TALKING TEETH: DENTAL NON-METRIC TRAITS OF WOODEN-COFFIN PEOPLE IN THE PANG MA PHA CAVE SITES, NORTHWESTERN THAILAND

Supaporn Nakbunlung[1] and Sukhontha Wathanawareekool[2]

[1]Department of Sociology and Anthropology, Chiang Mai University, Thailand
[2]Sydney University Village (Rm 2428), 90 Carillon Avenue, Newtown NSW 2042, Australia

ABSTRACT

A number of human bones and teeth have been found associated with wooden coffins in northwestern Thailand dated between 2080±60 and 1240±90 BP (Grave et al. *1994). These discoveries raise many questions: Who were those people found in the Pang Ma Pha cave sites? Where did they come from? Are they related to any of the living ethnic groups in the area? As part of the broader attempt to answer these questions, teeth have been examined first. Almost 500 teeth, all separated from the mandible and maxilla, have been identified and categorized. Using non-metric traits, upper incisor shoveling and double-shoveling have been studied. Examination of their teeth shows that these wooden coffin people have a low degree of shoveling, similar to Turner's Southeast Asian Sundadont dental category.*

Human skeletons found during an archaeological expedition always lead to questions about genetic inheritance, prehistoric migratory routes and biological distance related to living ethnic groups in the area. Similar questions can be addressed for the Pang Ma Pha cave sites, Mae Hong Son province in northwestern Thailand, made famous by Chester Gorman (1971) as the 'Spirit Caves'. This name came from the unique characteristics of these sites - wooden coffins. This paper is focused on the human dental remains found as surface finds, in apparent association with these wooden coffins, during many archaeological field seasons.

Although teeth can be easily worn out in the living, they are one of the best forms of osteological evidence preserved after death. Dental evidence is a key to personal identification in forensic science. Among archaeological populations, tooth morphology can be used to identify related populations. Teeth carry not only genetic, but also cultural information (Ring 1985). In this study, dental morphological variables are analysed to assess biological similarities.

Previous studies on dental non-metric traits have been focused on shovel-shaped incisors in both living (Srisopark 1968) and archaeological populations in Thailand (Dhiravarangkura 1988). The shovel-shaped incisor has been identified as a marker for so-called Mongoloids, especially Chinese (Turner 1989). However, there is much variation in the shovel-shaped incisor category; Hrdlicka (1920) and Turner *et al.* (1991) categorized them into 4 and 7 grades, respectively. The Chinese show not only the strongest grades of shoveling, but also the highest frequencies. Recently, the study of shovel-shaped incisors has become of interest to Thai scholars (Vajrabhaya *et al.* 1996, Pinnoi 1993).

MATERIALS AND METHODS

Four hundred and sixty-seven human teeth were collected from 16 archaeological cave sites in Pang Ma Pha district, Mae Hong Son province, northwestern Thailand. They are all isolated loose teeth. Each has been carefully identified and categorized, using the guidance of Bass (1987), Alt and Türp (1998) and Academic Group (n.d.) and with reference to teeth held in the Anthropological Laboratory at Chiang Mai University.

The method used in this study is the Arizona State University (ASU) Dental Anthropology System (Turner *et al.* 1991). Eight of the twenty-eight major traits in this system are significant variables for characterizing closely related 'Mongoloid' populations (Turner 1989, 1990). Due to some limitations in these archaeologically derived samples, only two of the eight traits mentioned above were used as diagnostic morphological features in this study. These are upper central incisor (UI1) shoveling and upper central incisor (UI1) double-shoveling.

The traits were observed and scored according to the scale intervals used on the ASU plaques. There are 7 grades, from 'none' through 'markedly shovel-shaped' for UI1 shoveling (Figure 1) and 7 grades from 'none' through 'extreme' for double-shoveling (Turner *et al.* 1991). Each tooth was scored three times for the purpose of consistency.

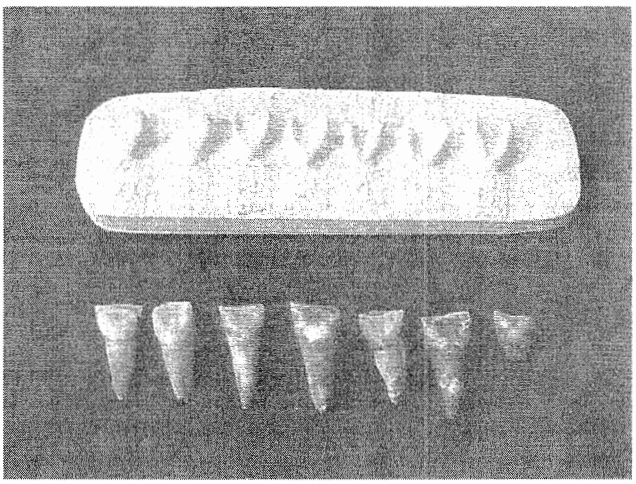

Figure 1: Grades of UI1 shoveling (Turner et al. *1991).*

Table 1: Grades of upper central incisor shoveling

Scoring Grade*	Percentage
0 = None	28.1
1 = Faint	17.1
2 = Trace	12.8
3 = Semi-shovel-shaped	33.1
4 = Semi-shovel-shaped	4.2
5 = Shovel-shaped	0.5
6 = Markedly shovel-shaped	4.2
Total	100%

