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NONMETRIC ANALYSIS OF THE PERMANENT DENTITION OF BRONZE AGE TELL LEILAN, SYRIA

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Abstract: Dental nonmetric traits were scored on two hundred and fifty-three permanent teeth that were recovered from the ancient Mesopotamian site of Tell Leilan (mid-third millennium BC) in northeastern Syria. Conspicuous features of the dentition include a 40% frequency of winging, a mild form of semi-shoveling and an absence of double-shoveling, a rarity of accessory cusps, and morphologically conservative molars. Overall, the pattern of dental traits is comparable to patterns previously identified for archaeological sites in the Near and Middle East that are from a similar time period.

Key Words: Mesopotamia, biological distances, dental morphology.

Resumen: Este estudio registra los rasgos no métricos dentales de 253 dientes permanentes que fueron recuperados de un cementerio antiguo mesopotámico ubicado en Tell Leilan (mediados del tercer milenio a.C.) en el noroccidente de Siria. Características visibles de la dentición incluyen el 40% de frecuencia en aleteo, una forma intermedia de semi-pala y la ausencia de doble pala en incisivos, cúspides accesorias poco frecuentes y molares morfológicamente conservadores. En términos generales, el patrón de los rasgos dentales es comparable con patrones identificados previamente en otros sitios arqueológicos ubicados en el medio y cercano oriente y asociados a un periodo de tiempo similar.

Palabras clave: Mesopotamia, distancias biológicas, morfología dental.

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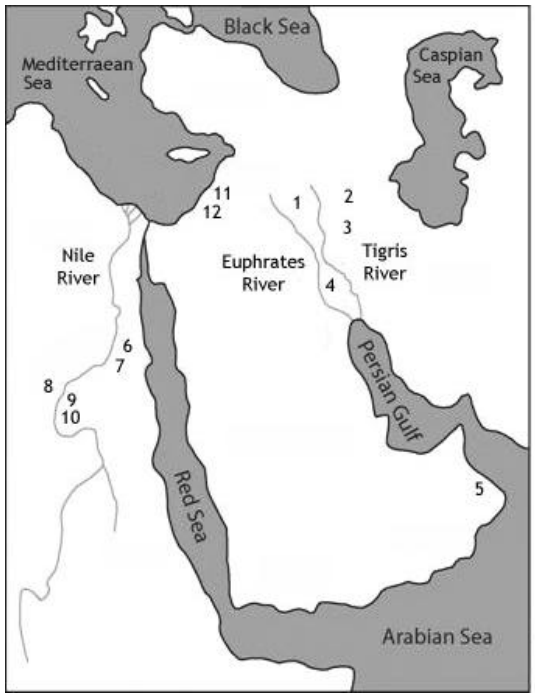
Introduction

This paper presents the results of the dental non-metric analysis of human remains from the northern Mesopotamian site of Tell Leilan in Syria (Figure 1) and is intended as a further contribution to the study of non-metric dental morphology in the ancient Near East. Dental non-metric traits have been recognized as valuable aids for assessing biological affinities between populations because these traits are highly heritable, largely independent of environmental influence, and show significant variation between populations (Scott and Turner 1997).

Figure 1. Map of the Near and Middle East showing the locations of Tell Leilan and other sites used for comparison in this study: 1 Tell Leilan; 2 Hasanlu; 3 Jarmo; 4 Kish; 5 Ra's al-Hamra; 6 Nubian C-Group; 7 Nubian Pharaonic; 8 Soleb; 9 Kerma; 10 Kawa; 11 Dothan; 12 Lachish.



There are few analyses of archaeological dentitions deriving from ancient Mesopotamia, perhaps because most excavations of human remains were conducted in the early part of the twentieth century at a time when dental studies were not valued components of osteological analysis. Although dental anthropological studies are now much more common, the political climate in the Near East has prevented further archaeological research at many ancient Mesopotamian sites, particularly in Iraq.

In recent decades, however, researchers have begun to explore the rich archaeological history of northern Mesopotamia (Weiss 1986) and as a consequence this new, albeit limited, data set from archaeological human remains from northeastern Syria is available for analysis and is described in this paper.

