# Pre- to Post-Lapita Predation Patterns:

## Shellfish Exploitation at Tanamu 1, Caution Bay, Papua New Guinea

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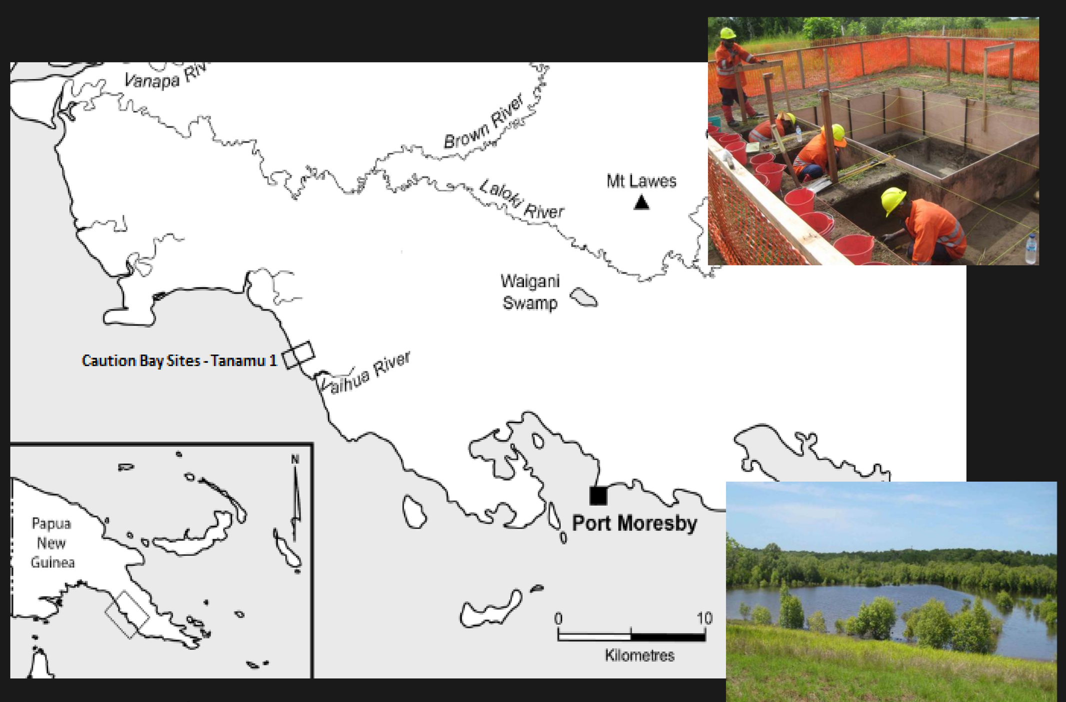


**Figure 1** Location of Tanamu 1, PNG.

## Introduction

Morphometric analyses of *Conomurex luhuanus* and *Anadara antiquata* are used to identify changes in shellfish size- and age-at-death across the pre- to post-Lapita sequence at Square B, Tanamu 1 from Caution Bay, southern Papua New Guinea (PNG) (Figure 1). Tanamu 1 comprises one of the rich and diverse shellfish midden assemblages within this Lapita landscape. Square B alone contains more than 130 marine shellfish species (Square B MNI=6023) (Tomkins *et al.* completed ms). Few studies have investigated past human shellfish predation patterns during the mid-to-late Holocene from mainland PNG. The Tanamu 1 assemblage provides a rare opportunity to study pre- to post-Lapita subsistence practices. Population profiles, shellfish ecology and changing sedimentation rates are combined to evaluate shifting species exploitation by pre- to post-Lapita shellfishers.

