

# Preceding of rainy season during the Mid-Holocene in the northern South China Sea

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Precipitation change in the northern South China Sea (SCS) is the key to understand the evolution and mechanism of the monsoon system.  $\Delta\delta^{18}\text{O}$ , calculated from coralline Sr/Ca and  $\delta^{18}\text{O}$  ratios [1], generally reflect changes of  $\delta^{18}\text{O}$  in sea water, which is controlled by fresh water input driven by precipitation.

$\Delta\delta^{18}\text{O}$  record of a modern *Porites lutea* coral from Sanya, south Hainan Island in the northern SCS revealed that the negative  $\Delta\delta^{18}\text{O}$  peaks generally lag the precipitation peaks in Hainan Island, as well as the maximum summer SSTs about 3 months. Such time lag suggests that it takes about 3 month for the fresh water precipitated in Hainan Island to flow into the offshore of Sanya and change the sea water  $\delta^{18}\text{O}$  there. This agrees with the lags between in-situ measured salinity changes and precipitation in Hainan Island.

However,  $\Delta\delta^{18}\text{O}$  record of a fossil *Porites lutea* coral with age of  $6494\pm 24$  aB.P. shows a preceding of the negative  $\Delta\delta^{18}\text{O}$  peaks of about 2 months than the maximum summer SSTs. Considering that precipitation in Hainan Island takes about 3 months to affect the seawater in Sanya, this negative  $\Delta\delta^{18}\text{O}$  peaks leading suggests that maximum precipitation in Hainan Island may occur in late winters and early springs during the Mid-Holocene, which precedes about 5 months than present.

Two mechanisms may interpret this preceding of the rainy season in this region: (1) The northward moving of the rain belt in the southern SCS. During the Mid-Holocene, winter monsoon was relative weak, and the rain belt in the southern SCS, in which precipitation peaks generally occur during October to December, moves to Hainan Island. As precipitation peaks occur during June to September in Hainan Island at present, the northward shifting of rain belt results in rainy season preceding in this region. (2) Typhoon landed in Sanya in late winters and early springs, and triggered the precipitation peaks occurring about 5 months earlier than present. Again, this is related to the weak winter monsoon during the Mid-Holocene.

## References

[1] McCulloch, M.T., Gagan, M.K., Mortimer, G.E., Chivas, A.R. and Isdale, P.J. (1994) *GCA* **58**, 2747-2754.