* Following ASU system

Table 2: Grades of upper central incisor double-shoveling

Scoring Grade*	Percentage
0 = None	49.7
1 = Faint	18.1
2 = Trace	9.3
3 = Semi-double-shovel-shaped	22.9
4 = Double-shovel-shaped	0.0
5 = Pronounced double-shovel-shaped	0.0
6 = Extreme double-shovel-shaped	0.0
Total	100%

* Following ASU system

RESULTS

The results in Table 1 show that 28.1% of the upper central incisors have no trace of shoveling, 29.9% are in grades 1 and 2, 37.3% are semi-shovel-shaped and less than 5% are markedly shovel-shaped. As for double-shoveling, shown in Table 2, 49.7% have no trace, 27.4% have slight traces, but only 22.9% are semi-double-shovel-shaped and none are double-shovel-shaped.

The sample therefore shows that the wooden coffin people rarely had shoveled or double-shovel-shaped incisors.

DISCUSSION

Following Turner's (1989) criteria for Sundadonty in Southeast Asian teeth and Sinodonty in Northeast Asian teeth, the latter can be characterized by having a greater proportion of shovel-shaped and double-shovel-shaped incisors than the former. The dental characteristics of the wooden coffin people in the Pang Ma Pha caves can then be compared with the formal definitions for Sundadonty and Sinodonty. Of the two traits tested, both showed significant mean differences with the Sinodont category (Table 3). The occurrence of shoveling in 42.0% of UI1 teeth falls less than one standard deviation above the Sundadont mean, but over 2.5 standard deviations below the Sinodont mean. The occurrence of double-shoveling in 22.9% of cases falls less than one standard deviation above the Sundadont mean, but almost exactly 1.5 standard deviations below the Sinodont mean.

Mae Hong Son, where our samples were collected, is located between the main areas of Southeast Asian Sundadonty and Northeast Asian Sinodonty. Turner (1989) proposed that Sundadonty was the more generalized state that gave rise to the more specialized Sinodonty. Historically speaking, some of the hill peoples who have recently migrated into Thailand (Schliesinger 2000), such as the Akha and the Yao (or Mien), have more Sinodont than Sundadont characteristics (Manabe *et al.* 1997). However, according to dental non-metric traits, the Pang Ma Pha archaeological population resembled Turner's Sundadont complex the most closely.

Previous studies of dental morphology in Thailand have usually reported that shoveling was characteristic of Southeast Asian teeth. Unlike some others, this study follows Turner's (1990) separation points between the shovel-shaped and non-shovel-shaped categories, with his grades from 3 to 6 being considered as shovel-shaped. Applying these separation points, the Pang Ma Pha population had only low shoveling, as shown in Table 4.

Table 3: Significant paired t-test scores between Sundadont, Sinodont and Pang Ma Pha samples

Trait	Sundadont*			Pang MaPha		Sinodont*	
	Mean	S.D.	*p*	Mean	*p*	Mean	S.D.
UI1 shovel-shaped **	30.8	15.8	*>.05*	42.0	*<.05*	71.1	11.5
UI1 double-shovel-shaped**	22.7	18.2	*>.05*	22.9	*<.1*	55.8	21.9

* After Turner (1990)
** The sum of grades 3-6

Table 4: Comparisons of UI shoveling according to the use of different grading criteria

Site	No.	Shoveling expression (%)				% Shovel-shaped	
		None (0)	Trace (1-2)	Semi (3-4)	Marked (5-6)	(3-6)	(1-6)
Pang Ma Pha	43*	28.1	29.9	37.3	4.7	42.0	71.9
Kok Phanom Di[1]	31**	25.8	41.9	25.8	6.5	32.3	74.2
Recent Thai[2]	49*	37.8	12.3	24.5	24.5	49.0	61.3
Sakai modern[3]	45**	44.5	40.0	13.3	2.2	15.5	55.5

[1]Dhiravarangkura (1988)
[2]Srisopark (1968) – recent Thai and Chinese Thai from Siriraj Collection
[3]Pinnoi (1993).
*UI1 **UI1 and UI2

CONCLUSION

Dental morphologies are useful evidence for assessment of biological similarities between populations. This preliminary study confirms that shoveling traits can be of key significance for population comparisons. However, the standard method should be applied for comparative studies.

