IODP Expedition 310
Tahiti Sea-level
Week 5 Report (3rd Nov – 9th Nov, 2005)

November 10, 2005

Operations

Logging of Hole M0017A (TAH-03A-1D): Logging commenced at Hole M0017A at 2130 hrs, 2nd November, and was completed by 0350 hrs, 3rd November. Resistivity, acoustic imaging, optical imaging, hydrochemical, caliper and sonic tools were run. The starting depth of the tools varied due to tools catching in cavities (between 31.55 and 23.23 mbsf) and the depth of the casing pipe was13.35 mbsf). The corebarrel fishing cable was used on one occasion to pull the sonic tool, which was stuck just below the casing, up to the surface. This process damaged a portion of the logging winch cable, which was cut at approximately 85 m. Reheading of the winch cable was completed well before the next logging operation.

Hole M0018A (TAH-03A-1E): A short echosounder survey (30 x 20 m grid) was conducted approximately 120 m SSE of Prospectus site TAH-03A-1 to locate a suitable site for Hole M0018A. At 0915 hrs, 3rd Nov, the DART was lowered at the chosen site and touched the sea bed 14 m deeper than suggested by the echosounder survey. The specific site was re-surveyed using the lead-line, and a new site chosen nearby. The DART was unable to be drilled-in at this site at first (a solid carbonate crust was evident on the camera survey), but was successfully drilled in on the second attempt (after the crust was broken by the stinger?). At 1640 hrs, 3rd Nov, coring operation began at Hole M0018A, and continued until 1200 hrs, 4th Nov. TD of the hole was 40.05 mbsf, with a total recovery of 61.50 %. The nature and quality of the material collected indicated that most of the coreable material was being collected. A camera survey was conducted after withdrawing the drilling equipment from the hole. No undue disturbance was observed, although there was a significant mound where the DART was situated with a slight 'tail' of ?cuttings coming from it and going down the presumed slope.

Transit from Hole M0018A (Maraa) to Hole M0019A (Faaa): Prior to departing the Maraa area, the taut-wire was re-spooled and the DART lifted onto the deck of the DP Hunter and secured. Once on deck, the stinger below the DART was found to be missing, and a new stinger was fitted. The vessel departed the Maraa area at 1750 hrs, 4th Nov, and arrived at the Faaa area at 2030 hrs.

Hole M0019A (TAH-01A-3): On arrival at Faaa, the DP Hunter was positioned above Hole M0019A (approximately 31 m S of Prospectus site TAH-01A-3) in 58 m water depth. All clearances with airport and seaport authorities were double checked before occupying the new location which was closest to the visible reef so far. A sea bed camera survey was run, and no live corals were observed. The DART was lowered, drilled in and coring operations at Hole M0019A began at 2320 hrs, 4th Nov. Coring was completed at 2400 hrs, 5th Nov, at a TD of 66.96 mbsf and with a total recovery of 41.12

%. Penetration was rapid but recovery was poor. Checks of the Jean Lutz automatic drilling recorder data confirmed the driller's view that there were significant void spaces throughout. When penetration rate reduced to below 10m/hr, indicating more solid material, core was usually obtained.

Hole M0020A (TAH-01A-3A): Prior to coring at Hole M0020A, the DART was retrieved and a short echosounder survey was conducted 50 m N of Hole M0019A to locate a site for Hole M0020A. The chosen site was checked using the taut-wire, and the DART and drill pipe were deployed in 83 m water depth. Coring operations began at Hole M0020A at 1200 hrs, 6th Nov, and continued until 1220 hrs, 7th Nov, to a TD of 42.16 m. Total recovery was 70.45 %.

Transit from Hole M0020A (Faaa area) to M0021A (Tiarei area): The vessel departed the Faaa area at 1320 hrs, 7th Nov, and arrived in the Tiarei area at 1610 hrs.

Hole M0021A (TAH-02A-5D): An echosounder survey (5 profiles) was conducted over suspected drowned reefs near to the foreslope imaged on the bathymetry. The water depth was confirmed at two locations using the taut-wire. After a sea bed camera survey, the DART was drilled in at one of these locations, approximately 115m SE of Prospectus site TAH-02A-5 in 82 m water depth. Coring operations began at Hole M0021A at 2200 hrs, 7th Nov, and continued until 1640 hrs, 8th Nov. TD was 34.23 mbsf and total recovery was 74.87 %. Good core recovery confirmed that the submerged pinnacle is a drowned reef.