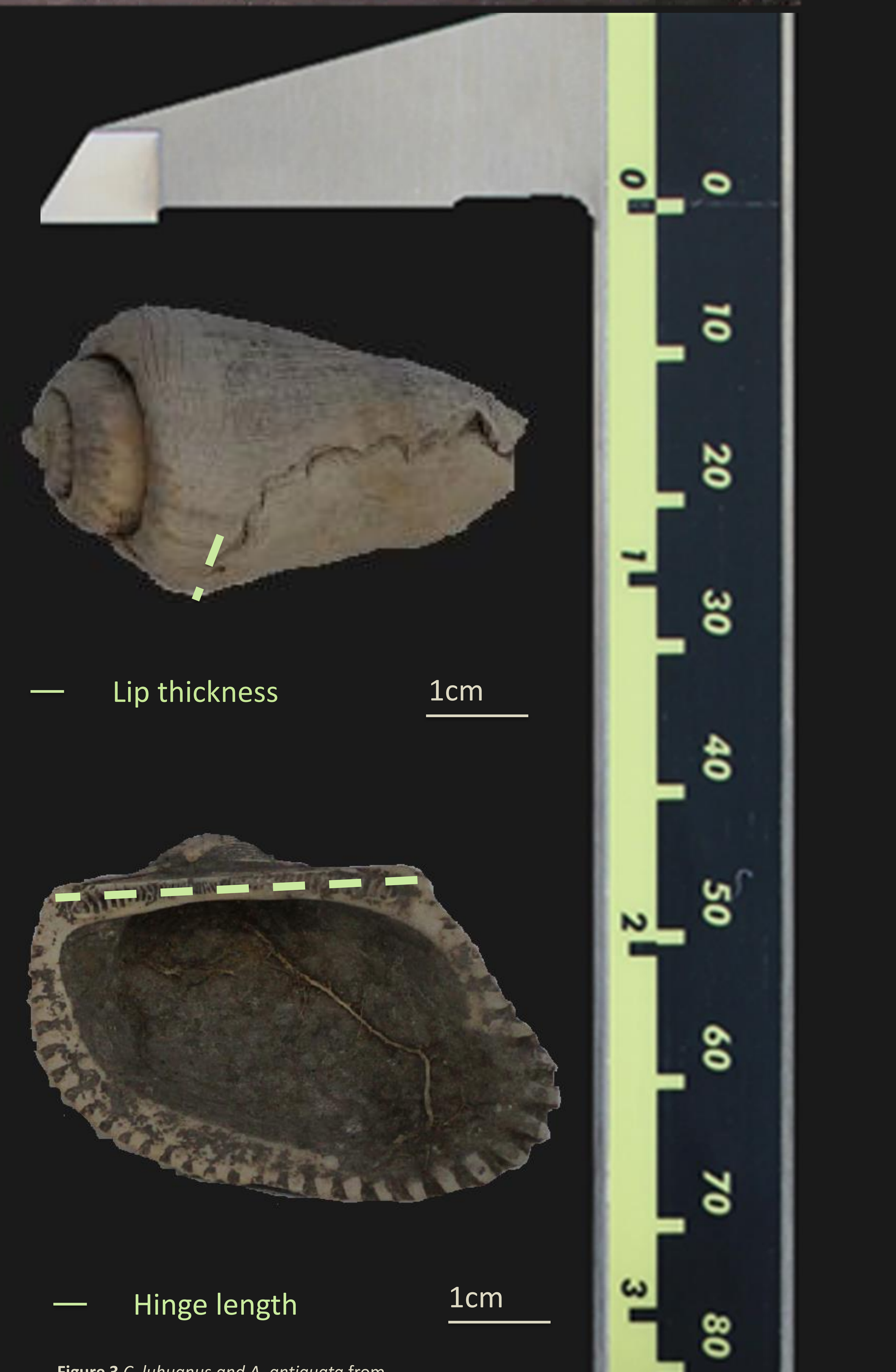


**Figure 3** *C. luhuanus and A. antiquata* from Tanamu 1, showing metric landmarks.

## Aims & Method

Two key shellfish species examined in this study are *C. luhuanus*, a sandy substrate to reef-flat species (Square B MNI=353) (Carpenter and Niem 1998:475; Poiner and Catterall 1988:192) and *A. antiquata*, a sandy-mud substrate species typically found adjacent to mangroves (Square B MNI=371) (Jahangir *et al.* 2014:263; Tebano and Paulay 2000:5). Together these two species comprise 12% of the total midden assemblage from Tanamu 1, Square B (XU1-134; 0-280cm depth) (see Figure 2) (Tomkins *et al.* completed ms). Our research aims to identify if *C. luhuanus* and *A. antiquata* assemblages from Tanamu 1 were subjected to human and/or environmental pressure from pre- to post-Lapita occupational phases. Morphometric data collected from each species using standard landmarks (Figure 3) were used to identify changes in size- and age-at-death of shells through time. Lip thickness was used to determine the age-at-death of *C. luhuanus* (see Poiner and Catterall 1988:193) and hinge length for *A. antiquata* (see Mzighani 2005:81). Radiocarbon dates were used to bracket metric data per species and per occupational phase (David *et al.* completed ms). These data were then statistically tested through one-way ANOVAs and one-way T-tests. The population distributions for age-at-death were combined with the ecology of the shellfish species, and evidence of changing sedimentation rates (Rowe *et* al. 2013:1138), to assess human shellfish targeting strategies.