Materials

Situated on the fertile Habur Plains of northeast Syria, Tell Leilan began as a small, rain-fed agricultural settlement, typical of many settlements in northern Mesopotamia (Weiss et al. 1993). Occupied from the mid-sixth millennium BC, the site became one of the three major urban centers of Subir during the emergence of complex state society in Mesopotamia in the mid-third millennium BC (Weiss et al., 1993).

As part of a program of archaeological exploration at Tell Leilan, excavations by Yale archaeologist Harvey Weiss in 1979, 1980, 1985, 1987 and 1989 yielded skeletal remains that subsequently were sent to the University of Alberta for osteological analysis. The remains of 21 adults are derived from intramural burials and date mainly to the third millennium BC (Leilan Periods II and III).

Preservation is poor, especially of the crania. Due to under-collection as well as postmortem damage, antemortem tooth loss, incomplete formation, and severe occlusal wear, the number of teeth scoreable for one or more dental morphological trait is low: only 253 permanent teeth, which is approximately one-third of the potential total sample of permanent teeth.

Due to the small number of observable teeth and the relatively homogeneous cultural context, the remains are treated in this study as a cross-sectional sample from a single population. Sexes are pooled because accurate sex assessment was extremely difficult due to the incomplete and fragmentary state of the skeletal remains, but this should not affect the results because several studies have observed that the only dental trait to exhibit consistent and significant degrees of sexual dimorphism across diverse populations is the distal accessory ridge of the upper and lower canines (Irish 2005; Scott and Turner 1997:33, 106).

Methods

Nineteen mandibular and twenty three maxillary tooth-trait combinations were recorded. The antimere exhibiting the highest degree of trait expression was used in the analysis, following the individual count method (Scott 1977, 1980; Turner and Scott 1973). This technique accounts for fluctuating asymmetry (Sciulli et al., 1979; Staley and Green 1971) and maximizes sample sizes when remains are fragmentary.

While variation in morphology was scored along a continuum of expression, trait expression was dichotomized into presence-absence for comparative purposes. Any degree of trait development was scored as a positive expression with the exception of lower molar cusp number, deflecting wrinkle, Tome's root, lower molar root number, Carabelli's trait, metacone, and hypocone (criteria for scoring all traits are given in Tables 1-4). All traits are described in the Arizona State University (ASU) Dental Anthropology System (Turner et al., 1991) and were recorded with the aid of standardized ASU and Dahlberg Zoller Laboratory rank-scaled reference plaques.

Data collection took place over the period of one month and intraobserver error was assessed one year later by re-scoring 21 maxillary and 13 mandibular traits in a 15% subsample of the permanent dental remains (Haddow 2001). Scoring inconsistencies occurred in only 3% of tooth-trait combinations and did not affect the dichotomized expression frequencies presented below.

Results

Tables 1 and 2 present the observed frequencies for the maxillary and mandibular traits of the permanent dentition. The notable features of dental variability are summarized below.

Maxillary teeth

• Winging of the central incisors occurs in 40% of the simple
• 25% of central incisors exhibit the shovel-shaped trait, but only a mild form of semi-shoveling
• 11% of lateral incisors display shoveling of some form
• Double shoveling does not occur on any maxillary incisors
• Interruption grooves, scored on UI2 as recommended by Scott and Turner (1997) occur with a frequency of 31%
• Molars are morphologically conservative.
• Large or very large forms of the metacone (distobuccal cusp) are the norm
• The hypocone (distolingual cusp) is fully expressed in the first molars
• Trace cuspule and small cusp forms of the metaconule, or cusp 5, occur occasionally on first molars
• 23% of first molars exhibit the trait of Carabelli
• 14% of molars exhibit the parastyle, a very rare trait

Mandibular teeth

• The Y-groove pattern is most common on M1; + groove is more common on M2
• Five cusps are most common on M1; four cusps on M2
• The protostylid occurs in 53% of observable cases but expression is confined to pit form
• The hypoconulid, or cusp 5, tends to be larger on M1 than on M2
• Accessory cusps are extremely rare
• 3-rooted molars are rare

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Table 1. Frequencies of Tell Leilan permanent maxillary dental traits.