Hole M009E (TAH-02A-5E): After coring at Hole M0021A was completed, the HQ pipe was lifted and the DART raised to 45 mbsl. The vessel moved 90 m to the NW to previous Site M0009, where a site for Hole M0009E was chosen in a water depth of 93 m. The DART was lowered, drilled in and coring operations at Hole M0009E began at 2030 hrs, 8th Nov. Coring was completed at 0550 hrs, 9th Nov, at a TD of 20.61 m and with a total recovery of 72.73 %.

Logging of Hole M0009E (TAH-02A-5E): Prior to logging, the hole was flushed and the HQ pipe pulled and re-run with a casing shoe. From 0715 hrs, 9th Nov, Hole M0009E was logged between approximately 2 and 15 m below the sea bed. The chisel tool was deployed once to clear a blockage at 6 mbsf. After logging was completed at 1440 hrs, the HQ pipe was tripped and the DART raised into mid-water.

Hole M0022A (TAH-02A-4E): The DP Hunter was positioned above Hole M0022A, approximately 175 m NNW of Prospectus site TAH-02A-4 in 115 m water depth. After checking the depth with the taut-wire, the DART was drilled in and coring commenced at 1750 hrs, 9th Nov. It was hoped that the hole would penetrate a Pleistocene gulley which may been subsequently accreted by post-glacial corals. Basalt gravel and volcaniclastic sand of Pleistocene affinity were recovered from a shallow depth, and so Hole M0022A was abandoned after 8.8 m penetration at 2310 hrs, 9th Nov. By midnight, preparations were being made to trip the API pipe and DART.

Summary of holes drilled to date

Hole	Latitude	Longitude	Water depth (m)	Drilled length (m)	Recovery (m)	Recovery (%)	Depth reached (mbsf)
M0005A	17° 45.989733'S	149° 33.052517'W	59.13	16.35	5.37	32.84	16.35
M0005B	17° 45.989733'S	149° 33.052517'W	59.13	12.35	9.24	74.82	21.75
M0005C	17° 45.991467'S	149° 33.047600'W	59.63	27.91	14.81	53.06	27.91
M0005D	17° 45.991467'S	149° 33.047600'W	59.63	79.17	51.35	64.86	102.17
M0005E	17° 45.992117'S	149° 33.045433'W	61.34	2	1.6	80.00	2
M0006A	17° 46.015133'S	149° 33.051483'W	81.58	2	1.55	77.50	2
M0007A	17° 45.955317'S	149° 33.041100'W	44.45	44.4	30.74	69.23	44.4
M0007B	17° 45.946200'S	149° 33.068150'W	41.65	47.93	27.02	56.37	48.23
M0007C	17° 45.955667'S	149° 33.012783'W	43.35	30.75	11.13	36.20	32.25
M0008A	17° 29.620700'S	149° 24.431033'W	62.65	38.7	9.49	24.52	40.2
M0009A	17° 29.317367'S	149° 24.206350'W	99.71	21.54	9.29	43.13	23.04
M0009B	17° 29.315283'S	149° 24.204400'W	100.31	26.29	17.42	66.26	27.12
M0009C	17° 29.312550'S	149° 24.208633'W	99.85	24.41	12.66	51.86	25.66
M0009D	17° 29.315283'S	149° 24.201117'W	103.18	43.31	23.62	54.54	44.59
M0009E	17° 29.314300'S	149° 24.212083'W	94.94	19.4	14.10	72.73	20.5
M0010A	17° 29.397800'S	149° 24.167917'W	89.53	33.25	10.02	30.14	34.6
M0011A	17° 29.369650'S	149° 24.160617'W	101.34	16.08	7.89	49.07	17.65
M0012A	17° 29.429067'S	149° 24.110367'W	77.05	32.3	8.37	25.91	34.1
M0013A	17° 29.411933'S	149° 24.111000'W	90.55	9.55	1.1	11.52	11.7
M0014A	17° 29.369733'S	149° 24.123650'W	99.25	18.61	8.65	46.48	14.41
M0015A	17° 46.044450'S	149° 32.849850'W	72.15	41.08	29.87	72.71	42.18
M0015B	17° 46.043483'S	149° 32.846133'W	72.3	40.12	28.83	71.86	40.12
M0016A	17° 46.053433'S	149° 32.856450'W	80.85	37.91	21.58	56.92	38.31
M0016B	17° 46.053417'S	149° 32.853567'W	80.35	27.62	14.31	51.81	44.62
M0017A	17° 46.012350'S	149° 32.843317'W	56.45	40.56	22.94	56.56	40.56
M0018A	17° 46.041583'S	149° 32.895900'W	81.8	40.05	24.63	61.50	40.05
M0019A	17° 32.079917'S	149° 35.919500'W	58.75	65.81	27.06	41.12	66.96
M0020A	17° 32.041400'S	149° 35.927717'W	83.30	41.83	29.47	70.45	42.16
M0021A	17° 29.340850'S	149° 24.168933'W	82.3	33.58	25.14	74.87	34.23
M0022A	17° 29.271317'S	149° 24.269117'W	117.54	7.7	4.4	57.14	8.8

