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Origins of the Neolithic people of Abu Hureyra, northern Syria

An attempt to address an archaeological question through a study of the mandibles

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Abstract: *A high degree of diversity noted in the Neolithic mandibles from Abu Hureyra provided the opportunity to address the problem of the meaning and origin of variability in the population. Mandible morphology is approached bearing in mind cranio-facial interactions. Two morphological patterns were identified in the Abu Hureyra mandible sample. The ABU morph represents the majority, while the ABO morph corresponds to a small group with a distinctive shape. In this preliminary study, variability of the mandibles was examined through bivariate analyses of the Abu Hureyra material and of five comparative samples. The ABU pattern has affinities with other populations of the Near East including Çatal Hüyük and Lachish as indicated by similarities of both ramus morphology and corpus robusticity, whilst the ABO pattern shows biologically significant resemblances to East African (Elmenteita) and North African Mesolithic (Afalou) as well as to Neolithic material from the Near East (Jericho). These similarities suggest that there were migrations to the Near East from north and east Africa at the end of the Pleistocene.*

Key words: mandible morphology; Neolithic; Near East; Africa

Introduction

Tell Abu Hureyra was a settlement site in the Euphrates valley, northern Syria, inhabited from c. 13,400 to 7,500 years ago. In 1972 and 1973 Andrew Moore undertook a rescue excavation in advance of the building of the Tabqa Dam. Seven trenches (A-G) were excavated in different parts of the tell (Moore 1975, Moore et al. 2000). The archaeological sequence at Abu Hureyra extends from the Epipalaeolithic/Mesolithic through the Pre-Pottery Neolithic (periods 2A, 2B at the site), to the introduction of pottery (Neolithic 2C) and beyond to the Modern (historic) period. The human

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remains come from the Neolithic levels ranging in time from ca. 10,600 to 7,500 cal BP (Moore et al. 2000).

Study of the mandibles excavated from Neolithic levels at Abu Hureyra brought to light two different types that are distinguished by non-metric traits of the mandibular body, the shape of the coronoid process and the breadth of the ramus. Whilst most of the mandibles present a morphology commonly found in Post-Pleistocene samples, a small group shows a combination of traits unusual in them. The first type is here designated the ABU morph (**Figure 1**); the second the ABO morph (**Figure 2**). Distinguishing traits of each are summarized in **Table 1**.

Although the mandible has been considered to be unreliable for phylogenetic analysis (Schultz 1933; Cronin et al. 1981) and is to some extent correlated with subsistence (von Cramon-Taubadel in press), a different perspective emerges when the variation of mandible features is explored in relation to cranio-facial growth processes (Rosas 1992, Bastir et al. 2004). For instance, the breadth of the ramus results from a compensatory growth mechanism associated with a forwardly flexed cranial base (Enlow et al. 1971a, b; Enlow 1991, Kuroe et al. 2004). The biological significance of the mandible features observed in the Abu Hureyra jaws suggests that the two morphs might be representatives of two distinct genetic influences present in the Neolithic sample. Here we attempt to explore some of the differences between them by comparative analysis with samples from earlier and contemporary sites.

Material

Table 2 shows the composition of the Abu Hureyra mandible sample. While juveniles were included in the morphological assessment, only adult specimens, male (n=18) and female (n=19) were included in this metric study.

For this exploratory study, comparative analysis of mandible morphology in Near Eastern, North African and East African material was undertaken in an attempt to locate the variation detected in the Abu Hureyra mandibles. Mandibles from Mesolithic (Natufian), Neolithic and post-Neolithic sites were considered, with original data for mandibles from Neolithic levels EVII and EVIII at Çatal Hüyük[1] (n=36), excavated by James Mellaart (1967); Pre-Pottery Jericho (n=12) and Bronze Age Lachish[2] (n=32), Southern Levant (Risdon 1939); Mesolithic Elmenteita (n=9), East Africa, which was originally described by Leakey (1935) and by Rightmire (1975) and dated

[1] "Çatal Hüyük" follows the spelling used by James Mellaart.

[2] The Bronze Age town of ancient Lachish on Tell Duweir in the Shephelah foothills between the coastal plain and the Judean Hills suffered a massive military destruction at the close of the eighth century BC. "Sennacherib devastated Judah, especially the Sephelah in the year 701 BC" (Noll 2001:48). Four large deposits of skeletal material, some damaged by fire, were recovered from charnel chambers (Risdon 1939:100).

7,410±160 BP (Villiers 1982). New data from Mesolithic Afalou, Algeria (n=15) was also included and as well as a modern sample from Tell Abu Hureyra (**Table 3**). The two Abu Hureyra morphs as defined by non-metric traits are the ABU morph (**Figure 1**) and the ABO morph (**Figure 2**).

