described (m)	No. Samples Collected
M0090C	1.075	1.075	5
M0090D	33.935	33.935	115
Rows above from Week 3, included here with number of samples collected for completeness.			
M0093A	0.775	0.775	5
M0093B	26.135	26.135	79
M0087A	1.475	1.475	1
M0087B	18.95	18.95	62
M0087C	0.835	0.835	5
M0087D	26.345	26.345	84
M0088A	1.09	1.09	5
M0088B	17.69	17.69	55
M0088C	0.96	0.96	5
M0088D	36.48	36.48	115
M0086A	1.4	1.4	5
M0086B	18.24	18.24	57
M0094A	0.805	0.805	5
M0094B	18.28	18.28	63

5. Preliminary Scientific Assessment

On Friday March 11, the last of 881 sections was split, sampled, and visually-described by the onboard Chikyu Science Party members. On this special day, all members of Expedition 386 stood together with the people of Japan, in commemoration of the devastating Tohoku Oki tsunami, 11 years ago today. It is fateful that, on this historic day, our expedition has finally completed examination of all the cores retrieved from the Japan Trench, which are already giving up their secrets- records of Tohoku Oki, and of similar tsunami over thousands of years. Our hope is that the research that comes from the study of these records will help better understand these catastrophic events, giving future generations even greater ability to prepare for them

The 832.5 m cores recovered at 15 sites located in 11 isolated Japan Trench trench-fill basins along the entire trench axis from 36°N to 40.44°N at water depth more than 7500 meter below seafloor, have now been described and are further being analyzed by the entire Science Party, spread all over the world. We learn from preliminary initial results, that the 20-40m long recovered sections recovered by Giant Piston Coring contain several very promising event-stratigraphic successions, with several and different types of events recorded, reaching back into the late Pleistocene (depending on site location and as of preliminary age constraints from bio- magneto and tephra stratigraphy). We now know that this is going to be a fantastic dataset and we are confident that post-expedition research will be able to achieve the primary Paleoseismology objectives for these 10-20,000 years timescales.

In detail, the hydroacoustic team reports in their preliminary assessment of the data that the northern Japan Trench basins have a different bathymetric character to the central and southern Japan Trench basins. They are not as tightly confined as their central and southern neighbours. Therefore, whereas basins in the south and central areas have sharp topographic ridges bounding both the eastern and western sides, the northern basins have more diffuse boundaries. For example, Basin 9, where Site M0088 is located around 40.1N along the trench axis, has a series of discontinuous ridges and a step-like basin margin (to the west), rather than a sharp topographic discontinuity. The northern basins also have a different acoustic character, with multiple, thick (>10m) packages of acoustically transparent materials forming marker horizons identifiable between basins, rather than the much thinner, isolated acoustically transparent layers in the central and southern areas. An interesting feature from the north is the possibility of small thrust faults seen in the newly-acquired high-resolution sub-bottom profiling data from our Expedition 386.

The lithostratigraphy team this week reports a spectacular event deposit that was identified in Holes M0091B and D. The deposit is 6 m thick bounded at the base by a sharp contact. From the base upwards it contains ~50 cm of slightly deformed, interbedded clay and very fine sand layers overlain by very fine sand mixed with coarse sand. A notable 5 m structureless clay occurs above the coarse basal deposit, covered by clay with some silt and very fine sand laminae. Sparse bioturbation occurs above the clay. The top of the deposit is marked by a sharp boundary, above which the sediment is heavily bioturbated. The lack of bioturbation within the deposit suggests that it was deposited rapidly. In contrast, the heavy bioturbation above indicates that there was sufficient time for organisms to repopulate the sediment. The internal structure of this particular event and associated processes will need to be studied carefully because similar thick clay intervals have been noted at sites M0081, -82, and -83.

Micropaleontologic analyses for foraminifers in the “remote” lab at the University of Central Missouri continued with examination of samples from sites M0093 and M0084. Both sites have samples which contain allochthonous calcareous benthic forams probably displaced from upper bathyal paleoenvironments with taxa associated with the oxygen minimum zone. A few samples have only agglutinated foraminifers, which likely represent in situ faunas.

The geochemical signals observed in interstitial water (IW) from the various sites all indicate non-steady conditions likely related to variations in sediment deposition. The limited amount, or lack, of sulfide at all sites points to an iron-dominated system, which is furthermore characterized by high

amounts of silica in the interstitial waters potentially tied to the dominance of siliceous-microfossils in these sediments.

The physical properties group continued to examine moisture and density (MAD), penetrometer and multi-sensor core logging (MSCL) data and compile site chapter drafts. Data quality have all been very good and often share common patterns and trends. For example, zones with high natural gamma ray tend to also have low porosity, reflecting a relatively high-porosity clay-rich interval. These patterns provide a degree of confidence in the core quality and the fidelity of the physical property measurements. The physical properties team also spent time together with the lithology team examining the relationship between magnetic susceptibility and lithology. In particular, time was spent binning magnetic susceptibility into high, medium, and low values and then comparing them with lithology. While still preliminary, these exercises are showing potential very informative relationships that reflect lithology (event beds, tephra, background sediment) and diagenesis overprinting (e.g., presence or absence of monosulfide minerals). The group also compiled all penetrometer data of undrained shear strength to investigate potential seismic strengthening (or lack thereof) signatures and to explore the potential relationship of shear strength as a proxy for event beds and non-event beds.

