

RINGKASAN EKSEKUTIF

Holocene Reef Growth of the Inshore Kimberley Bioregion and Response to Sea Level Changes and Climate Impacts



The study aims to gain a comprehensive description of reef geomorphology and Holocene growth history in combination with detailed sea level records and climate impacts. The methods involved are remote sensing application, seismic survey records and assessment, Holocene reef growth analysis, and sedimentary environment identification.

Pembahasan Ringkas Kerangka Pemikiran

The Kimberley region is located in northwest Australia extending approximately from 12°S to 18°S and from 118°E to 126°E (Fig. 1). This region is envisaged to be one of the world's last great virgin areas that need recognition and protection (Simpson, 2011). The Kimberley Marine Research Program (KMRP) of the Western Australia Marine Science Institution (WAMSI) is a program of marine research to help plan and manage the proposed marine parks in Kimberley bioregion (Simpson, 2011). One of the research priorities listed in KRMP Science Plan (Simpson, 2011) is research on **reef growth and maintenance**.

Coral reefs are prominent marine ecosystems which are characterised by both biological and geological components (Buddemier *et al.*, 2004). They have been known as environmental archives in marine geological research that can provide earth history records (Collins *et al.*, 2011). Despite the fact that coral reefs give significant benefits to human life through various roles, they are also considered to be one of the most susceptible marine ecosystems. Buddemeier *et al.* (2004) reported that between 50% and 70% of all coral reefs in the world are under direct threat from human activities. Natural and anthropogenic influences such as pollution, intensive sedimentation, mining and physical destruction put high pressure on reef systems. In addition, now they face growing risk from coral bleaching that would be another major contributing factor to coral reef deterioration (Hoegh-Guldberg, 1999).

The distance of the Kimberley coast bioregion induces slight protection from anthropogenic impacts that are likely continue to increase in the future (Collins, 2011a). Unlike the relatively well-studied offshore isolated reefs such as Scott Reefs and Rowley Shoals (Collins, 2011a), the inshore fringing reefs of this complex are relatively poorly recognised and little studied, with limited exclusions such as Montgomery Reef (Wilson and Blake, 2011) and Talbot Bay Reef (Wilson *et al.*, 2011). Therefore,

detailed information is still required for the inshore fringing reefs due to the significant differences between the offshore isolated reefs and the inshore fringing reefs regarding environmental conditions, relative exposure to the Indonesian Throughflow (ITF) and macro-tidal regimes. The current study will try to fill the data gap by focusing on **regional geomorphology and the Holocene growth history of the selected Kimberley coral reefs in combination with sea level records and climate impacts.**

Pembahasan Hasil Penelitian

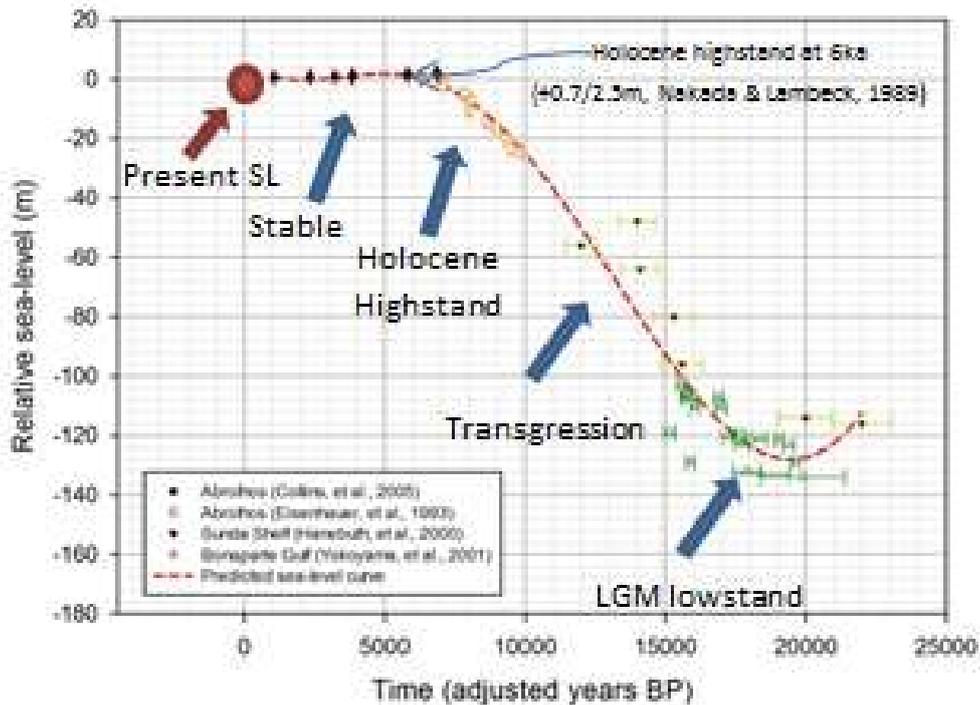
Recently, I have just finished my PhD candidacy and now I am focusing on sea-level history study and images processing and analysis using remote sensing techniques. Geological fieldwork and samples collection will be carried out in October, 2013. Laboratory work and analysis will subsequently be conducted after fieldwork completion.