ACKNOWLEDGEMENTS

We would like to thank Rasmi Shoocongdej who persuaded us to become involved in the Highland Archaeology Project in Pang Ma Pha district, Mae Hong Son province. This research has been supported by the Thailand Research Fund. Our thanks also go to Chris King who kindly provided us with the set of the ASU dental morphological plaques and to Nuttamon Pureepatpong, Atisak Chuengpattanawadee and Tummanoon Wongsawadiwat, who were very helpful during the process of dental identification. Thanks are extended to Putchong Kulthonbutre, Laxmi Worachai, Jureerat Thomas, Gary Suwannarat and Peter Bellwood for their comments. The Asian-Pacific Area Research Program, Academia Sinica, in Taiwan generously offered partial funding for the presentation of this paper at the 17th Congress of IPPA.

REFERENCES

Academic Group, Dentistry Student Club, Chulalongkorn University. n.d. *Dental Anatomy*. Chulalongkorn University, Academic Group, Dentistry Student Club (in Thai).

Alt, K.W. and J.C. Türp. 1998. Hereditary dental anomalies. In K.W. Alt, F.W. Rosing and M. Teschler-Nicola (eds), *Dental Anthropology*, pp. 95-128. Vienna: Springer-Verlag.

Bass, W.M. 1987. *Human Osteology: A Laboratory and Field Manual*. Columbia: Missouri Archaeological Society, Inc.

Dhiravarangkura, P. 1988. Shovel-shaped incisors of prehistoric people at Kok Phanom Di: Part 1. *Chulalongkorn University Dental Journal* 11(1-3):9-15 (paper in Thai with English abstract).

Gorman, C.F. 1971. *Prehistoric Research in Northern Thailand: A Cultural-Chronographic Sequence from the Late Pleistocene through to the Early Recent Period*. PhD dissertation, Department of Anthropology, University of Hawai'i.

Grave, P., J. Spies, M. Barbetti and M. Hotchkis. 1994. Dating of log coffins of northwestern Thailand. Paper presented at IPPA Conference, Chiang Mai: 5-12 January.

Hrdlicka, A. 1920. Shovel shaped teeth. *American Journal of Physical Anthropology* 3:429-65.

Manabe, Y., R. Ito, Y. Kitagawa, J. Oyamada, A. Rokutanda, S. Nagamoto, S. Kobayashi and K. Kato. 1997. Non-metric tooth crown traits on the Thai, Aka and Yao tribes of Northern Thailand. *Archieves of Oral Biology* 42(4):283-91.

Pinnoi, C. 1993. Shovel-shaped hncisors of Hunter-gatherer group Sakai, Trang province. *Chulalongkorn University Dental Journal* 16(3):213-9 (paper in Thai with English abstract).

Ring, M.E. 1985. *Dentistry: An Illustrated History*. New York: Harry N. Abrams, Inc.

Schliesinger, J. 2000. *Ethnic Groups of Thailand: Non-Tai-Speaking Peoples*. Bangkok: White Lotus.

Srisopark, S. 1968. A *Study on the Size of Permanent Teeth, Shovel-shaped Incisors and Paramolar Tubercle in Thai Skulls*. Masters dissertation in Basic Medical Sciences (Anatomy), University of Medical Sciences, Thailand.

Turner, C.G. II. 1989. Teeth and prehistory in Asia. *Scientific American* 260:88-96.

Turner, C.G. II. 1990. Major features of Sundadonty and Sinodonty, including suggestions about East Asian micro-evolution, population history, and Late Pleistocene relationships with Australian Aborigines. *American Journal of Physical Anthropology* 82:295-317.

Turner, C.G. II, C.R. Nichol and G.R. Scott. 1991. Scoring procedures for key morphological traits of the permanent dentition: The Arizona State University Dental Anthropology System. In M.A. Kelly and C.S. Larsen (eds), *Advances in Dental Anthropology*, pp. 13-31. New York: Wiley-Liss.

Vajrabhaya, T., C. Pinoi, T. Teerawattanapong, T.L. Thongkam, P. Kullawanich, P. Dhiravangkura, S. Rapisuwan and S. Poolsuwan. 1996. *Index for the Tai: Linguistic and Biological Interpretation*. Mimeograph (in Thai). Paper presented at the 6th International Conference on Thai Studies at Chiang Mai, Thailand, 14-17 October.