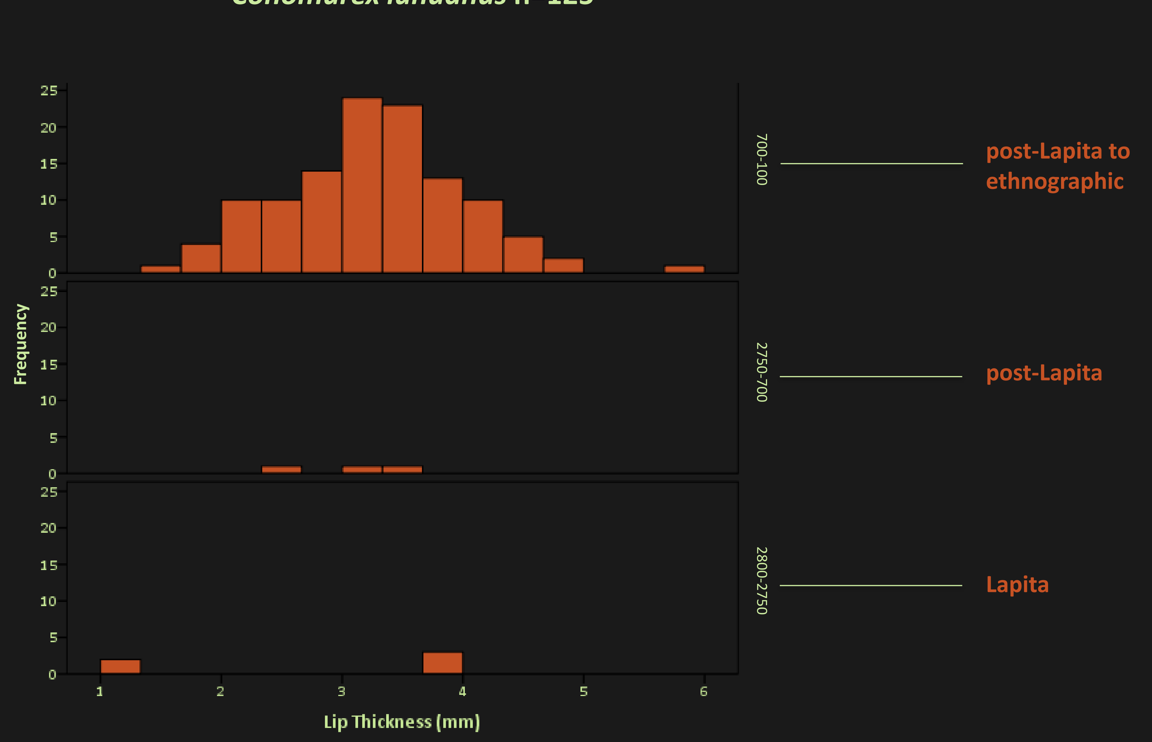


**Figure 4** *C. luhuanus* age through time. Juveniles 0-2.0mm, adolescents 2.0-3.9mm and adults 4.0+mm.

## Results

One-way ANOVA results identified no statistically significant difference in the age-at-death of *C. luhuanus* between occupational phases ($F$ (2, 122) = 1.3, $p$ = .255). The majority of *C. luhuanus* comprise the adolescent (2.0-3.9mm) age profile (n=97, 77.60%) with the highest frequency of adolescents present between 700-100 cal BP (n=91, 77.78%). One-way ANOVA results indicated that there was a statistical difference in the age-at-death of *A. antiquata* through time ($F$ (4, 314) = 48.0, $p$ = .000). One-way T-tests revealed that the greatest difference in the age-at-death of *A. antiquata* occurred between 4350-4050 cal BP ($M$=28.63, $SD$=6.15) and 2800-2750 cal BP ($M$=19.98, $SD$=3.12; $t$(260)13.11; $p$ =.000, two-tailed). The majority of *A. antiquata* comprise the adult (23-50mm) age profile (n=196, 61.44%) with the highest frequency of adults present between 4350-4050 cal BP (n=138, 85.71%). Figures 4-5 illustrate the frequency of distributions and age-at-death of *C. luhaunus* and *A. antiquata* through time and per occupation phase.

