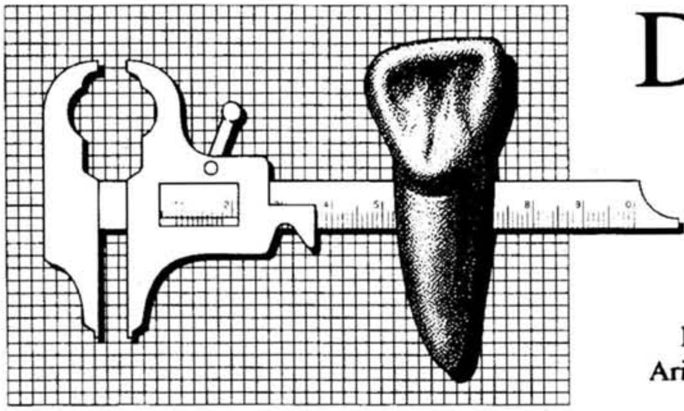

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Preliminary Impression of Current Dental Anthropology Research in China

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As the only two members of the Dental Anthropology Association in mainland China, we are both watching and experiencing the rapid development of dental anthropology in this big country. From 1991 to 1992, through the aid of a fellowship from Academia Sinica, Liu Wu studied dental anthropology under Dr. Christy G. Turner, II, of Arizona State University. With Liu's efforts, the scoring procedure of the Arizona State University Dental Anthropology System has been introduced to China. Several institutions, including IVPP, Institute of Archaeology of Chinese Academy of Social Sciences and Jilin University in Manchuria are now using the system. Dental morphological study has grown over the past two years and now plays a significant role in the field of anthropology.

Current dental anthropology research focuses on the following topics:

1. dental morphology of the inhabitants of China from the Neolithic (about 5,000-7,000 BP) to present;
2. dental pathology of Neolithic and historic inhabitants of China;
3. biological relationship of Chinese populations to neighboring peoples in East Asia;
4. temporal changes and microevolution of human dental morphological traits since the late Pleistocene (and earlier) in China; and
5. a dental interpretation for the origin of modern Chinese.

NEOLITHIC SAMPLES

Last year three dental collections were obtained from the archaeological sites listed in Table 1 and shown on the map in Fig. 1. Liu Wu analyzed the dental morphology of the first two samples. Professor Zhu Hong of Department of Archaeology, Jilin University, joined the senior author to observe the teeth of Miaozigou site. The statistical analysis included comparisons with dental morphological data of other Asian populations. The teeth of Longxian are still under analysis by the present authors with the support from the National Science Foundation of China.

TABLE 1. The dental collections under current study.

Sample	Number	Provenience
Xiawanggang	156	Neolithic (5,000 BP) Xichuan county, Henan province
Miaozigou	28	Neolithic (5,500-5,000 BP) Inner Mongolia
Longxian	140	Zhanguo period (2,000 BP) Shanxi province

Although the entire study is not yet complete, we can offer the following preliminary summary. In general, the frequencies of most dental morphological traits of the North Chinese Neolithic humans are quite similar to those of other Northeast Asians and are different from Southeast Asians. This is especially true of shovel-shaped incisors, double-shoveled incisors,

