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Summary of Vertebrate and Molluscan Assemblages Excavated from Late-Pleistocene and Holocene Deposits at Khao Toh Chong Rockshelter, Krabi, Thailand

Cyler Conrad*[1], Hannah G. Van Vlack[2], Ben Marwick[3], Cholawit Thongcharoenchaikit[4], Rasmi Shoocongdej[5] and Boonyarit Chaisuwan[6]

[1]*University of New Mexico, Department of Anthropology, MSC01-1040, Anthropology 1, Albuquerque, New Mexico, USA*
[2]*San Jose State University, Department of Anthropology, Clark Hall Suite 469, One Washington Square, San Jose, California, USA*
[3]*University of Washington, Department of Anthropology, Box 353100, Seattle, Washington, USA*
[4]*National Science Museum, Technopolis, Khlong 5, Khlong Luang, Pathum Thani, Thailand*
[5]*Silpakorn University, Department of Archaeology, Naphrathard Road, Bangkok, Thailand*
[6]*15th Regional Office of Fine Arts Department, Srisoonthon Road, Phuket, Thailand*

ABSTRACT: The zooarchaeological record of a recently excavated rockshelter site in peninsular Thailand is summarized. Detailed identification of mammalian, reptilian, piscean and molluscan taxa indicate a unique foraging pattern of prehistoric humans throughout the late-Pleistocene to Holocene.

KEY WORDS: vertebrate and molluscan assemblages, late-Pleistocene and Holocene deposits, Khao Toh Chong, Krabi, Thailand.

INTRODUCTION

Khao Toh Chong Rockshelter is a site which was excavated June through July 2011 outside of Krabi, Thailand (Fig. 1). Khao Toh Chong (KTC) is significant to Southeast Asian archaeology because of its similarities and proximity to Lang Rongrien, a site with a long but sparse archaeological sequence (Anderson, 1990; Mudar and Anderson, 2007). KTC has potential to address questions of human adaptation raised by previous work in the region due to its high-resolution archaeological deposit. The archaeological and faunal records indicate that the excavated deposit spans from the late-Pleistocene until recent times (Fig. 3; see Marwick *et al*., 2013 for more details). During excavations the deposit was observed to be relatively undisturbed with intact stratigraphy. Faunal remains indi-cate prehistoric human exploit-tation of freshwater dwelling shell-fish and turtles or tortoises, as well as a variety of small and large sized mammals. Mollusk discard rates appear to peak in the early Holocene, coincident with the increased

*Corresponding author.
E-mail: cylerc@unm.edu

monsoonal precipitation. Vertebrate remains show the reliance on artiodactyla during the terminal Pleistocene, followed by the exploitation of reptiles. We attribute this shift to adaptation of human foraging and hunting behaviours, to local environmental conditions.

MATERIALS AND METHODS

Two trenches, A and B, were excavated in four one by one meter units (Fig. 2). In Trench A, the southernmost trench, excavations reached a depth of 1.1 meters below the surface (mbs) (Fig. 3). In trench B, the northernmost trench, excavations were obstructed by bedrock in the northwest and southwest units. Subsequently, excavation depths in trench B extended to approximately 2.0 meters in the northeast and southeast units. A 0.03 m screen was used to sieve the upper strata, while a 0.10 m screen was used to sieve lower strata sediment during the excavation because the high clay content made it difficult for the deposit to pass through the smaller mesh.

Zooarchaeological analyses were performed on all faunal material excavated from the southwest unit of Trench A. Mammalian, reptilian, and piscean taxa were identified using standard zooarchaeological reference manuals (Lekagul and McNeely, 1977; Auetrakulvit, 2004; France, 2009 and Ankel-Simons, 2000). Molluscan taxa were identified using the comparative collections of the National Science Museum of Thailand and additional mollusk references manuals (Swennen *et al.*, 2001; Jiwaluk *et al.*, 2007 and Sucharit and Panha, 2008). The identification processes were hampered by the lack of comparative skeletal material for mammalian, reptilian and piscean taxa. As such, identification of the former was generally broad based in order to limit identification error and provide a basis for future analysis. Avian taxa were absent from this unit of the KTC assemblage. Number of identified specimen (NISP) counts were used to record the abundance of faunal taxa per stratigraphic unit (Lyman, 2008).