Paleomagnetic data of sites M0091, M0092and M0095 between the southern and central Japan Trench focus area were studied this week. Some long intervals which reveal dispersed distribution in the paleomagnetic direction are recognized. These intervals seem to be related to distribution of thick turbidite intervals. General variation in inclination and declination profiles are very similar among those sites, suggesting to reflect the paleomagnetic secular variation which is useful for chronological control.

6. Figures

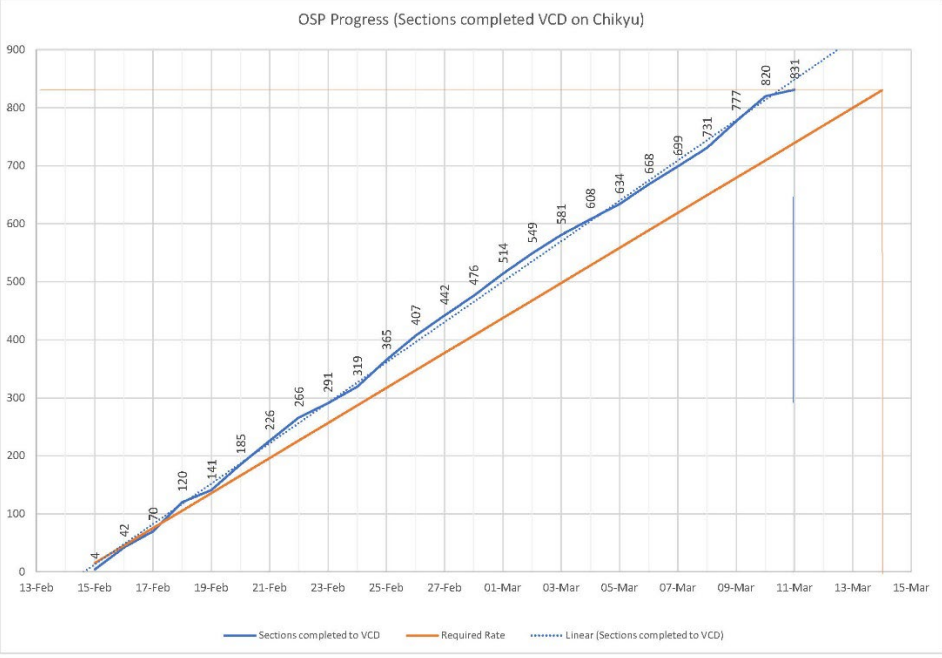
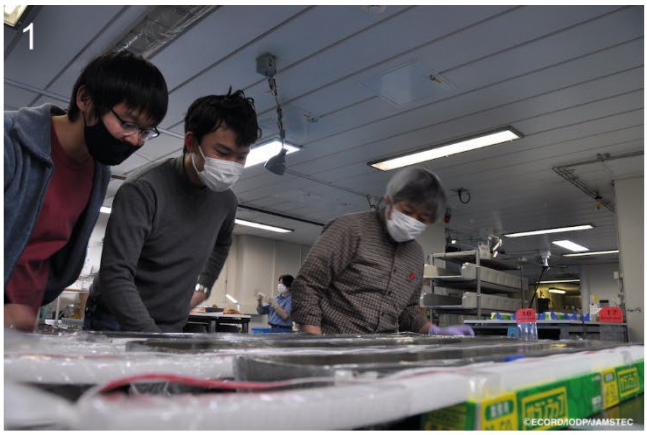
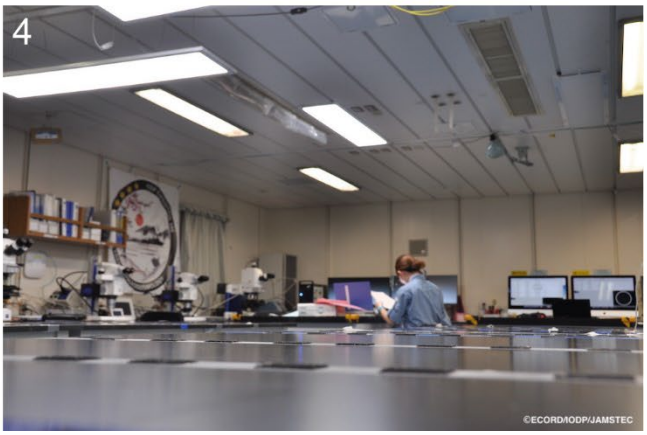


Figure 1: Number of core sections split, scanned and described aboard the *Chikyu*.

7. Photographs





1: Onboard Visual Core Description team discussing a finding in a core section, 2: Kanamatsu-san departs the Chikyu, 3: The last core is finished! 4: Empty core description and sampling tables in the Chikyu lab.