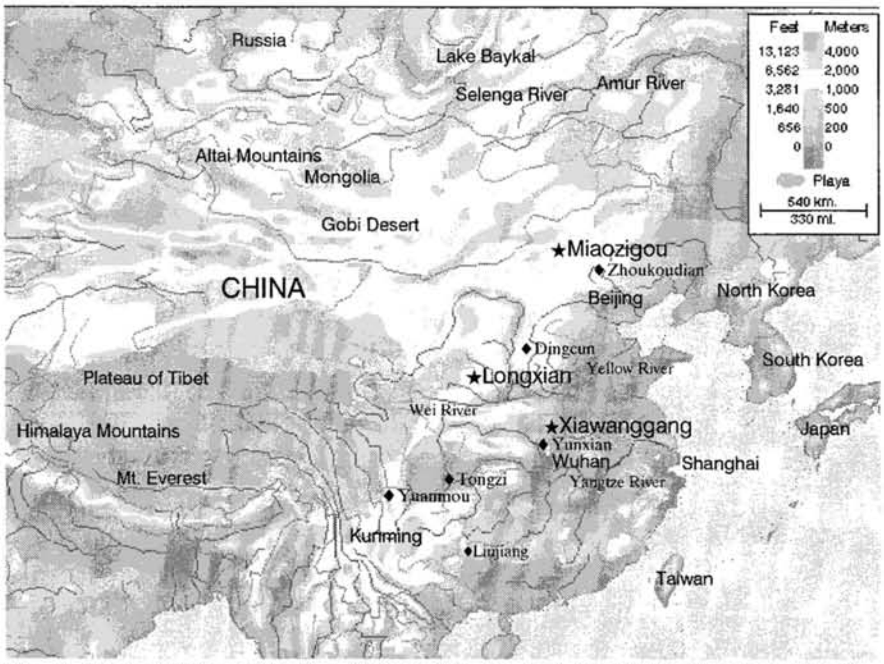

Fig. 1. Map of China with sites discussed in the text. Neolithic sites marked with a star; fossil sites, with a diamond.

upper molar enamel extensions, lower molars deflecting wrinkle and three-rooted lower first molars. Statistical analyses of MMD's (mean measure of divergence) show that the inhabitants of Xiawanggang and Miaozigou sites are dentally more like Anyang and other Northeast Asians than Southeast Asians. Cluster analysis indicates the two populations are positioned in the Sinodonty branch of Turner's terminology of Sundadonty and Sinodonty in East Asia.

Table 2 has frequencies for 29 key morphological traits of the Arizona State University Dental Anthropology System for Xiawanggang and Miaozigou, the two Neolithic human groups. The dental morphology of these samples can be summarized as follows:

1. Upper central incisor winging is common.
2. Shovel-shaped incisors occur frequently, and expression is marked, especially on UI1. The frequency on UI1 is about 90% and mainly in grades 3 and 4.
3. Double-shoveling on UI2 is common and expressed well with frequencies of 52.7% - 57.9%.
4. Interruption groove occurs on 46.2% - 75% of the lateral incisors.
5. *Tuberculum dentale* of UI2 are common but mainly in the weak grades (1-3).
6. A maxillary canine mesial ridge (Bushman canine) is extremely rare and never occurs in strong grade.
7. Upper canines with distal accessory ridges are common.
8. No Uto-Aztecan premolar was found.
9. Nearly all upper molars have a hypocone, which is usually large.
10. Cusp 5 on upper molars occurs in low frequencies (4.0% - 16.7%) and in weak expression.
11. Carabelli's cusp is rare.
12. The parastyle on upper molars are rare.
13. Upper first molar enamel extensions are common with frequencies of 51.7% - 81.3%.
14. One-rooted upper first premolar frequency ranges from 60.7% - 68.5%.
15. Three-rooted upper second molars are very common.
16. Peg/Reduced/congenital absence of upper third molars is uncommon, with frequencies of 15.4% and 16.2% respectively.
17. Lower second premolars with more than one cusp occur on 77.8% - 87.0% of the teeth.
18. Y-groove pattern of lower second molars is uncommon with frequencies of 5.8% - 12.5%.
19. 14.8% - 31.3% of lower first molars are six-cusped.
20. Four-cusped lower second molars in Miaozigou are low (18.8%), and in the other sample of Xiawanggang are common (27.6%).
21. Deflecting wrinkle of lower first molars is very common.

TABLE 2. Frequencies of 29 dental morphological traits of Xiawanggang and Miaozigou.

	Winging UI1	Shoveling UI1	Double-shoveling UI1	Interruption groove UI2	*Tuberculum dentale* UI2	Mesial ridge UC	Distal accessory ridge UC	Hypocone UM2	Cusp 5 UM1	Carabelli's cusp UM1
	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)
Xiawanggang	33.3 (6)	90.1 (71)	52.7 (74)	46.2 (78)	35.9 (78)	5.9 (101)	45.3 (53)	98.3 (120)	4.0 (125)	0.0 (128)
Miaozigou	— —	100.0 (17)	57.9 (19)	75.0 (20)	45.0 (20)	0.0 (24)	46.2 (13)	88.2 (18)	16.7 (18)	11.8 (17)
Presence/Grades	1,2/0-4	3-6/0-6	2-6/0-6	+/+,-	1-6/0-6	1-3/0-3	2-5/0-5	2-5/0-5	1-5/0-5	2-7/0-7