A digital palm scale was used to record the mass of identified elements to the nearest 0.1 gram. Standard inter-landmark dimen-sions were taken in millimeters, when applicable. In addition, identification of cut marks and burning were noted for both mollusk and vertebrate remains. Photographs of complete mollusk specimens were taken using a Canon EOS60D digital camera (Figs. 4 and 5). All archaeofaunal specimens are deposited at the Department of Archaeology, Silpakorn University, Bangkok, Thailand.

Figure 1. Approximate location of Lang Rongrien Rockshelter (1) and Khao Toh Chong Rockshelter (2) outside of Krabi, southern Thailand.

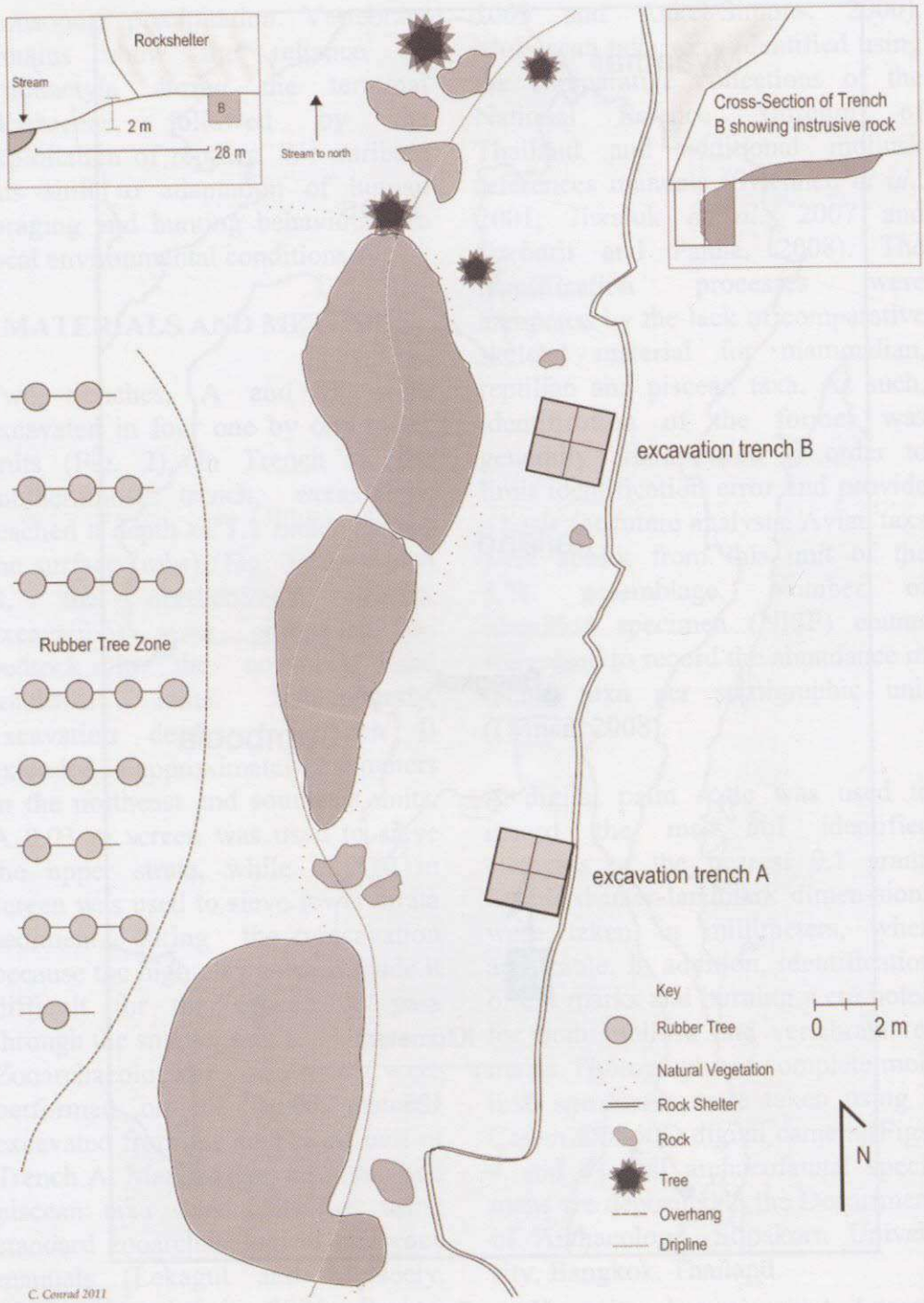

Figure 2. KTC trench location and site morphology (Marwick *et al*., 2013).

