IODP Expedition 310:
Tahiti Sea-level
Week 1 Report (6th-12th Oct, 2005)

October 13, 2005

Operations

Operations prior to departure from Port of Papeete: At 0900 hrs on 6th October, the Expedition 310 Scientists joined the DP Hunter in the Port of Papeete. Mobilization of the vessel had begun at the end of August in Tampa, Florida, and the final stages were completed in Papeete. Winches for logging and some equipment for the microbiology lab were loaded on deck. Local students and press visited the ship at 1030 hrs for 1 hour. In the afternoon, a project specific safety briefing was held by the Operations Superintendent and Seacore Offshore Manager. Following this, a science meeting was held to discuss the core work-flow in detail. By 1830 hrs, the mobilization was complete and the vessel commenced day rate operations. DP Hunter departed for the first site at 1930 hrs.

Transit to Site M0005 and operations on arrival: The vessel arrived at Site M0005 at 2330 hrs on the 6th October, and immediately conducted dynamic positioning calibration tests approximately 250 m south of the first site, M0005A. By 0250 on the 7th October, the vessel was positioned above Site M0005A.

Hole M0005A (TAH-03, #4): After overcoming problems with a hydraulic ram which caused the moonpool doors to fail to open, Seacore's Drilling and Re-entry Template (DART) was deployed on API drill string (used as conductor pipe for this expedition) to just above the sea bed. From 1335 hrs, a sea bed survey around the position of the first site was conducted using the down pipe underwater camera. A suitable site was located ~2 m from the planned position, and the DART was placed on the sea bed with 8 tonnes of weight. After removing the camera, the HQ (piggy back) drill string was run through the API conductor to the sea bed, and coring operation at Hole M0005A commenced. The first core arrived on deck at 2000 hrs. Thereafter coring continued with difficult barrel latching and short core runs were used to avoid drilling rather than coring until the best coring parameters were established. The first cores displayed large cavities, and recovery was poor. Core barrel jams and problems with blocked bit related mis-latching led to slow progress at this hole. When re-entering the hole after one particular drill string trip to remove a core blockage from the bit, coring appeared to re-commence at 10.4 m. Good core was obtained, and it appeared that the borehole may have been re-started in a deviation or has avoided a previous deviation. This was taken as the start of a new hole, M0005B, at 1840 on the 8th October.

Hole M0005B (TAH-03, #4A): At 0140 on 9th October, and at 20 m depth, the core barrel failed to latch in. A replacement barrel also failed to latch. The hole was verified clear by the chisel tool. It was suspected that the HQ pipe was bent, and the string was tripped. On deck, the third and second pipe stands (4 joints) of the HQ drill string were bent. The

decision was made by all to terminate Hole M0005B, not to log and make modifications to the DART before continuing with a new hole. The down pipe camera was prepared and an environmental impact inspection of the coring area was carried out by raising the DART from the sea bed and lowering the camera through the DART. There was difficulty in identifying the drilling area due to minimal impact of the DART on the sea bed. The camera was recovered and the inspection was completed by 0615 hrs on the 9th October.

Modification of the DART: Starting at 0615 on the 9th October, the API string was tripped and the DART was brought on deck, and secured above moonpool. The vessel departed Holes M0005A/B, and headed for a nearby sheltered bay to carry out work on the DART. The DART feet were removed and a stinger was installed. The vessel departed the sheltered bay and was back at Site M0005 by 1330 hrs.

Hole M0005C (TAH-03, #4B): DP Hunter took position above Hole M0005C, approximately 10 m ESE along slope from Holes M0005A & B, and was ready for operations by 1510 hrs, 9th October. When lowering the DART on the API string, a burst hydraulic union on the rig hydraulics caused an operational shutdown until the oil spill on the deck was contained and repairs made. AT 1835 hours, the down pipe underwater camera was deployed for a pre-drilling site check, and the stinger was engaged with the sea bed under camera observation. The DART was drilled 1.3 m into sea bed and stabilized ready for the coring string. The HQ coring string was run at 2000 hrs and coring operations commenced at Hole M0005C. At 0545, on the 10th October, sand in the drill string caused the core barrel to jam and the string had to be tripped to free it. At 1110 hrs, the vessel requested a heading change, which was carried out with the HQ string off bottom but still in the hole. After the heading change, the core barrel was unable to be run into the HQ string and it was observed that the API pipe was not central in moonpool. The HQ string was tripped, and 9 stands were removed with bends. A problem with the dynamic positioning was analyzed and resolved before resetting the DP to average the previous drilling position. At that position, the down pipe camera was run at 1515 hrs to see if the HQ hole was still in the stinger. No HQ hole was apparent but the decision was made to trip the HQ string with an insert bit and drill down to the previous depth. Re-entry into the earlier borehole was not confirmed, even though the template had not moved, so a new hole was started, Hole M0005D.