Sea-level history

The sea-level curve estimation of Kimberley Bioregion during Last Glacial Maximum (LGM) and Holocene time are derived from some previous studies conducted in several localities such as Abrolhos (Eisenhauer, A. et al., 1993; Collins, et al., 2005), Sunda Shelf (Hanebuth, et al., 2000), and Bonaparte Gulf (Yokoyama, et al., 2001). This combination shows the best estimate sea-level curve to be applied in Kimberley Bioregion considering the proximity to the study area, tectonical displacements, and glacio-hydroisostatic.

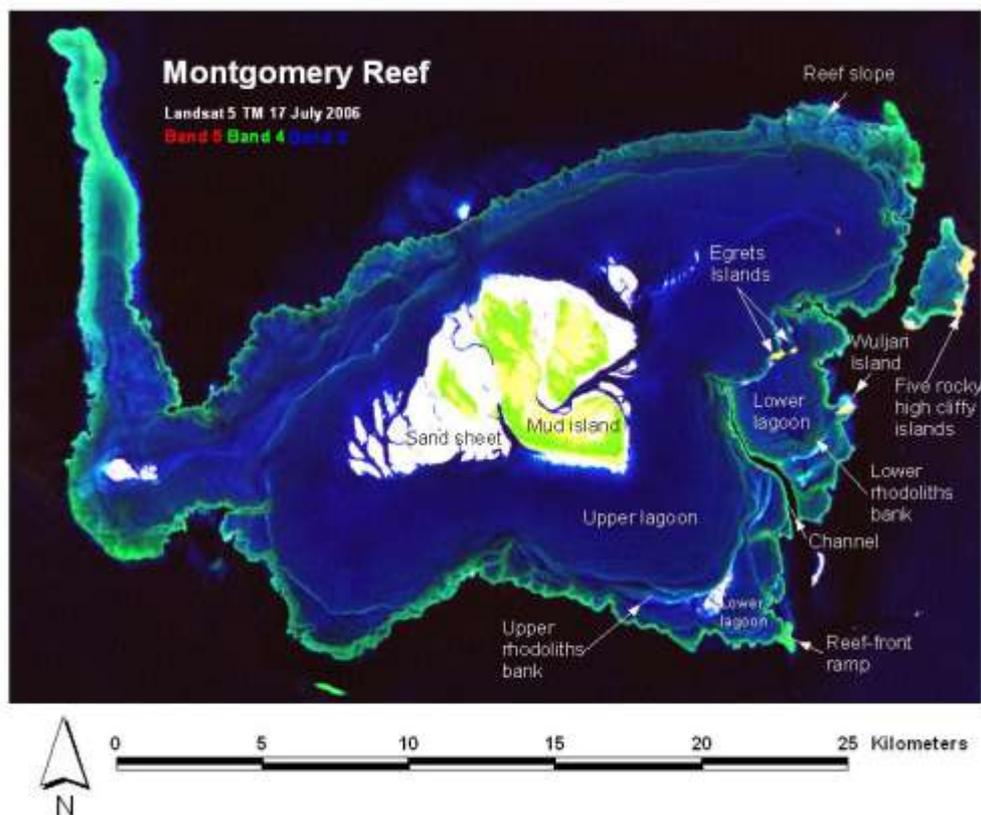
Drowning model

Based on bathymetric chart and sea level history, a drowning shelf model of Kimberley bioregion was established with focusing on some targeted areas e.g. Champagny Island, Montgomery reef, Cockatoo Island, and Sunday Island. Starting from -120 m depth contour, the drowning model was created up to present sea-level where every depth contour corresponds to U/Th age BP. Samples from Sunda Shelf and Bonaparte Gulf were dated using AMS Radiocarbon and adjusted to U/Th age by adding 1ky. Based on this drowning model, reefs on Champagny Island, Montgomery reef, Cockatoo Island, and Sunday Island are predicted to start growing in the Mid-Holocene after 8.4ka. The sea-level rose dramatically and was reaching current sea level at the post glacial termination, about 6.5ka. This rise remained steady up to 1.5m above present sea-level at 6ka and subsequently started to fall down until present time.



Reef geomorphology

With available Landsat TM Imagery, some coral reef mapping techniques such as unsupervised classification, supervised classification with potential coral reef training area, and scattergram have been examined to obtain best feature of reef geomorphology.



Rekomendasi

The recognition of reef distribution by using integrated remote sensing and Geographic Information System (GIS) techniques will provide insight on spatial reef distribution linked to an understanding of geomorphology, coastal geology and biodiversity processes. This initial information gives a foundation for long-term coral reef studies and management (Hopley *et al.*, 2007). Whilst a seismic record assessment will deliver information on reef morphology, thickness and antecedent reef platform from which whole description of reef architecture and growth will relatively be easier to determine.