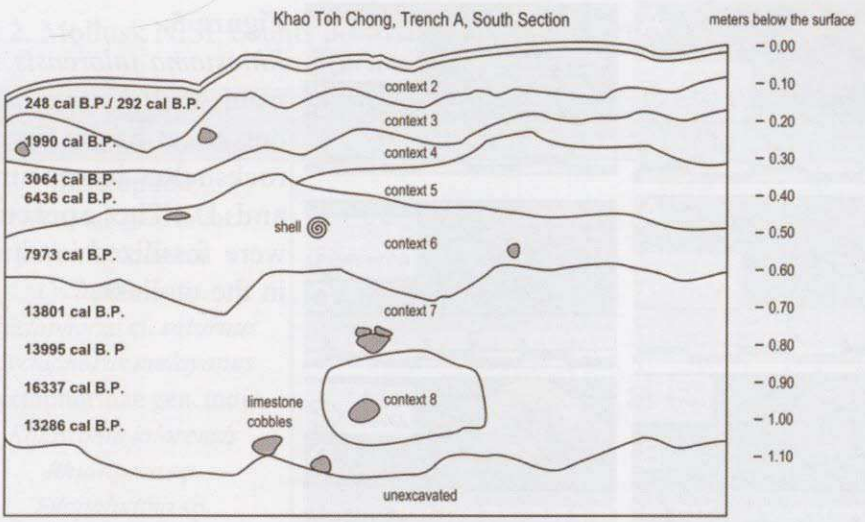

Figure 3. KTC stratigraphy, radiocarbon dates and sample origin in Trench A (Marwick *et al.*, 2013).

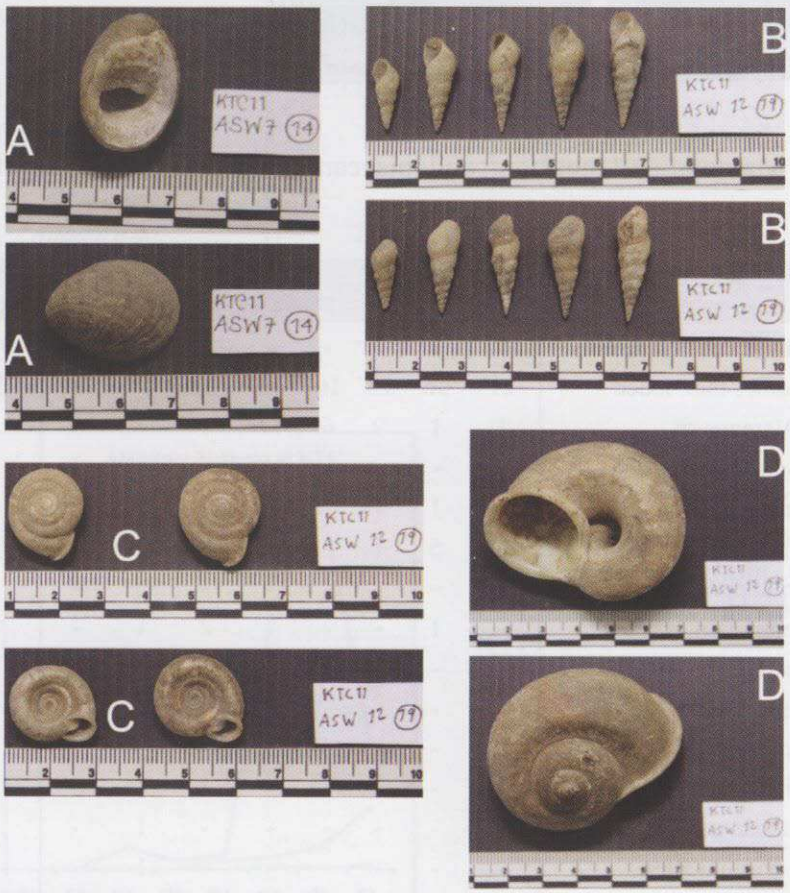

Figure 4. Shells from unit ASW- A. *Nerita balteata* B. *Neoradina prasongi* C. *Plectopylis degerbolae* D. *Cyclophorus malaynus*.

Figure 5.
Rhiostoma jalorensis shells from ASW Notice calcareous effect of the limestone rockshelter in specimen B and D. The operculums were fossilized in situ with in the mollusk.

Table 1. Mammalian, reptilian, and piscean NISP counts per stratigraphic context.