Trait	**Tooth**	**n**	**N**	**%**
Winging (+ = ASU 1+)	UI1	2	5	40
Shoveling (+ = ASU 2-6)	UI1	2	8	25
Shoveling (+ = ASU 2-6)	UI2	1	9	11
Labial Convexity (+ = ASU 2-4)	UI1	8	9	89
Double Shoveling (+ = ASU 2-6)	UI1	0	11	0
Double Shoveling (+ = ASU 2-6)	UI2	0	11	0
Interruption Groove (+ = ASU M, D, MD, Med)	UI2	4	13	31
Tuberculum Dentale (+ = ASU 2-6)	UI2	2	11	18
Distal Accessory Ridge (+ = ASU 2-5)	UC	0	2	0
Metacone (+ = ASU 3-5)	UM1	13	13	100
Metacone (+ = ASU 3-5)	UM2	11	11	100
Metacone (+ = ASU 3-5)	UM3	7	7	100
Hypocone (+ = ASU 3-5)	UM1	13	13	100
Hypocone (+ = ASU 3-5)	UM2	6	10	60
Hypocone (+ = ASU 3-5)	UM3	4	7	57
Cusp 5 (Metaconule) (+ = ASU 1-5)	UM1	2	13	15
Carabelli's (+ = ASU 2-7)	UM1	3	13	23
Parastyle (+ = ASU 1-6)	UM1	2	14	14
Parastyle (+ = ASU 1-6)	UM2	0	10	0
Parastyle (+ = ASU 1-6)	UM3	0	7	0
Enamel Extensions (+ = ASU 1-3)	UM1	0	10	0
Premolar Root # (+ = ASU 2-3)	UP1	5	9	56
Upper Molar Root # (+ = ASU 3-4)	UM2	5	6	83

n = number of teeth expressing trait; N = number of observable teeth; % = frequency of expression (n/N)

Table 2. Frequencies of Tell Leilan permanent mandibular dental traits.

Trait	Tooth	n	N	%
Lingual Cusp # (+ = ASU 2-9)	LP2	2	5	40
Anterior Fovea (+ = ASU 2-4)	LM1	3	4	75
Y-Groove Pattern	LM1	10	11	91
+-Groove Pattern	LM1	1	11	9
Y-Groove Pattern	LM2	2	10	20
+-Groove Pattern	LM2	6	10	60
X-Groove Pattern	LM2	2	10	20
Molar Cusp # (+ = ASU 5-6)	LM1	10	15	66
Molar Cusp # (+ = ASU 5-6)	LM2	2	11	18
Deflecting Wrinkle (+ = ASU 2-3)	LM1	2	4	50
Protostylid (+ = ASU 1-6)	LM1	8	15	53
Cusp 5 (+ = ASU 1-5)	LM1	9	14	64
Cusp 6 (+ = ASU 1-5)	LM1	0	17	0
Cusp 7 (+ = ASU 2-4)	LM1	1	17	6
Canine Root # (+ = ASU 2)	LC	0	10	0
Tome's Root (+ = ASU 3-5)	LP1	3	8	38
Molar Root # (+ = ASU 3)	LM1	0	4	0
Molar Root # (+ = ASU 2-3)	LM2	5	6	83

n = number of teeth expressing trait; N = number of observable teeth; % = frequency of expression (n/N)

Discussion

It is common to compare the trait expression frequencies of one population with those of several other populations, either synchronically or diachronically. Ideally, the comparative populations should be drawn from the regions nearest the study population, with a mind to a particular research problem.

In the case of Bronze Age Mesopotamia, research problems abound, such as the effects of urbanization on the gene frequencies of previously localized, rural populations during the third millennium BC; or the biological affinities of northern and southern Mesopotamian populations and their relationships to other populations in the region. Unfortunately, there are few dental non-metric trait data from ancient Mesopotamian populations that can be used to address those questions.

This study therefore relies on a comparison of data from the Tell Leilan teeth to data from archaeological Near and Middle Eastern populations (Figure 1). The comparative set consists of data from skeletal samples from Ra's al-Hamra, Oman (ca 4000-3000 BC), Lachish (ca 3300-1200 BC) and Dothan (ca 1400-1100 BC) in Israel, and five prehistoric populations in Nubia, ranging from 2000 BC to 1350 BC (Irish 2005, Macchiarelli 1989, Ullinger et al. 2005).