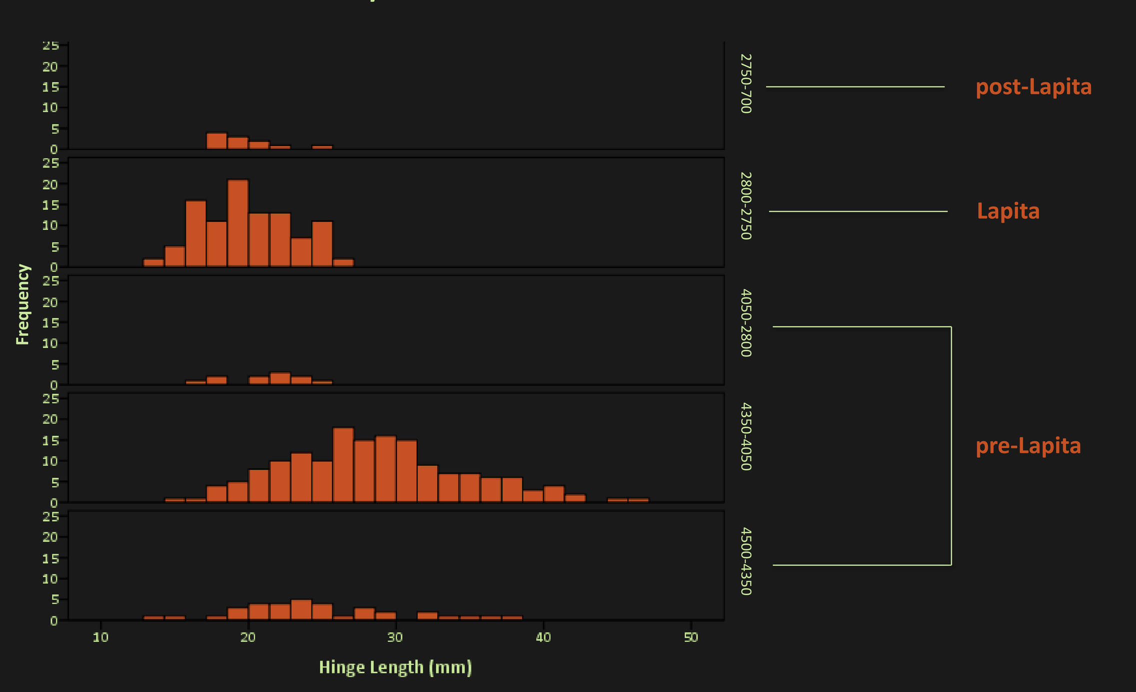


**Figure 5** *A. antiquata* age through time. Juveniles 0-15mm, adolescents 16-22mm and adults 23-50mm.

## Discussion & Conclusion

For *A. antiquata* adults are most abundant during the pre-Lapita horizon (4500-2800 cal BP), whereas adolescents predominate in the Lapita and mixed Lapita-post-Lapita horizons (2800-2750 and 2750-700 cal BP), with a significant reduction in abundance during the post-Lapita horizon. *A. antiquata* are not present in the post-Lapita to ethnographic horizons (700-100 cal BP). Intensive exploitation of *C. luhuanus* is evident in the late post-Lapita horizons, but absent/minimal in the pre-Lapita to Lapita horizons. Pollen records indicate that an expansive mangrove population dominated from 1950-950 cal BP (Rowe *et al.* 2013), perhaps expanding habitats favourable to *A. antiquata.* Adolescent colonies of *C. luhuanus* occur in sandy habitats associated with coral reefs (Catterall and Poiner 1983). Environmental changes from increasing levels of terrigenous sedimentation, reduced tidal flushing and increased soil salinity, caused tree dieback and established unvegetated mudflats (post-950 cal BP) (Rowe *et al.* 2013:1138). A corresponding shift in species exploitation from *A. antiquata* to *C. luhuanus* is evident at Tanamu 1 (see Figures 4-5). This shifting focus of exploitation by pre- to post-Lapita shellfishers arguably signals changing habitats and resource availability in the face of increased coastal siltation following heightened permanent populations and landscape modifications, in particular gardening and landscape burning (see Amesbury 2007). These questions are currently the subject of further investigations.