Science

Hole M0018A

This hole exhibits two carbonate sequences characterized by their lithologic features and biotic composition :

1) Microbialite-coralgal frameworks dominated by microbialites. Coral colonies are encrusted by nongeniculate coralline algae and microbialites (laminated fabrics and thrombolite accretions).

This sequence is characterized by the following successive coral assemblages:

a) Unidentified encrusting corals (including agariciids) associated with massive and submassive *Porites* and tabular/encrusting acroporiid in Cores 1R to 5R.
b) Tabular *Acropora* in Cores 6R and 7R.
c) Branching *Porites* (?) associated with robust branching *Acropora* and *Pocillopora*, massive *Porites*, tabular *Acropora* and encrusting *Montipora* in Cores 8R through 17R.
d) Massive *Porites* (up to 30 cm-thick); these colonies are interlayered with layers of rounded croal clasts (branching and massive *Porites*, branching *Pocillopora* including *Pocillopora eydouxi*, encrusting faviids).

Occurrence : Hole M0018A, Cores 1R through 22R.

2) Gray coral and skeletal limestone including tabular *Acropora* and fragments of robust branching *Pocillopora*. This limestone display a conspicuous alteration and abundant solution cavities at the top of Core 22R and grades downwards into a well lithified dense limestone.

Occurrence : Hole M0018A, Core 22R

Hole M0019A

Four carbonate sequences have been identified in that hole :

1) Loose coral-microbialite frameworks. Coral assemblage is dominated by encrusting colonies of *Montipora*, agaricids, *Psammopora* and *Echinophyllia*. In Core 8R, the coral assemblage includes also massive colonies of *Leptastrea* and fragments of robust branching colonies of *Pocillopora.* Corals are usually coated by thin red algal crusts. Microbialites consist of dark gray thrombolitic accretions.

Core 9R recovered a diversified coral assemblage dominated by massive colonies of *Porites*, *Montastrea*, *Cyphastrea* and *Leptastrea* ; encrusting colonies of *Montipora* and fragments of branching *Porites* (?) are associated at the top of the core. Red algae form thick crusts on coral colonies. Microbialites (thrombolitic accretions) usually coat encrusting colonies of *Montipora*.

Occurrence : Hole M0019A, Cores 1R through 9R

2) Alternations of beige coralgal and skeletal limestone bearing *in situ* coral colonies and beds comprised of coral rubbles and gravels.

The coral assemblage consists of massive and branching colonies of *Porites*, encrusting colonies of unidentified corals, massive colonies of faviids (Cores 17R and 19R), corymbose and tabular colonies of *Acropora* (*Acropora hyacinthus* in Core 11R) and branching colonies of *Pocillopora*. Massive colonies of *Porites*, up to 25 cm long, are dominant and occur in all cores. Coral colonies are locally encrusted by red algae; microbialite crusts are rare (Core 11R). The associated sediments consist of rich in *Halimeda* segments. In Cores 18R (bottom of Section 1) through 20R, this skeletal packstone-floatstone is well lithified and displays locally a conspicuous alteration ; pore spaces usually exhibit a red brown staining.

