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Martine Jeanine Josette Couapel
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*The Gulf of Carpentaria Palaeoenvironments:
OSL Dating and Nannofossil evidence*

*A thesis submitted in fulfilment of the requirements
for the award of the degree*

Doctor of Philosophy

From the

University of Wollongong

By

Martine Jeanine Josette Couapel

School of Earth and Environmental Sciences

2005

Certification:

I, Martine J. J. Couapel, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Earth and Environmental Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged.

The document has not been submitted for qualifications at any other academic institution.

Martine J. J. Couapel

March 2005

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Nadir is the best position to gather the needed energy to reach the zenith, merci to Korigan for being the source of this energy.

Adversity is a boundless inspiration for the optimistic

Abstract:

The Gulf of Carpentaria is a near-equatorial region, a domain in which past environmental changes are not well understood, but in which much of the world's weather has its origin. Being situated adjacent to the Western Pacific Warm Pool, responsible for the largest transfer of heat and moisture between the surface and the atmosphere, the Gulf of Carpentaria is an epicontinental sea (maximum depth 70 m) bordered to the east by Torres Strait (12 m depth) and to the west by the deeper Arafura Sill (53 m depth), an area sensitive to the Asian monsoon and ENSO, which have a crucial importance on a worldwide scale. Furthermore, this region could be a key point to monitor the palaeocirculation between the Pacific and the Indian oceans that records the switching on and off of the global thermohaline circulation during glacial/interglacial alternations. The Gulf is tectonically stable, therefore no corrections are necessary when interpreting the palaeo-sea level curve. Throughout the Late Quaternary, during times of sea-level low-stands, the gulf was separated from the open waters of the Indian and Pacific oceans, forming Lake Carpentaria with outlet channels to the Arafura Sea.

In 1997, six sediment cores were collected from the Gulf of Carpentaria using a giant piston-corer deployed from the *Marion Dufresne*, as part of the International MARine Global changEs Study (IMAGES). This study provides an interpretation of the palaeoenvironments in the Gulf of Carpentaria over the last 180 ka by means of OSL dating and analysis of abundance and distribution of coccolith assemblages within this series of sediment cores. The usefulness of the OSL Dating technique on such sediment cores covering marine to lacustrine conditions has been demonstrated by establishing a time frame for the changing environments of the Gulf of Carpentaria since MIS 6.6. The shallowness of the Gulf of Carpentaria, as well as its restricted basin size, allow the use of Optically Stimulated Luminescence (OSL) to date the sediment. Indeed, these parameters mean that the quartz grains were bleached soon before deposition and thus that the event date is the real time of deposition. From the thirteen samples processed, twelve dates ranging from 7 ± 1 to 178 ± 18 ka, have been estimated over three cores from the Gulf of Carpentaria. These dates also allow the calculation of the sedimentation rate, which ranges from 4.3 cm ka^{-1} in the central area to 7.8 cm ka^{-1} on the western margin. These results are consistent with the modern sedimentation rate observed in the Gulf of Carpentaria. A clear reduction in the sedimentation rate starting about 90-100 ka

ago is noticed in the three cores, however this needs to be confirmed by further dating on other levels.

Coccolithophores are planktonic marine algae distributed from the open ocean to nearshore littoral and lagoonal environments. They secrete minute calcified plates, coccoliths, which are a major component of pelagic carbonates. Coccolith assemblages preserved in marine sediments are excellent proxies of palaeoceanographic conditions. The lack of coccoliths could be either due to bad preservation conditions or to a freshwater environment. In the Gulf of Carpentaria, coccolith assemblages confirm at least two non-marine/marine cycles, during the past 180 ka, as well as some short marine intervals, as minor incursions of seawater during a non-marine sequence.

These collated results are presented on a series of maps illustrating the discrete closure and breach sequences of the Arafura Sill and Torres Strait as related to Quaternary sea level fluctuations, and the corresponding alternations between the Gulf of Carpentaria and Lake Carpentaria. When viewed together, the compilation and interpretation of these data enables the development of a detailed spatial and temporal understanding of the palaeoenvironmental history of the Gulf of Carpentaria since MIS 6.6 (ca. 180 ka). From the sedimentary record of the Gulf evidence of dry and wetter episodes are observed and interpreted as intensification of the monsoon and cyclonic activity. These may be linked to ENSO events and global oceanic and atmospheric processes.

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