Moreover, long term quantitative data on Holocene reef growth in combination with sea level history will enable identification of reef response to sea level changes and climate impacts. Collins (2011b) highlighted that understanding of Holocene sea level history is a primary process to reconstruct reef growth over the last thousands of years and beyond. Furthermore, information related to sedimentary environments around the inshore reefs will depict interaction between sediment substrate and coral communities. Regarding a proposed project of Kimberley Marine Parks, surface sediment analysis will be relevant in examining possible impact of sediment dynamics to adjacent environments (Wolanski and Spagnol, 2003).

Aside from providing foundations to help planning and management, this study is expected to expand networking between State and Commonwealth agencies, universities, the Australian Institute of Marine Science (AIMS), the Commonwealth Scientific and Industrial Research Organization (CSIRO), industry and NGOs for marine research collaboration in Western Australia. Furthermore, this study is also expected to support international institutions such as the International Panel on Climate Change (IPCC) in building powerful mathematical models that can help climate prediction in the future, so that mitigation and adaptation programs can be undertaken in advance.

Penulis

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	<p>Pengembangan Kawasan Budidaya di Perairan Pemangkat, Sambas, Kalimantan Barat.</p> <p>2011 : - sedang menjalankan Tugas Belajar -</p>
<p>Publikasi</p>	<p>Solihuddin, T., Eva Mustika Sari, Gunardi Kusumah, 2011. <i>Prediksi Laju Sedimentasi di Perairan Pemangkat, Sambas Kalimantan Barat Menggunakan Metode Pemodelan</i>. Buletin Geologi Tata Lingkungan, Vol. 21 No.3, hal. 117-126</p> <p>Solihuddin, T., Gunardi Kusumah, Dini PURBANI, 2012. <i>Distribusi Konsentrasi TSS di Perairan Teluk Banten dan Dampaknya terhadap Ekosistem Laut dan Perikanan</i>. Prosiding Seminar Nasional Teori dan Aplikasi Teknologi Kelautan, hal. 454-460.</p> <p>Kusumah, G., Tubagus Solihuddin, Dini PURBANI, 2012. <i>Distribusi Konsentrasi TSS di Perairan Teluk Banten dan Dampaknya terhadap Ekosistem Laut dan Perikanan</i>. Prosiding Seminar Nasional Teori dan Aplikasi Teknologi Kelautan, hal. 365-371</p>