As is evident from the data presented in Tables 3 and 4, comparability of data is problematic; for some 11 tooth-trait combinations no data are available for comparison with that data from Tell Leilan. Of the remaining 30 tooth-trait combinations, the Tell Leilan sample exhibits considerably higher frequencies of winging, labial convexity, tuberculum dentale, Tome's root, and anterior fovea, and much lower frequencies of canine distal accessory ridge, hypocone, Carabelli's trait, premolar lingual cusps, and 5-cusped lower molars.

Frequencies for shoveling, double shoveling, interruption groove, parastyle, and cusp 6 on lower molars are relatively consistent across all samples. Aside from the traits that appear consistently in the comparative samples,Tell Leilan shares similar frequencies with the Canaanite samples for expressions of premolar root number, lower molar groove pattern, and protostylid. Frequencies similar to those for Nubian samples include canine root number, and lower and upper molar root numbers. A final nine traits are too variable in their expression for pattern recognition.

In addition, although not included in Table 3 because the manner in which the trait was scored is unclear, or because exact frequencies for trait data were not published, cusp and tubercle forms of Carabelli's trait were observed in 24% of the permanent maxillary molars of the Bronze Age inhabitants of the southern Mesopotamian city of Kish (Carbonell 1960), in an unspecified proportion of the remains from Neolithic Jarmo, Iraq (Dahlberg 1960); and were absent in dentitions from Iron Age Hasanlu in northern Iran (Rathbun 1972).

Conclusion

Overall, there are roughly equivalent numbers of similarities and dissimilarities when trait frequencies are examined as a function of tooth class, and while Tell Leilan has a higher expression of three anterior traits and a lower expression of three molar traits, three anterior traits and two molar traits are also consistent across the samples. However, the high frequencies of winging and labial convexity and the relatively low frequencies of seven other traits in the Tell Leilan dentitions when compared to the Nubian samples seems to rule out biological affinities between northern Mesopotamia and synchronic upper Nile Valley populations. On the other hand, although Tell Leilan shares frequencies with Canaanite samples for three traits, there are two few data for any conclusions to be drawn with respect to biological relationships. Similarly, Tell Leilan shares four tooth-trait frequencies with the sample from Ra's al-Hamra, but also differs in five tooth-trait frequencies, ruling out any definitive statement about affinities.

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Table 3. Comparison of frequencies (%) of permanent maxillary dental traits for Tell Leilan, Bronze Age Dothan and Lachish (Israel), Ras al-Hamra (Oman) and 3rd millennium BC Nubia.
(data from Irish 2005, Machiarelli 1989, Ullinger et al. 2005).

Trait	Tooth	Leilan	Dothan	Lachish	C-Group Nubia	Pharaonic Nubia	Kawra Nubia	Kerma Nubia	Soleb Nubia	Ras al-Hamra
Winging (+ = ASU 1+)	UI1	40	-	-	16	3	8	5	8	-
Shoveling (+ = ASU 2-6)	UI1	25	*	*	11	25	33	22	11	0
Shoveling (+ = ASU 2-6)	UI2	11	-	-	-	-	-	-	-	-
Labial Convexity (+ = ASU 2-4)	UI1	89	-	-	58	40	42	38	50	-
Double Shoveling (+ = ASU 2-6)	UI1	0	5	0	0	0	0	0	0	-
Double Shoveling (+ = ASU 2-6)	UI2	0	-	-	-	-	-	-	-	-
Interruption Groove (+ = ASU M, D, MD, Med)	UI2	31	15	0	45	20	20	9	31	-
Tuberculum Dentale (+ = ASU 2-6)	UI2	18	*	*	35	20	70	8	25	-
Distal Accessory Ridge (+ = ASU 2-5)	UC	0	*	*	13	50	17	18	0	-
Metacone (+ = ASU 3-5)	UM1	100	-	-	-	-	-	-	-	100
Metacone (+ = ASU 3-5)	UM2	100	-	-	-	-	-	-	-	-
Metacone (+ = ASU 3-5)	UM3	100	-	-	-	-	-	-	-	-
Hypocone (+ = ASU 3-5)	UM1	100	-	-	-	-	-	-	-	100
Hypocone (+ = ASU 3-5)	UM2	60	-	-	76	83	85	92	79	86
Hypocone (+ = ASU 3-5)	UM3	57	-	-	-	-	-	-	-	-
Cusp 5 (Metaconule) (+ = ASU 1-5)	UM1	15	12	0	*	*	*	*	*	-
Carabelli's (+ = ASU 2-7)	UM1	23	68	32	75	79	90	52	13	0
Parastyle (+ = ASU 1-6)	UM1	14	-	-	-	-	-	-	-	-
Parastyle (+ = ASU 1-6)	UM2	0	-	-	-	-	-	-	-	-
Parastyle (+ = ASU 1-6)	UM3	0	2	0	3	4	8	5	0	-
Enamel Extensions (+ = ASU 1-3)	UM1	0	-	-	2	14	0	4	10	-
Premolar Root # (+ = ASU 2-3)	UP1	56	35	44	83	72	68	80	69	-
Upper Molar Root # (+ = ASU 3-4)	UM2	83	-	-	87	84	80	90	91	-

