Hydrographic changes during ENSO events discerned from coupled radiocarbon and stable isotope time-series in the giant clam *T. gigas*

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El Niño-Southern Oscillation (ENSO) is presently the largest source of interannual climate variability in the world and therefore understanding of its past behavior under contrasting climate states is of upmost importance in predicting future ENSO behavior. The Western Pacific Warm Pool (WPWP) plays a dominant role in the development of ENSO but the detailed oceanographic observations do not go far enough back in time to assess the changes in circulation patterns of the WPWP over seasonal and interannual periods.

Climate signals and ocean circulation patterns were investigated in a modern giant clam (*T. gigas*) from the Huon Peninsula, Papua-New Guinea (PNG) located along the Vitiaz Strait in the heart of the WPWP. Time-series analyses of stable oxygen and carbon isotopes at subweekly resolution, coupled with a detailed suite of AMS $\Delta^{14}C$ determinations, has allowed documentation of hydrographic and salinity changes occurring during ENSO events. Our results indicate that during El Niño, the *T.gigas* record exhibits an increase of 5‰ above average in $\Delta^{14}C$ with a range of 11‰ accompanied by positive $\delta^{18}O$ and $\delta^{13}C$ excursions while during La Niña $\Delta^{14}C$ falls 3‰ below average with a range of 30‰ accompanied by negative $\delta^{18}O$ and $\delta^{13}C$ excursions. Our data suggests that Vitiaz Strait acts as an important gateway of ocean masses leading to ENSO events. During an El Niño the flow in the Vitiaz Strait is from Southeast to Northwest and waters are sourced in the ^{14}C-enriched subtropical ocean surface. In contrast, during La Niña the flow switches from Northwest to Southeast and is sourced in older, ^{14}C-depleted, waters derived by upwelling in the Eastern Pacific. The combined study of stable isotopes and $\Delta^{14}C$ demonstrates that giant clams show potential to serve as robust archives of seasonal and interannual variability in ocean circulation and water salinity accompanying ENSO events. Furthermore we show that by applying modern threshold limits, high resolution paleo-ENSO records can be acquired from fossil giant clams that are associated with the flight of uplifted coral reef terraces on the Huon Peninsula, PNG.