Cores 21R and 22R recovered *in-situ* corals embedded in a well lithified bioclastic grainstone/packstone matrix. The corals include massive and submassive *Porites*, encrusting *Montipora* and unidentified encrusting corals. Abundant coral clasts are associated and include fragments of branching *Porites* and *Pocillopora*, robust branching *Pocillopora* and submassive *Porites*. Some corals are coated with thin encrusting coralline algae. The walls of cavities and vugs display a brown staining throughout this interval.

Occurrence : Hole M0019A, Cores 10R through 22R

3) Yellowish brown grainstone (Cores 22R through 24R) that grades downward into a dark brown grainstone rich in volcaniclastic grains (Core 25R) which overlies a calcareous volcaniclastic sandstone (Core 26R) also rich in volcanic grains. Skeletal content includes abundant coral fragments (branching *Pocillopora* and *Acropora* and massive *Porites*), coralline algae, *Halimeda*, and molluscs.

Occurrence : Hole M0019A, Cores 22R through 26R

4) Sandy skeletal packstone/grainstone/ rudstone interlayered with intervals comprised of coralgal boundstone including a shallow-water coral assemblage characterized by robust branching (corymbose) *Acropora*, branching *Pocillopora*, branching *Acropora*, and submassive *Porites*.

Occurrence : Hole M0019A, Cores 27R through 34R

Hole M0020A

The reef deposits recovered from Hole M0020A are divided into six successive sequences.

1) Coralgal boundstone. The coral assemblage is dominated by encrusting forms such as *Montipora* and agariciids. *Leptoseris* and submassive Porites occur in Cores 2R and 3R, respectively.

Occurrence : M0020A, Cores 1R through 3R.

2) Loose coralgal-microbialite frameworks dominated by microbialites (laminated dense and thrombolitic fabrics). Encrusting corals, most of which cannot be identified, are dominant in this interval. Coral colonies are encrusted by nongeniculate coralline algae and microbialites. Large cavities, partly to fully filled with skeletal sand rich in *Halimeda* segments (*Halimeda* packstone), commonly occur.

Occurrence : M0020A, Cores 3R through 6R.

3) Skeletal packstone/grainstone interlayered with a coralgal boundstone. The packstone/grainstone is composed chiefly of fragments of corals, coralline algae, *Halimeda*, molluscs and echinoids. The coralgal boundstone interval includes encrusting corals and submassive colonies of faviids.

Occurrence : M0020A, Cores 7R through 9R.

4) Well indurated *Halimeda* floatstone interlayered with a coralgal boundstone including unidentified encrusting corals associated with laminated microbialites. An *in-situ* colony of branching *Porites* is embedded in a *Halimeda* floatstone matrix in Core 9R.

Occurrence : M0020A, Cores 9R through 11R.

5) Coralgal-microbialite frameworks interlayered with an interval composed of coralgal boundstone and floatstone/packstone rich in *Halimeda* segments (Cores 15 and 16R). Coral colonies are heavily encrusted by nongeniculate coralline algae and by microbialites (massive laminated fabrics overlain by thrombolitic accretions). Some coral colonies display traces of bioerosion; large bioerosion cavities are locally filled with microbialite crusts (e.g. Core 22R). Associated sediments consist of skeletal floatstone/packstone rich in *Halimeda* segments. Large solution cavities and pore spaces usually exhibit a brown staining.

This sequence is characterized by the following successive coral assembalages:

a) Encrusting corals (including *Montipora*) associated with branching and submassive *Porites* (?) in Cores 11R through 14R.
b) Massive and branching colonies of *Porites* and encrusting corals in Cores 15R and 16R.
c) Massive and branching colonies of *Porites*, robust branching *Pocillopora* and *Acropora*, massive colonies of *Favites*, and encrusting colonies of *Pavona* and *Montipora* in Cores 17R through 24R; a single massive colony of *Porites* (*P. australiensis*) of about 3.5 m long was recovered in Cores 22R and 23R.

Occurrence : M0020A, Cores 11R through 24R.

6) Well lithified skeletal packstone-floatstone bearing coral colonies (massive *Porites*; encrusting agaricids and fragments of robust branching *Pocillopora*). Large solution cavities are abundant and are locally lined by yellow cements or exhibit a brown staining.

Occurrence : M0020A, Core 24R.