Table 1. Morphological differences between the ABU and ABO morphs.

	ABU	ABO
1	Alveolar arcade is displaced posteriorly.	Alveolar and basal arcades superimposed.
2	Alveolar component more developed anteriorly.	Alveolar component strongly developed at the level of M3.
3	Deep mandible depression; with high resorption in anterior symphysis.	
4	Corpus deep at mental foramen.	Corpus borders parallel.
5	Deep antegonial notch.	No antegonial notch.
6	High resorption at the posterior basal border; buccal inclination of M3.	Body robust at level of M3.
7	Low mandible body at M3.	Deep mandible body at M3.
8	Mylohyoid line steeply inclined.	Mylohyoid line low and parallel to alveolar border below M2 and M3.
9	Ramus high and narrow.	Ramus low and broad; anterior border strongly curved.
10	Coronoid process thin, apex upwardly orientated.	Coronoid process low, apex orientated anteriorly.
11	Gonial region small.	Gonial region square and expanded.
12	Submandibular fossa well developed.	Submandibular fossa weakly developed.

Table 2. Composition of the Abu Hureyra mandible sample. While juveniles were included in the morphological assessment, only adult specimens, male (n=18) and female (n=19) have been included in this study.

Period		**Trench**					**Total**
		A	B	C	D	E	
Modern		4	1			4	9
	2C					2	2
Neolithic	2B	4	15	5		10	34
	2A				3		3
Total		8	16	5	3	16	48

Figure 1. ABU mandible 73.2133; Tell Abu Hureyra Trench B 2B ph.2.

The ABU morph

The alveolar arcade is displaced in relation to the basal arcade. As a consequence, a deep mandible depression is developed. Bone texture indicative of a high degree of resorption is present in the anterior part of the symphysis. The posterior location of the alveolar component is not restricted to the symphysis but involves the complete alveolar arcade and can result in a buccal inclination of the M3 molar roots due to lingual drift of the crown. The alveolar component is strongly developed at the anterior part

Table 3. Comparative samples used in this study.

Site	Number	Period	Provenance
Çatal Hüyük	36	Neolithic	Turkey
Jericho	12	Neolithic	Israel
Lachish	32	Bronze Age	Israel
Afalou	15	Mesolithic	Algeria
Elmenteita	9	Mesolithic	Kenya

Figure 2. ABO mandible 73.2771a; Tell Abu Hureyra Trench A 2B.

of the body in association with bone deposition at the basal border. Consequently, the mandible body is deep at the level of the mental foramen. Conversely, a high degree of bone resorption is well defined in the posterior part of the mandible body and a deep antegonial notch is developed in some specimens. The result of this is a low mandible body at the level of the M3. The mylohyoid line is steeply inclined, crossing the mandible body diagonally from the last molar to vertically below the premolars. The ramus is high and narrow. The coronoid process is thin with the apex consistently upwardly orientated. The gonial area is proportionately small in relation to the size of the mandible.

The ABO morph

The alveolar and basal arcades are disposed one on top of the other. The alveolar component is strongly developed at the level of M3 in contrast to the ABU morph, in which the alveolar component is more strongly developed in the anterior region. In consequence, the height of the body maintains a similar value all along the corpus and the alveolar and basal borders are parallel to each other. There is no antegonial notch. The mylohyoid line occupies a low position in relation to the alveolar border below the second and third molars. The ramus is low and broad, making a closed angle with the body, in marked contrast to the ABU pattern. The anterior border of the ramus is strongly curved, which is evidence for an abrupt inversion of remodelling between the resorptive lower part and the depositional upper part. In harmony with this, the coronoid process is anteriorly orientated. The shape of the gonial area is square and much more developed than in the ABU pattern.

Methods

The Abu Hureyra mandible sample was divided into two subgroups designated ABO and ABU morphs on the basis of general shape and form as described above; each was treated independently. The ABU morph comprises the largest part of the sample, whereas ABO refers to those specimens that are considered as the test case for identification. To describe the ramus and corpus morphologies of the mandibles, six variables (from more than 30 attempted) were selected because they were measureable in the material (**Figure 3**):

- RB': Minimum ramus breadth
- M3-Gon: The distance from gonion to M3 describes the development of the gonial area.
- M3-Cor: The distance from coronoid vertex to M3 describes the development of the coronoid process.
- Ht M3: Height corpus at M3 (Coronoid Index = Ht M3/M3–Cor $\times$ 100).
- Ht For: Height corpus at mental foramen.
- B For: Breadth corpus at mental foramen (Robusticity Index = B For/Ht For $\times$ 100; Cross Sectional Area = Ht For $\times$ B For $\times$ $\pi/4$).