	Parastyle UM3	Enamel extension UM1	One-rooted UP1	Three-rooted UM2	Peg/reduced /congenital absence UM3	1>Lingual cusp LP2	Y-groove pattern LM2	Six-cusped LM1	Four-cusped LM2	Deflecting wrinkle LM1
	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)
Xiawanggang	3.2 (93)	51.7 (120)	68.5 (149)	77.4 (115)	16.2 (111)	77.8 (135)	5.8 (155)	14.8 (162)	27.6 (156)	60.3 (73)
Miaozigou	5.6 (18)	81.3 (16)	60.7 (28)	88.9 (18)	15.4 (13)	87.0 (23)	12.5 (16)	31.3 (16)	18.8 (16)	100.0 (13)
Presence/Grades	1-6/0-6	2-3/0-3	1/1-3	3/1-4	+/+,-	2-9/0-9	Y/Y,X,+	6/4-6	4/4-6	2-3/0-3

	Distal trigonid crest LM1	Protostylid LM1	Cusp 7 LM1	Tomes root LP1	Two-rooted LC	Three-rooted LM1	One-rooted LM2	Odontome Premolars	Uto-Aztecan UP1
	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)	% (n)
Xiawanggang	37.0 (92)	23.2 (181)	2.6 (155)	70.1 (137)	0.7 (152)	36.4 (187)	31.0 (184)	0.6 (831)	0.0 (140)
Miaozigou	50.0 (14)	53.3 (15)	11.8 (17)	76.0 (25)	3.7 (27)	47.6 (21)	27.8 (18)	1.6 (192)	0.0 (28)
Presence/Grades	+/+,-	1-7/0-7	1-5/0-5	1-5/0-5	2/1,2	3/1-3	1/1-3	+/+,- (teeth)	+/+,-

% is the frequency. (N) is the number of observable dentitions. Presence-absence breakpoints expressed as Presence (grades indicating presence)/Grades (range of grades for trait). Trait ranking criteria given in Turner et al. (1991).

22. Distal trigonid crest of lower first molars is common.
23. Protostylid of lower first molars are common but mainly in the weak grades (1-3).
24. Cusp 7 is not common.
25. 70.1% - 76.0% of lower first premolars have Tome's root
26. Two-rooted lower canines are rare.
27. Three-rooted lower first molars are very common with frequencies of 36.4% - 47.6%.
28. One-rooted lower second molars occur on 27.8% - 31.0% of the teeth.
29. Both upper and lower premolars with odontome are rare.

These findings indicate the two Neolithic collections are dentally quite similar to other Northeast Asian Sinodonts. Some differences are related to their geographic locations. The Xiawanggang site is closer to South China than Miaozigou, being situated on the Hanshui River, a branch of the Yangtze River. This may account for some of the southern dental patterns of this sample (low frequency of peg/reduced/congenital absence of UM3 and high frequency of four cusps of lower second molar). Similarly, the dental pattern in the more northern Miaozigou teeth make this group a typical Mongoloid population. Although no Neolithic human teeth from South China are available to describe, the current study suggests that the large dental differences between the peoples of South and North China go back to at least since Neolithic times.

OBSERVATIONS ON FOSSIL SAMPLES

In the meantime, the temporal changes and the course of evolution of certain morphological traits were studied by observing some fossil teeth found in China. Some traits were found to have existed as early as *Homo erectus*, and evolved until modern humans. Table 3 presents the occurrence and expression of shovel-shaped incisors and double-shoveled incisors on the fossil Chinese teeth.

TABLE 3. The occurrence of shovel and double-shovel upper incisor on the fossil teeth of some early humans in China.

