

U-series dating of coral reefs from the South China Sea

JIAN-XIN ZHAO¹ AND KEFU YU^{1,2}

¹Radiogenic Isotope Laboratory, CMM, Univ. Queensland, Brisbane, Qld 4072, Australia; j.zhao@uq.edu.au

²South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou, China; kefuyu@scsio.ac.cn

South China Sea (SCS) (2-22 °N) is climatically important as it is part of the western Pacific Warm Pool and the moisture source region of the East Asian summer monsoon rainfall. We have carried out detailed investigations of coral reefs throughout the SCS and obtained over 400 U-series dates, providing a rare opportunity for understanding Holocene sea-level, sea-surface temperature and salinity change and recent storm/tsunami and coral bleaching/mortality history.

For instance, TIMS U-series ages for nearly 100 *in situ* massive corals from an emerged reef terrace on Leizhou Peninsula, northern SCS show that corals grew periodically from 7100 to 1500 yr BP. Such coral ages and their elevations and distributions suggest that multiple sea-level highstands of ~2 m above the present sea-level occurred when these corals developed. The timing of such sea-level highstands correlates well with iceberg discharge events recorded in the North Atlantic at 5900, 4200, 2800 and 1500 years ago [1], implying possible linkage between high latitude climate and low latitude coral reef development.

In addition, high-precision dates for individual rims of mid-Holocene microatolls with accurately measured elevations allow us to establish detailed sea level history on multi-decadal scales. The results indicate that, during the period of 7050 - 6600 yr BP, the sea level was about 170 to 220 cm above the present and registered at least four cycles of century-scale fluctuations by 20-40 cm, mimicking air-temperature oscillations recorded in the Greenland ice cores

Moreover, precise dating of wave-transported large *Porites* blocks on Yongshu reef in the southern SCS indicates that at least six giant wave events (storms or tsunamis) occurred over the last millennium [2], further confirmed by increased deposition rates revealed in a well-dated lagoon core [3]. Interestingly, the last two events (1685±8 to 1680±6, and 1872±15 A.D.) correlate well with the Krakatau eruptions (and resultant tsunamis) in 1680 and 1883 AD, respectively.

Furthermore, high-precision (±1-2 years) dates for dead *Porites* heads on the reef flats of Yongshu and Meiji Reefs in southern SCS reveal that massive corals died many times over the past two centuries, some of which correlate in time with historic El Niño events (e.g. 1997-1998, 1991-1992, 1982-1983, 1972-1973 and 1957-1959 AD), consistent with high temperature bleaching during El Niño years.

References

- [1] Bond, G. *et al.* (1997) *Science* **278**, 1257-1266.
- [2] Yu K.F., Zhao J.X., *et al.* (2004) *Palaeo3* **210**, 89-100.
- [3] Yu K.F., Zhao J.X., *et al.* (in press) *QSR*.