NISP Taxa per Stratigraphic Context	2	3	4	5	6	7H	8	7L	NISP∑
Osteichthyes subclass indet.	5	-	-	-	-	2	-	-	7
Testudines fam. indet.	21	36	25	10	42	26	11	44	215
Varanus sp.	1	1	9	6	12	4	1	5	39
Pythonidae gen. indet.	-	-	-	-	-	-	-	1	1
Primates fam. indet.	2	1	-	-	1	-	-	2	6
Macaca sp.	-	5	1	-	-	8	-	3	17
Trachypithecus obscurus	-	-	-	-	-	-	2	-	2
Rodentia fam. indet.	-	1	-	-	-	2	1	-	4
Rattus remotus	-	-	-	-	-	1	-	-	1
Cannomys badius	-	-	-	-	-	-	-	2	2
Atherurus macrourus	-	-	-	-	1	-	-	-	1
Carnivora fam. indet.	-	-	-	-	-	1	-	-	1
Tragulidae gen. indet.	-	-	-	-	-	-	1	-	1
Cervus unicolor	-	-	-	-	-	-	1	-	1
Muntiacus muntjak	-	-	-	-	-	-	1	3	4
Bovidae gen. indet.	-	-	-	-	-	-	-	1	1

Table 2. Mollusk NISP counts per stratigraphic context.

NISP Taxa per Stratigraphic Context	2	3	4	5	6	7H	8	7L	NISP∑
Gastropoda									
Neritidae gen. indet.	-	-	1	-	-	-	-	-	1
Nerita balteata	-	-	-	-	2	-	-	-	2
Cyclophorus sp.	-	-	-	-	-	7	-	-	7
Cyclophorus cf. *saturnus*	-	-	-	-	-	-	-	1	1
Cyclophorus malayanus	-	-	-	-	9	1	-	1	11
Cyclophoridae gen. indet.	-	2	3	2	1	28	5	30	71
Rhiostoma jalorensis	-	-	2	2	10	9	2	2	27
Rhiostoma sp.	-	-	-	-	-	6	3	2	11
Filopaludina sp.	-	-	2	-	-	-	-	-	2
Viviparidae gen. indet.	-	1	-	-	-	-	-	-	1
Pila sp.	-	-	-	-	-	2	4	-	6
Ampullariidae gen. indet.	-	-	-	-	-	3	-	3	6
Neoradina prasongi	-	8	134	52	82	1584	2215	771	4846
Telescopium telescopium	-	-	3	2	3	4	2	-	14
Muricidae gen. indet.	-	1	4	-	1	-	-	-	6
Plectopylis degerbolae	-	-	1	-	1	2	3	5	12
Amphidromus atricallosus	-	-	1	-	1	1	-	-	3
Bivalvia									
Anadara sp.	-	1	-	-	-	-	-	-	1
Arcidae gen. indet.	-	-	3	-	1	-	-	-	4
Pseudodon sp.	-	-	1	9	-	-	-	-	10
Amblemidae gen. indet.	-	-	-	-	56	72	143	372	643
Corbiculidae gen. indet.	-	-	-	-	-	1	-	-	1

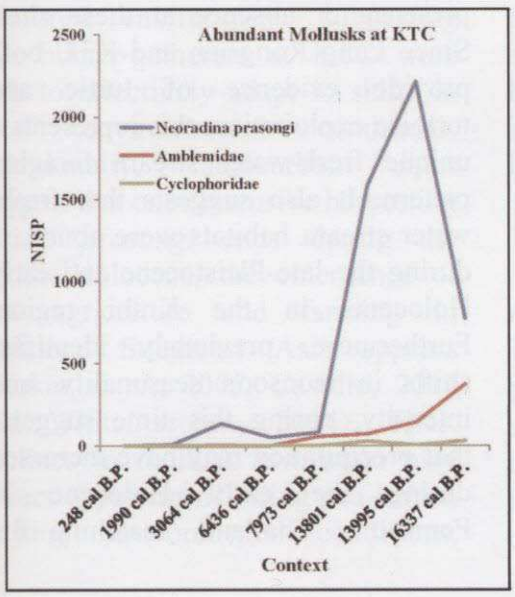

Figure 6.
Shifting *Neoradina prasongi*, Amblemidae, and Cyclophoridae abundance throughout the late-Pleistocene and Holocene at KTC.

DISCUSSION

KTC rockshelter has a remarkably undisturbed record of mammalian, reptilian, piscean and molluscan assemblages present in situ. The invertebrate record at the rockshelter provides a unique and detailed description of molluscan taxa and subsistence patterns during periods of occupation. *Neoradina prasongi* molluscs were abundant during the late-Pleistocene, but much less frequent during the mid and late Holocene.