Hole M0021A

Five successive carbonate sequences have been recognized :

1) White yellow coralline algal bindstone (0-24 cm from the top) mostly composed of overlapping thalli of thin encrusting nongeniculate coralline algae.

Occurrence : M0021A, Core 1R.

2) Coralgal bindstone. Corals include unidentified encrusting forms. The interskeletal pore spaces are filled with grey skeletal sand.

Occurrence : M0021A, Core 1R.

3) Microbialite-coralgal frameworks. The microbialite crusts are dominant and are comprised of laminated fabrics overlain by thrombolitic accretions. Large cavities are common to abundant throughout this interval; their walls usually display a veneer of microbial dendritic fabrics.

This sequence is characterized by the following successive coral assemblages:

a) Encrusting corals including agariciid (*Leptoseris* ?) and *Porites* or *Montipora* (?) in Core 1R.
b) Foliaceous *Pachyseris*, encrusting *Montipora*, branching and foliaceous *Porites* and robust branching *Pocillopora* in Cores 2R through 5R.
c) Branching *Porites* asscoated with encrusting corals (including *Montipora*) and branching *Pocillopora* in Cores 9R through 16R; massive *Porites* (up to 30 cm long) occur in Cores 6R, 13R and 14R.
d) Robust branching *Pocillopora* and branching *Porites* in Cores 17R through 19R.

Occurrence : M0021A, Cores 2R through 19R.

4) Silty bioclastic wackestone/packstone (Core 19R) and sandy bioclastic packstone (Cores 20R and 21R). The silty bioclastic wackestone/ packstone is overlain by the microbialite with a sharp contact at 0.72 m in Core 19R. The reef deposits in this sequence contain nongeniculate coralline algal crusts and, to a less extent, *Halimeda* segments and shell fragments. Some bioclasts display brown staining. Coral clasts (including branching *Acropora*) are scarcely found.

Occurrence : M0021A, Cores 19R through 21R.

5) The lowest sequence is composed of microbialite-coralgal frameworks. Large cavities infilled with skeletal sand rich in *Halimeda* segments are common. Coral fauna is dominated by encrusting agariciid and *Montipora* corals.

Occurrence : M0021A, Cores 21R and 22R.

Hole M0009E

Two carbonate sequences have been identified in that hole :

1) Microbialite-coralgal frameworks dominated by dark gray microbialite crusts (dense and thrombolitic microbial fabrics). Coral fauna is dominated by encrusting and foliaceous corals (including *Montipora* and agariciid) associated with submassive *Porites* in Cores 1R through 6R and includes branching and massive *Porites* (massive colonies are up to 10 and 17 cm-long in Cores 7R and 9R respectively), branching *Pocillopora*, and encrusting *Montipora* in Cores 7R through 11R.

Occurrence : M0009E, Cores 1R through 11R.

2) Well lithified grey coralgal and skeletal limestone ; volcanic gravels and sand-sized grains are abundant. Solution cavities are rimmed by yellow cement crusts.

Occurrence : M0009E, Cores 11R and 12R.

Hole M0022A

The sequence recovered in that hole is composed of :

- cobble sized pieces of basalt associated with pebble-sized clasts of microbialite-coralgal frameworks (Core 1R) ;
- sandy bioclastic packstone including coral branches and shell fragments ; basalt clasts are locally altered (Core 2R) ;
- moderately to well consolidated volcaniclastic sandstone with bioclasts ; corals are rare (Core 3R).

HSE Activities

On 4th Nov, all permissions for operations close to Faaa Airport and the Port of Papeete were confirmed prior to occupying the site.

On 7th Nov, Danny Bennets (Seacore) and Christian Wilson (ESO) were taken ashore by Pilot Boat for treatment of severe toothache which had continued for a number of days. The agent arranged emergency appointments with a local dentist and both were back on board by the same Pilot Boat before darkness. Both were able to resume duties immediately after coming back on board.

On 9th Nov, a salt taste in ship's water had been detected was monitored by the microbiologist and geochemist. The salt taste appeared to be linked to supply of ?fresh water delivered by barge from shore, which possibly used a salt water ballast tank to ferry supplies without cleaning it out properly. As all drinking water on vessel is bottled water and tea/coffee can also be made from this there was no ongoing problem.