The measurements record linear distances between land-marks:

- For: Anterior margin of the mental foramen.
- Cor: Vertex of the coronoid process.
- Gon: The point on the gonial perimeter that crosses the bisector of the angle defined by the tangents to the posterior margin of the ramus and the basal border.
- M3: Located at the bucco-distal corner of the alveolus M3.

Measurements affected by M3 agenesis were excluded. Means and standard deviations were computed for the linear measurements (**Tables 4a, 4b** and **4c**).

Results

The most outstanding metric differences between the ABU and ABO morphs are in aspects of the gonial region and in corpus robusticity. In addition, although not significantly different, the height of the body at the level of M3 is greater in the ABO morph. Males and females are equally represented in both morphs. Dimorphism between males and females is greater in the ABU than in the ABO jaws (**Table 4a**). Differences between ABU and ABO morphs include non-metric traits of a different nature than those detected in sex variation. No differences in general size were

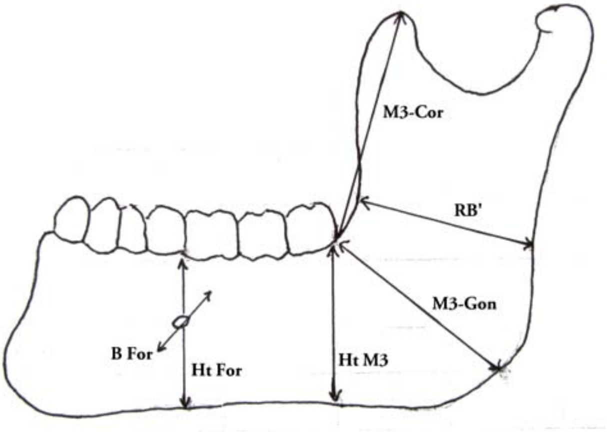

Figure 3. Six dimensions taken on the mandibles used in this study.

noted between the ABU and ABO morphs, although there are clear size differences in some of the other samples (**Table 4b**). Consequently ratios were used to describe the development of the ramus and corpus of the mandibles (**Table 4c**).

Since average size and shape of the mandible usually differs between the sexes, differences between ABU and ABO morphs were checked after sex-wise standardization of the six measurements and three indices. Values of both parametric and non-metric tests for between sample differences are statistically significant for M3-Gon, M3-Cor and RB' as well as for the Coronoid and Robusticity Indices (**Table 5**).

Ramus morphology

The most outstanding differences between the two mandible morphs concern the combination of a low and broad ramus with a high development of gonion, represented by the distance M3-Gon, and the height of the body at the level of M3. Distances are significantly greater in the ABO than in the ABU morph. The ABU groups with Çatal Hüyük and Lachish; Jericho, Elmenteita and Afalou are intermediate.

Ramus development is recorded by the Coronoid Index (ratio of the height (Ht M3) of the mandible body at the level of M3 to the distance M3-Cor $\times$ 100) and M3-Gon. A very low coronoid process characterizes the ABO morph, as measured by the distance M3-Cor. Thus, a broad ramus together with a deep body at the level of M3 and the shape of the coronoid process defines the ABO morph. Specimens of the ABO morph are clearly clustered at one extreme of the distribution; there is a greater body depth relative to coronoid process height due to the development of the gonial region. Some individuals treated as ABU morph approach the ABO morph and are intermediate in form (**Figure 4**). In contrast, Afalou jaws have the tallest coronoid processes among the comparative samples (**Figure 5**).

Breadth of the ramus RB'

The ABO morph presents a broad ramus similar to that of Elmenteita from East Africa and distinct (although not significantly) from that of Afalou from North Africa, the ABU morph or the other Neolithic samples (**Table 4b**). ABU and Çatal Hüyük samples are similar to each other, with Jericho occupying an intermediate position. Finally, Lachish has a narrower ramus (**Figure 6**).

Corpus robusticity

Corpus robusticity is represented by the breadth and height of the mandible body at the level of the mental foramen on the elliptical cross sectional area (height × breadth

Table 4a. Summary statistics for male and female mandibles from Tell Abu Hureyra.

