Drowned Reefs in The Great Barrier Reef And Hawaii: a New Era in IODP Coral Reef Drilling

Jody M. Webster[1]

[1]*School of Earth Sciences, James Cook University, Townsville, Qld 4811, Australia*

The success of the recent IODP Tahiti Sea Level Expedition 310 has paved the way for a new era in shallow water carbonate drilling and research. This paper will summarize the scientific rationale and progress towards IODP drilling of drowned reefs off the GBR and Hawaii. The site survey has now been completed for the GBR with EM300 bathymetry, seismic, AUV imaging and rock dredging data collected on a 2007 RV *Southern Surveyor* cruise. Similar to the Tahiti expedition, the scientific objectives of the GBR drilling are three fold; (1) to establish the nature of sea level rise since the last ice age about 20 ka; (2) reconstruct associated changes in sea surface temperature and salinity; and (3) determine how the GBR responded to these changes in terms of geometry, composition and community structure. Scientific drilling in the GBR will provide not only an important comparison with the Tahiti record but also a unique archive of Western Pacific sea level variability, climate change and reef evolution. Observational and numerical modeling data from the drowned Hawaiian reefs indicate that the internal stratigraphy and tops of the reefs are highly sensitive to sea-level and climate changes. Furthermore, as a direct result of Hawaii's rapid but constant subsidence, thick (100-200 m) expanded reef sequences are preserved. These reefs span important periods in Earth climate history that are either not available or are highly condensed, due to a lack of accommodation space and/or unfavorable shelf morphology, on stable (eg., GBR, Tahiti) or uplifted margins (eg., PNG, Barbados). The Hawaiian reefs grew throughout (albeit episodically) the majority of the last six glacial cycles. Therefore, scientific drilling through these reefs will generate a new record of sea-level and associated climate variability during several controversial and poorly understood periods over the last 500 kyr.

Sediment Flux and Composition Changes in Canyons on a Carbonate-Siliciclastic Margin: Evidence From Turbidite Deposits Along The Great Barrier Reef Margin.

Webster, J. M[1]., Ludman, D., Wust, R., Beaman, R., Renema, W, Moss, P. Jacobsen, G.

[1]*James Cook University*

The shelf edge and slope of the Great Barrier Reef is heavily incised by submarine canyons which terminate in the Queensland Trough. Traditionally, sedimentation on the margin has been investigated within the framework of idealized siliciclastic or carbonate systems, depending on whether rivers or shallow marine carbonate producers dominate supply. The widely accepted paradigm ('reciprocal' sedimentation) states that sea-level strongly influences shelf, slope and basin sedimentation, with siliciclastics dominating lowstand periods and carbonates dominating transgressions/highstands. However, recent work (e.g., Dunbar and Dickens, 2003) on cores from the slope and basin has challenged this view. These workers argue that accumulation of both siliciclastic and carbonate sediments varies in phase, with the highest rates observed during transgressions, lowest rates during lowstands and moderate sedimentation during highstands. Irrespective of which model is correct, exactly how the sediment (carbonate or siliciclastic) moves from the shelf to the basin, and the role of submarine canyons in this process is not understood. We address this problem directly by investigating sedimentation in the canyons bordering the GBR. Combining new multibeam bathymetry and seismic data with x-radiograph, magnetic susceptibility, insitu reflectance spectroscopy, grain size, CNS, petrologic, pollen and ^{14}C AMS analyses of canyon cores off Cooktown and Cairns, we aim to establish the source, timing and frequency of turbidite events deposited in the canyons over the last glacial to interglacial cycle, thereby testing the competing models. Our preliminary data confirm that: (1) the canyons record a distinct sedimentary shift from siliciclastic turbidites to calciturbidites; (2) the siliciclastic turbidites were deposited before 28 ka – providing strong support for the "reciprocal" model of margin sedimentation; and (3) the canyons have been active throughout the last deglaciation and into the late Holocene.