THE SEDIMENTARY, HYDRODYNAMIC AND TURBIDITY REGIMES AT INNER-SHELF CORAL REEFS, HALIFAX BAY, CENTRAL GREAT BARRIER REEF, AUSTRALIA.

Thesis submitted by

ANDREW RICHARD COSTEN BSc (JCU)

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ANDREW COSTEN

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ABSTRACT

Taxonomic, seismic, vibrocore stratigraphy, surficial sedimentology, turbidity and hydrodynamic data were collected from Paluma Shoals and Phillips Reef. Paluma Shoals are a series of five near-shore patch reefs located within the inner-shelf terrestrial sediment wedge of southern Halifax Bay. Phillips Reef is an isolated patch reef located approximately 15 km northeast of Paluma Shoals. These data sets were collected to compare and contrast the sedimentary, hydrodynamic and turbidity regimes at both Paluma Shoals and Phillips Reef.

The taxonomic survey (Watson, 1996) of Paluma Shoals indicated that total coral cover on the leeward reef flat (53.4±3%) was almost twice that of the windward reef flat (27.9±3.3%). The presence of juveniles was also detected at both the leeward and windward reef flats. The presence of juveniles (<5cm) suggests that coral recruitment is occurring. The taxonomic survey suggests that the corals at Paluma Shoals are a healthy diverse population.

From 79 km of high resolution seismic images, eight seismic facies were identified within the study area. These facies are consistent with those identified by previous investigations. Seven vibrocores were collected to ground truth the seismic profiles. Four postglacial facies were identified on the basis of grain size, stratigraphic relationship and mineralogy.

A total of 135 surficial sediment samples were collected from the study area. Based upon field and laboratory observations and high-resolution laser diffraction grain size analysis, the study area has been divided into, two marine inner-shelf and four coastal facies assemblages.

Entropy analysis of grain size distributions from 58 inner-shelf and coastal sediment samples resulted in statistical clusters which were visually discrete. Seven entropy groups were defined and high resolution grain size maps compiled. High resolution grain size mapping of the inner-shelf of Halifax Bay was successful in producing a map which mirrored the distribution of the surficial sediment facies assemblage.

A total of 1340 hours of continuous high resolution time-series hydrodynamic and turbidity data were recorded at Paluma Shoals (671 hours) and Phillips Reef (669 hours) between Julian days 248 and 276 (1995). Maximum turbidity values were an order of magnitude greater at Paluma Shoals (175 NTU) than Phillips Reef (15 NTU) and generally were higher. The hydrodynamic and turbidity data suggest that Paluma Shoals and Phillips Reef are influenced by the same regional hydrodynamic processes. The surficial sediment seaward of Paluma Shoals are predominantly muddy sand, sandy mud and gravelly muddy sand and on the reef top, muddy sand and sandy mud. Therefore, there is a large source of fine grained sediment available for resuspension. The surficial sediments surrounding Phillips Reef are mostly gravelly muddy sand. Therefore, there is less fine grained sediment available for mobilisation.

The variations in near bed turbidity values at Paluma Shoals and Phillips Reef appear to be a function of local surficial sediment distribution, wind direction and hydrodynamics. At Paluma Shoals the complex interaction between these processes results in high turbidity values but limited sediment settling. At Phillips Reef the limited sediment resuspension and transport (low NTU values) may be attributed to the reefs depth and coarse grained nature of the surface sediments.

Three main implications arose from the collection and collation of these data sets, these are: 1) The corals at Paluma Shoals exist in water conditions widely inferred within the literature as being detrimental to coral growth and distribution; 2) "turbid water reefs" such as Paluma Shoals are potentially common and are healthy diverse populations; 3) during coral reef initiation (c.a. 6.8 ky B.P.) sediment dynamic, hydrodynamic and therefore turbidity regimes may have been similar to those of today. Therefore, "turbid water reefs" may form modern analogues to coral reefs that underwent initiation 8.5-5ky B.P.

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