Hole M0005D (TAH-03, #4C): Coring commenced at Hole M0005D at 2330 hrs, 10th October. Coring was steady and recovery moderate to good throughout the day on 11th October. At 0510 hrs, 12th October, the decision was made to stop coring at Hole M0005D, after reaching 102 mbsf and without reaching the basaltic substrate. The HQ string was pulled and the logging tools were prepared.

Logging of Hole M0005D (TAH-03, #4C): At 0820 hrs, 12th October, the gamma logging tool was lowered, but got stuck just below the sea bed. It was suspected that the top of the hole was unstable, within a zone of low recovery noted while drilling. The top 5 m of the hole was cased with the HQ pipe. The gamma logging tool was lowered, but was still unable to enter the hole from the pipe. The HQ pipe was run all the way to the

base of the hole, a gamma log was run inside the HQ pipe and then, after ensuring that the pipe was free from obstruction the HQ pipe was pulled back in 25m increments and the logging was conducted in the open hole below.

Science

The composite sequence based on the visual observation of cores from Holes M0005A through M0005D displays two successive sequences :

A) The upper sequence is comprised of 33 m of coralgal frameworks heavily encrusted by microbialites (laminated and columnar microbial fabrics), locally interlayered with coarse skeletal sands and gravels rich in coral and algal fragments. Microbialites are very abundant and may represent locally the major part of the reef rock. Corals are well preserved and form distinctive associations dominated by: a) tabular *Acropora* at the base of the sequence, b) robust branching *Pocillopora* associated with tabular *Acropora* in its middle part and c) by encrusting forms in the upper part of the sequence (agaricids, *Porites* and *Millepora*). This succession suggests a change in time from high-energy environments to deeper water and quieter conditions.

Occurrences: Holes M0005A through C, and Hole M0005D, Cores 1R through 6R.

B) The lower sequence, recovered in Hole M0005D, is composed of six distinctive lithological units, from top to base:

1) Limestone rich in coralline algal crusts with minor volcaniclasts; corals are scarce and mostly fragmented and reworked. These limestones are well lithified at the top of the unit and weakly to moderately lithified below. Abundant centimetre-sized cavities as well as the recrystallization of coral skeletons indicate that these limestones were subject to subaerial diagenetic processes.

Occurrence: Hole M0005D, Cores 7R through 16R-1.

2) Massive volcaniclastic sandstone with bioclasts in the upper part of the unit and bioclastic packstone and grainstone in the lower part.

Occurrence: Hole M0005D, Cores 16R-CC through 20R-CC.

3) Coralgal frameworks heavily encrusted by microbialites and bioclastic packstone and grainstone. Large colonies of massive *Porites* were recovered in that unit; other corals include robust branching *Pocillopora*.

Occurrence: Hole M0005D, Cores 20R-CC through 24R.

4) Sandy bioclastic limestones with coral clasts (mostly branching fragments).

Occurrence: Hole M0005D, Cores 25R through 28R.

5) Coralgal frameworks with bioclastic grainstone to packstone. The abundance and grain size of the volcaniclastic intervals increase downwards. Coral fauna is dominated by massive forms (*Porites* and *Montastrea*) with tabular *Acropora* and robust branching *Pocillopora* in cores 30R through 32R and by robust branching *Pocillopora* and massive *Montastrea* in cores 33R and 34R. Corals are diagenetically altered indicating a secondary subaerial exposure.

Occurrence: Hole M0005D, Cores 30R through 34R

6) Floatstone and rudstone including abundant coral and coralline algal fragments. Lithoclasts with brown coatings were observed in Core 36R and may originate from older or coeval coralgal limestones. Strong diagenetic imprints are characterized by the alteration of coral skeletons and by the occurrence of large solution cavities. The base of the unit includes poorly lithified carbonates rich in volcanic grains. Corals are characterized by abundant robust branching Pocillopora fragments.

Occurrence: Hole M0005D, Cores 35R and 36R.

Downhole logging data acquired on the lower sequence from Hole M0005D are of very good quality and provide important data that will be of great use to reconstruct the integrality of depositional sequences recovered in that hole. Logging data are very consistent with the lithological data obtained in intervals characterized by a good recovery.

Technical Activities

Detailed in 'Operations'.

HSE Activities

On 6th October, a project specific safety briefing was conducted by Operations Superintendent and Seacore Offshore Manager.

On 7th October, a broken hydraulic pipe on one of the moonpool door rams resulted in a significant leak of hydraulic oil into the moonpool. Operations were halted to fix the leak and clear up the oil, which was safely contained in the moonpool. The oil was soaked into oil absorbent mats placed on the surface of the water in the moonpool and these in turn were skimmed into containers and removed to waste oil storage on board, before the moonpool doors were successfully opened.

A boat drill was conducted for all ship personnel at 1300hrs, 7th October. The fire alarm signal was also sounded after this drill and all emergency signals were explained by the ship's staff.

On 10th October, a hydraulic oil leak at the rig onto the starboard side of deck from a burst hydraulic union occurred. Oil Spill procedures, which were reviewed and revised

after the incident with the moonpool, were immediately in place and all was quickly, efficiently and successfully contained.