Fossil teeth	Provenience	Date (BP)	Shoveling	Double shovel
Two central incisors	Yuanmou county, Yuannan South China	600,000 or 1.7 mya	present	trace
One central incisor	Zhoukoudian, Beijing	460,000-230,000	present	trace
One central incisor	Yunxian county, Hubei province	*Homo erectus*	present	trace
One central incisor	Dingcun, Shanxi province	210,000 - 160,000	present	marked
One central incisor	Tongzi, Guizhou province	181,000 - 115,000	present	absent
Liujiang Man skull	South China	670,000	?	absent

The main findings are as follows:

1. In addition to confirming the results of earlier investigators that shovel-shaped incisors exist on nearly all upper incisors of fossil teeth discovered in China, the present study reveals that double-shoveled incisors occur on the teeth of *Homo erectus* as early as 650,000 BP in the Yuanmou Man. Some temporal changes of double-shoveled incisors are indicated from the table. While the expressions of double-shoveling on all *Homo erectus* teeth are very weak, this trait is much more pronounced on the tooth of the early *Homo sapiens,* Dingcun Man. Liujiang Man does not possess this trait at all.
2. The upper central incisors of Yuanmou Man and the upper lateral incisors of Dincun Man all exhibit interruption grooves.
3. Enamel extensions were not present on any fossil teeth, suggesting this trait occurs only on the teeth of anatomically modern humans.
4. Both visual and X-ray inspection revealed two cases of congenitally absent third molars in the fossil specimens of China. In Lantian Man from Shanxi province (650,000 BP) both mandibular third molars are absent and in Liujiang Man the right upper third molar is congenitally absent.

5. Like shovel-shaped incisors, nearly all fossil lower molars found in China exhibit the deflecting wrinkle.
6. Three-rooted lower first molars were found on the right side of the mandible of the *Homo erectus* excavated from Zhoukoudian in 1959.
7. All the lower second molars of fossil teeth of China have five cusps.

SUMMARY

In sum, we have accumulated some basic dental morphological data for Neolithic human groups in north China. The preliminary impressions from the findings mentioned above also confirm south-north differences represented by Sundadonty and Sinodonty. Further analyses are necessary to explain some phenomenon revealed in this research, especially the temporal changes of certain dental morphological traits. Such an interpretation will demonstrate the course of the origin of modern Chinese. In the near future, some more dental and cranial specimens will be collected and the research will continue.

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The Anthropological Significance of Alveolalgia ("dry socket")

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The clinical syndrome known as "dry socket" (DS) is a frequently encountered complication of tooth extraction. The major symptom of this troublesome condition is a delayed-onset, excruciating pain following 2-4 days of minimal post-surgical discomfort (Archer, 1975, p.1106). Variously known as alveolalgia (inflammation of the alveolus), alveolar osteitis, and alveolitis, dry socket is characterized by 1) non-production or loss of socket blood clot, 2) improper granulation bed formation, and 3) localized jawbone inflammation (Schofield and Warren, 1981; Tomasetti et al., 1993). First documented a century ago, dry socket was initially described as "disintegration of a normal socket blood clot" (Crawford, 1896). X-rays can help to confirm the diagnosis of dry socket in two ways: a) by revealing another key defining indicator—"ghost imaging" of the socket, detectable up to three weeks following the extraction, and b) by ruling out jaw damage or sequestra (fragments of necrotic bone in the socket) as the source of the inflammation and pain (Abrahmsohn et al., 1993).

Reported incidence rates of dry socket range from 1-30% in various random and consecutive samples of dental removals, with an average of 3-5% for all extraction sites (Archer, 1975, p. 1628; Lilly et al., 1974). Dry socket incidence is highest in impacted mandibular tooth extractions, especially third molars where the rate of occurrence is 14-35% (Belinfante et al., 1973; Krekmanov, 1981). The latter author reported dry socket in 17.4% of a sample of 195 extraction patients with "partially erupted or totally impacted" mandibular third molars (Krekmanov, 1981).

While the exact cause of dry socket has been a debated issue among researcher since its initial discovery, "faulty healing" is usually cited as the principal precipitating factor. Amber (1973) pinpoints the pathogenesis to a disruption in the healing process between "Stage 1" (blood clot formation) and "Stage 2" (granulation tissue deposition) of normal extraction recovery. Lacking the necessary amount of granulation tissue, the bony walls of the empty socket are subsequently exposed to the outside air which may increase both the severity of the pain and the risk of local infection (Tomasetti et al., 1993).