Table 4. Comparison of mandibular dental trait frequencies (%) from Tell Leilan, Bronze Age Dothan and Lachish (Israel), Ras al-Hamra (Oman) and 3rd millennium BC Nubia
(data from Irish 2005, Machiarelli 1989, Ullinger et al. 2005)

Trait	Tooth	Leilan	Dothan	Lachish	C-Group Nubia	Pharaonic Nubia	Kawra Nubia	Kerma Nubia	Soleb Nubia	Ras al-Hamra
Lingual Cusp # (+ = ASU 2-9)	LP2	40	86	100	72	75	60	86	44	-
Anterior Fovea (+ = ASU 2-4)	LM1	75	-	-	100	0	33	44	40	-
Y-Groove Pattern	LM1	91	-	-	-	-	-	-	-	100
+-Groove Pattern	LM1	9	-	-	-	-	-	-	-	-
Y-Groove Pattern	LM2	20	25	22	50	25	50	41	53	80
+-Groove Pattern	LM2	60	-	-	-	-	-	-	-	-
X-Groove Pattern	LM2	20	-	-	-	-	-	-	-	-
Molar Cusp # (+ = ASU 5-6)	LM1	66	-	-	*	*	*	*	*	55
Molar Cusp # (+ = ASU 5-6)	LM2	18	*	*	56	25	42	41	27	0
Deflecting Wrinkle (+ = ASU 2-3)	LM1	50	*	*	36	50	18	11	0	-
Protostylid (+ = ASU 1-6)	LM1	53	48	67	32	14	31	12	29	-
Cusp 5 (+ = ASU 1-5)	LM1	64	-	-	-	-	-	-	-	-
Cusp 6 (+ = ASU 1-5)	LM1	0	5	0	6	0	8	0	0	-
Cusp 7 (+ = ASU 2-4)	LM1	6	*	*	12	0	5	17	0	-
Canine Root # (+ = ASU 2)	LC	0	-	-	8	4	0	2	6	-
Tome's Root (+ = ASU 3-5)	LP1	38	-	-	20	9	29	25	10	-
Molar Root # (+ = ASU 3)	LM1	0	-	-	3	0	0	2	0	-
Molar Root # (+ = ASU 2-3)	LM2	83	-	-	91	92	75	94	80	-

Int. J. Dental Anthropol. 9: 1-7. (ISSN 0124-7336)

Because of the small sample size, the Tell Leilan skeletal material was treated as if it were a cross-section of a once-living population at a particular point in time. Had the sample been larger, an analysis of changes in dental trait expression frequencies at Tell Leilan during the course of the third millennium BC may have shed some light on the changing face of the Tell Leilan population at a time when hyper-urbanization was transforming the region. More dental non-metric studies of living and archaeological dentitions in the Near East, using standardized recording procedures, are required, especially for the ancient civilizations of Mesopotamia. More research will ultimately lead us to a better understanding of such complex issues as migration and urbanization, and to a better understanding of the biological relationships of ancient Near Eastern peoples to one another and to other populations of the world.

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