Origin of Barrier Reef Elucidated along the Gulf of Papua Shelf Edge

Because the initial phase of barrier reef evolution is often buried under more recent phases of coral-algal growth, the origin of modern barrier reefs has remained elusive. Direct observations on the nature of the substrate on top of which barrier reefs have developed are lacking, and simple questions whether substrate controls or even dictates their overall linear morphology have remained unanswered. NSF MARGINS and IMAGES funded 2004 PANASH and 2005 PECTEN cruises on the R/V Melville and on the N/O Marion Dufresne, respectively, surveyed the shelf edges in the Gulf of Papua at the northern extremities of the Great Barrier Reef and PNG Barrier Reef. In the northern part of Ashmore Trough, the surveys uncovered a 30 to 50 m-high ridge that parallels the shelf edge with linear segments exceeding 10 km in length. Analyses of a core, recovered in a re-entrant in front of the ridge, demonstrate that a coast-line, essentially siliciclastic, reached the present-day shelf break during Last Glacial Maximum - LGM and the Oldest Dryas - OD (17.5-16.5 cal. ky. BP). During a major pulse of sea level rise, between ~ 16.0 and 13.0 ky cal. ky. BP, a cor-algal reef established itself on top of a LGM/OD siliciclastic beach barrier complex, and subsequently drowned. On the northwest PNG shelf edge, an early transgressive, as thick as 30 m, coral-algal edifice complex, sampled at its flank by a piston core at ~ 107 m below modern sea level, established itself on top of a LGM shelf edge delta lobe, partially eroded and located at about 120-125 m below modern sea level.

Figure:
(left): Drowned barrier reef with linear segments exceeding 10 km in length established on fossil beach ridges bounding a lowstand large delta complex.
(right): Early transgressive 19 cal. Ky. BP coral-algal edifices growing on top of a prograding lowstand delta lobe. The fist size Galaxea coral colony was collected in the core catcher of a Calypso piston core.