As Brandt (1974) describes, *Neoradina prasongi* mollucs live in fresh-water stream habitats. At KTC, *N. prasongi* shells constitute the bulk of molluscan food waste in the archaeological assemblage. The period of peak discard rates for *N. prasongi* is approximately 13ky cal B.P., suggesting that the most intensive use of the rockshelter occurred during this time. Utilization of this mollusk also indicates that freshwater stream habitats occurred in proximity to the rockshelter during the late-Pleistocene and early Holocene. Mudar and Anderson (2007) have suggested that during the late-Pleistocene a drier and more open environment occurred in the Krabi region, this period was also characterized by increased monsoon seasonality. During the peak mollusk discard period of the late-Pleistocene, a drier and more open environment would have allowed hunter-gatherer groups to utilize large artiodactyls in the grassland-savannah habitat, alongside *N. prasongi* in seasonally abundant fresh-water stream resources. Occurrence of abundant turtle or tortoise remains at KTC also suggests that fresh-water stream habitats were found in proximity to the site throughout the late-Pleistocene and early-Holocene.

At Lang Rongrien the abundant Testudines elements through time provided evidence that a previously unidentified record of Southeast Asian turtle and tortoise exploitation occurred at the rockshelter (Mudar and Anderson, 2007). This record also appears at KTC with the presence of abundant Testudines specimens throughout the late-Pleistocene and Holocene deposits. Although, at archaeological sites located near KTC and Lang Rongrien, this record was not identified. Moh Khiew Cave and Sakai Cave in southern peninsular Thailand both had very low abundances of Testudines remains during the late-Pleistocene and Holocene (Pookajorn, 1996). Generally, Testudines elements were only identified by presence or absence at these sites. Since Lang Rongrien and KTC both provide evidence of turtle and tortoise exploitation, this represents a unique fresh-water stream foraging pattern. It also suggests that fresh-water stream habitats were abundant during the late-Pleistocene and early Holocene, in the Krabi region. Furthermore, previously identified shifts in monsoon seasonality, and intensity, during this time suggests that precipitation may have increased during the early Holocene in Peninsular Thailand, matching the

faunal record at KTC (Marwick and Gagan, 2011).

The declining exploitation of freshwater *N. prasongi* molluscs into the Holocene may reflect the shift from freshwater to mangrove swamp habitats in this region or a shift in the foraging dynamics of prehistoric groups (Shoocongdej, 2000 and 2010). Rising sea-levels throughout the Holocene would have shifted mangrove environments closer to the rockshelter overtime, which may have influenced the abundance and distribution of locally available resources and freshwater stream environments (Anderson, 1990; Horten *et al.*, 2005; Tjia, 1996, and Sinsakul, 1992). As Barker *et al.* (2005) describes, archaeologists in Southeast Asia have recently tried to identify how effectively late-Pleistocene hunter-gatherers utilized tropical rainforest environments. Initial faunal data from KTC describes a pattern of hunter-gather groups utilizing a diverse range of locally available taxa in the tropical rainforest environment, suggesting that hunter-gatherers at KTC were able to effectively adapt to shifts in local environmental conditions. Additionally, radiocarbon dates suggest that once intensive harvesting of *N. prasongi* ends during the middle-Holocene, the emergence of rice agriculture and farming in mainland Southeast Asia appears (Barker *et al.*, 2005; Castillo, 2011 and White *et al.*, 2004). Thus, declines in mollusk utilization may reflect a pattern of rising sea-levels, shifting environmental conditions, and occurrence of agriculture during the mid and late-Holocene in peninsular Thailand.

Our data from KTC not only suggests that a subsistence change occurred at the Pleistocene-Holocene transition, but that foragers utilizing the rockshelter displayed a unique pattern of faunal exploitation not previously seen at archaeological sites in Thailand. As Bulbeck (2003) describes, large abundances of shellfish in rockshelter sites tend to date to the middle-Holocene when a transition towards a broad-spectrum diet occurs, not during the terminal Pleistocene. The earlier peak in the molluscan assemblage at KTC suggests that a different pattern of shellfish exploitation occurred here, one that we link to local environmental conditions. This suggests that the diversity of past human subsistence behaviours in this region may have been underestimated and broader diets may have appeared earlier than previously observed. Khao Toh Chong is a valuable archaeological and palaeoecological resource aiding the understanding of hunter-gatherer subsistence behaviours in Southeast Asia during the late-Pleistocene and Holocene.

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