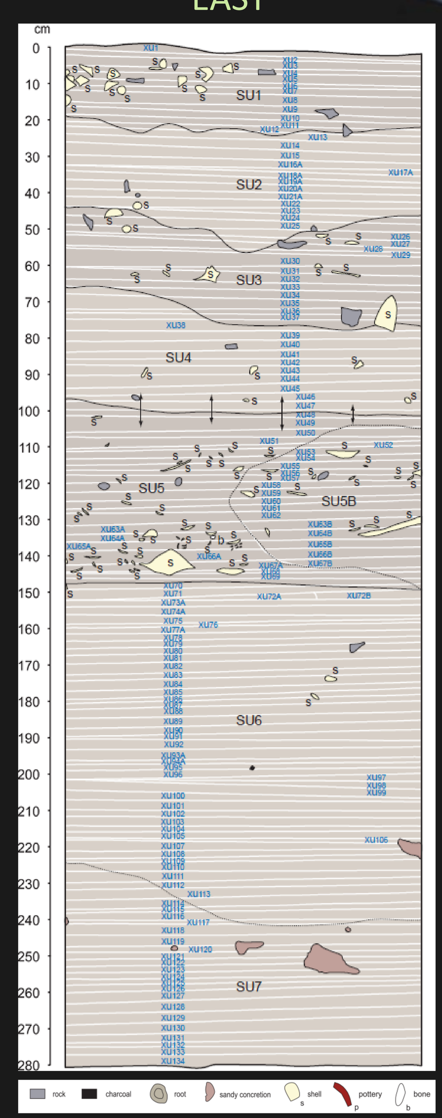


Figure 2 Tanamu 1 stratigraphic profile.

## References

Amesbury, J.R. 2007 Mollusk collecting and environmental change during the prehistoric period in the Mariana Islands. *Coral Reefs* 26:947-958.

Carpenter, K.E. and V.H. Niem (eds) 1998 FAO *Species Identification Guide for Fishery Purposes: The Living Marine Resources of the Western Central Pacific*. *Volume 1: Seaweeds, Corals, Bivalves and Gastropods.* Rome: Food and Agriculture Organization of the United Nations.

Catterall, C.P. and Poiner, E.R. 1983. Age- and sex-dependent patterns of aggregation in the tropical gastropod *Strombus luhuanus*. *Marine Biology* 77: 171-182.

David, B., I.J. McNiven, K. Aplin, F. Petchey, K. Szabó, J. Mialanes, H. Tomkins, B. Asmussen, C. Rowe, T. Richards, B. Barker, S. Connaughton, M. Leavesley, H. Mandui and C. Jennings. Completed ms. Tanamu 1: A 5000 Year Sequence from Caution Bay. In B. David, T. Richards, I.J. McNiven and K. Aplin (eds), Lapita to Post-Lapita Transformations at Caution Bay: Cultural Developments Along the South Coast of Mainland Papua New Guinea. Caution Bay Studies in Archaeology, Volume 2.

Jahangir, S., G. Siddiqui and Z. Ayub 2014 Temporal variation in the reproductive pattern of blood cockle *Anadara antiquata* from Pakistan (northern Arabian Sea). *Turkish Journal of Zoology* 38:263-272.

Poiner, I.R. and C.P. Catterall 1988 The effects of traditional gathering on populations of the marine gastropod *Strombus luhuanus* linne 1758, in southern Papua New Guinea. *Oecologia* 76:191-199.

Rowe, C., I. McNiven, B. David, T. Richards and M. Leavesley 2013 Holocene pollen records from Caution Bay, southern mainland Papua New Guinea. *The Holocene* 23(8):1130-1142.

Tebano, T. and G. Paulay 2000 Variable recruitment and changing environments create a fluctuating resource: The biology of *Anadara uropigimelana* (Bivalvia: Arcidae) on Tarawa Atoll. *Atoll Research Bulletin* 488. Washington, DC: National Museum of Natural History, Smithsonian Institution.

Tomkins, H., B. Asmussen, S. Ulm and P. Faulkner. Completed ms. The Molluskan Remains of Tanamu 1: Subsistence and Resource Habitats. In B. David, T. Richards, I.J. McNiven and K. Aplin (eds), Lapita to Post-Lapita Transformations at Caution Bay: Cultural Developments Along the South Coast of Mainland Papua New Guinea. Caution Bay Studies in Archaeology, Volume 2.

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