Integrated Ocean Drilling Program
Expedition 325 Scientific Prospectus

Addendum

Great Barrier Reef environmental changes

The last deglacial sea-level rise in the South Pacific: offshore drilling NE Australia

Jody M. Webster
School of Geosciences
The University of Sydney
NSW, 2006
Australia

Yusuke Yokoyama
Ocean Research Institute /
Department of Earth and Planetary Sciences
University of Tokyo
1-15-1 Minamidai
Tokyo 164-8639
Japan

Carol Cotterill
Staff Scientist
British Geological Survey
Murchison House
West Mains Road
Edinburgh EH9 3LA
United Kingdom

October 2009

Following a meeting in August 2009 between ESO, the vessel contractors, Great Barrier Reef Marine Park Authority and the Australian Maritime Safety Authority (AMSA), two significant amendments were made to details contained within the Scientific Prospectus. These amendments concern information to be found under sections:

- Proposed Drill Sites / Tables
- Operational Strategy

All other details contained within the Scientific Prospectus published by IODP Program Management International for the Integrated Ocean Drilling Program in August 2009 remain the same.

Proposed Drill Sites

Offshore Cooktown: Ribbon Reef 5

Due to proximity of Sites #1 and #2 to the modern reef, it was felt that should there be a significant problem with vessel power, steerage, dynamic positioning and/or weather, then the reef and vessel could be at risk. For this reason, an agreement was made that Expedition 325 would not attempt to recover cores from sites ≤250m from a modern reef. This therefore prohibits activity taking place on Sites #1 and #2 at RIB-01C (Ribbon Reef 5) (see revised Table T1)

Table T1. Location RIB-01C (Ribbon Reef 5)

Site	Water depth (m)	Sediment penetration (m)	Substrate penetration (m)	Longitude	Latitude	Target
# 3	70	30	10	145° 47.8483' E	15° 22.7075' S	70 m terrace
# 4	75	30	10	145° 47.8744' E	15° 22.7508' S	70 m reef
# 5	198.7	100	0	145° 47.8825' E	15° 22.8768' S	Fore-reef slope (upper slope)
Total Penetration		160	20			

Operational Strategy

Following discussions with the contractors supplying the vessel for the expedition, it became apparent that there would be a change to the drilling platform used for the operational phase. Details of the new platform, and changes to the coring methodology are documented below.

Drilling platform

The water depths for the proposed drilling sites on the GBR range from approximately 30 m to 200 m and so require the use of a mission specific platform (MSP) capable of working in shallow waters. The drilling platform, chosen by the contractor, is the '*Greatship Maya*', an IMO Class II dynamically positioned vessel complete with geotechnical coring capability.

The *Greatship Maya* is a geotechnical drilling vessel capable of working in water depths of up to 1800 m. The vessel is equipped with a large moonpool and a Bluestone TT150 derrick and Foremost Hydraulic top drive.

The compact top drive onboard the *Greatship Maya* is a 150 ton Canadian-built system (Foremost Industries) that is both rugged and powerful. The design of this top drive system has been adapted to make it ideal for geotechnical or scientific drilling, sampling, and coring activities. Key specifications of the top drive are as follows:

Maximum Speed	200 rpm
Maximum Torque	23,000 ft.lbs
Maximum Hook Load	150 tons (300,000 lbs)
Maximum Input Power	450 hp (335kW)

The *Greatship Maya* will have sufficient capacity by way of food, water and accommodation for 50 day continuous operational capability. Therefore there will be no requirement for a port call for re-supply.

Coring Methodology

General

For efficient drilling/coring it is essential to apply a steady weight onto the drill bit. Vessel heave can reduce or apply excessive weight to the drill bit, therefore the drilling system onboard is heave-compensated to allow for vessel movement. The drill string is suspended below the top drive and the drill string compensator. The fast line runs over a relative motion compensating heave (3.5 m stroke cylinders) and is connected to the draw works winch. The deadline similarly runs to the anchor point at the drill floor. Compensator loading is about 80 metric ton. Sea water will predominately be used as drilling medium, with the option to use biodegradable drilling mud if drilling conditions dictate.

The components of the coring system are outlined below:

- **Drill String**. The drill string consists of 151 joints of drill pipes, 5 drill collars, 2 BHAs (Bottom Hole Assembly), and a selection of drill bits. This will make up about 1400 m in total length thus providing sufficient back-up for most operations. The drill pipes are API 5 ½" with 5 ½" FH tool joints with 4" bore ID. The length of each joint is 31 ft. Additional drill pipes, if required, can be placed at the stern of the main deck.

- **Bottom Hole Assemblies (BHA's)**:

  API Core Barrel - A versatile BHA for the API drill string that enables rock coring to be conducted, using wireline coring techniques. Impregnated and stag bits are currently available.

  Mining-Type Core Barrel - An HQ-size wireline core barrel deployed on a mining drill string, which fits inside the API drill string. This BHA can also be deployed through the API system, using the API drill string as a conductor or casing.

Initial coring sequence
Initially, a camera will be deployed through the API pipe to assess the sea bed and reef structures prior to drilling. The API pipe will then spud in, acting like a stinger and reducing the sea bed footprint, so minimising any potential impacts on the sea bed environment.

Coring with an HQ string
In this method the API drill pipes or drill string are used as a casing. The drill string is lowered to the seabed, with a bumper sub connected 3m from the drill bit. The drill string is then drilled down to the rock head and locked (using slip) on the drill floor. There are various lengths of drill pipe that can be used, to suit the depth (water depth + rock head). When the casing (drill string) is in place, the HQ core barrel is lowered to the rock head, via the HQ rod and cross over to the top drive. The rotational speed and bit load can be adjusted accordingly by the three speed gear change and the compensator. Constant bit load can be achieved by increasing and decreasing the air in the compensator. The pump flow rate is managed digitally by controlling the RPM of the pump. When a single core run (3m) is achieved, the inner barrel is retrieved by wire line and laid on a core rack on the drill floor whilst a standby barrel is lowered immediately. While the driller is coring the second run, the inner barrel with core is extracted, cleaned and fixed for the next run. This process is continued until the Target Depth (TD) is reached

A supplementary method to above can be used when encountering sediments or sand layers, with the drill string advancing as the coring proceeds. Advancing the drill string prevents the hole from caving in, thus preventing the core barrel

from getting stuck. The drill string is advanced only when there is evidence of high torque during coring on the HQ rod.

Coring with API BHA

A QD Tech coring system can be used to core both rock and sediments. This core barrel is directly connected to the API drill string, which has the advantage over the HQ coring system of a faster total execution time. The core barrel (BHA), comes with different selections of inner barrels. There are 2 types of inner barrels for this project, 1) EXN (Extended Nose), which is used in sediments and 2) ALN (Alien inner barrel), which is used in rock formation. The operation of this coring tool follows the similar procedure as the HQ rod/barrel.