	M3-Gon	M3-Cor	Ht For	B For	HtM3	RB'
TAH ABU Male						
Count	9	9	13	12	14	6
Mean	36.0	38.4	32.6	12.8	8.2	34.9
SD	3.9	4.1	2.1	0.9	2.9	3.4
SE	1.3	1.4	0.6	0.3	0.8	1.4
Range	31.2-42.9	30.4-46.4	29.7-36.1	10.8-14.0	23.5-33,1	30.8-40.2
TAH ABO Male						
Count	2	1	3	3	3	2
Mean	37.4	32.0	30.7	13.0	28.6	38.4
SD	2.8		3.3	1.2	2.9	2.3
SE	2.0		1.9	0.7	1.7	1.6
Range	35.4-39.3		27.1-33.4	11.6-14.0	25.3-30.9	36.8-40.0
TAH ABU Female						
Count	10	10	14	13	14	3
Mean	30.7	35.7	30.4	12.0	24.8	31.9
SD	2.4	4.8	3.2	1.9	3.2	3.2
SE	0.8	1.5	0.9	0.5	0.9	1.9
Range	27.4-35.2	25.6-44.8	26.0-38.5	9.6-16.6	19.7-29.9	29.5-35.5
TAH ABO Female						
Count	4	3	3	4	4	3
Mean	37.3	30.6	30.0	13.5	28.2	37.2
SD	0.9	1.5	1.3	1.5	1.1	0.9
SE	0.5	0.9	0.8	0.8	0.6	0.5
Range	36.0-37.8	29.0-31.9	28.5-30.8	11.2-14.5	27.0-29.5	36.9-38.2

$\times$ $\pi/4$) following Chamberlain and Wood (1985). Both Abu Hureyra morphs group with Çatal Hüyük and Afalou. Robusticity is clearly greatest in the ABO and Elmenteita samples and is clearly greater in the ABO than in the ABU morph, with Lachish occupying an intermediate position. Samples from Jericho, ABO and Elmenteita have a larger cross section area than do the others (**Figure** 7).

Discussion

Two morphological patterns observed in the Tell Abu Hureyra mandible sample have been analysed to describe ramus development and corpus robusticity. The morphometric analyses support the distinctiveness of the two morphs. Comparison of the ramus has shown that, taken as a whole, the Abu Hureyra mandibles present a considerable spectrum of variation with some mandibles showing transitional shapes, suggesting continuity between very different extremes represented by the morphs designated

Table 4b. Summary statistics for dimensions used in study.

Site	n	Mean	SD	SE	Range	n	Mean	SD	SE	Range
			M3-Gon					M3-Cor		
TAH ABU	19	33.2	4.1	0.9	27.4-42.9	14	37.1	5.0	1.4	32.6-46.4
TAH ABO	6	37.3	1.4	0.7	36.0-39.3	4	31.0	1.4	0.7	29.0-32.0
Çatal Hüyük	32	33.0	4.1	0.7	25.8-41.1	30	36.2	4.9	0.9	23.0-43.1
Jericho	10	36.0	3.0	1.0	32.6-41.1	8	41.3	5.8	2.1	32.5-50.4
Lachish	30	33.0	3.6	0.6	27.0-39.3	29	41.1	4.7	0.9	35.0-49.9
Elmenteita	16	36.1	4.4	1.1	30.3-44.0	9	42.4	7.7	2.6	34.1-58.4
Afalou	15	36.0	5.0	1.3	26.1-42.8	15	46.6	4.5	1.2	40.0-52.8
			Ht For					B For		
TAH ABU	25	31.5	2.9	0.6	26.0-38.5	25	12.4	1.5	0.3	9.6-16.6
TAH ABO	6	30.4	2.3	1.0	27.1-33.4	6	13.6	1.1	0.5	11.6-14.5
Çatal Hüyük	35	31.0	2.6	0.4	26.5-37.8	35	11.4	1.6	0.3	8.6-14.4
Jericho	12	34.1	2.1	0.6	31.4-38.8	12	13.1	1.7	0.5	9.9-16.1
Lachish	32	31.5	3.2	0.6	26.6-38.9	32	12.7	1.5	0.3	9.2-15.7
Elmenteita	17	32.6	3.0	0.7	28.1-37	17	14.2	1.6	0.4	11.7-17.7
Afalou	15	32.8	2.8	0.7	26.7-37.6	15	13.9	1.7	0.4	8.6-14.8
			Ht M3					RB’		
TAH ABU	14	25.9	3.5	0.9	19.7-30.5	9	33.9	3.5	1.2	29.5-40.2
TAH ABO	4	28.4	1.3	0.7	27.0-29.5	5	37.7	1.4	0.6	36.6-40.0
Çatal Hüyük	30	26.4	2.7	0.5	22.4-31.3	18	34.5	2.7	0.6	29.3-38.3
Jericho	8	27.9	2.2	0.8	25.2-32.1	10	35.9	2.4	0.8	33.2-40.6
Lachish	29	26.0	2.8	0.5	21.5-31.2	30	32.3	3.0	0.5	28.0-38.5
Elmenteita	9	27.3	2.2	0.7	23.0-29.4	10	38.6	2.5	0.8	35.9-44.1
Afalou	15	26.9	3.7	1.0	19.8-33.3	15	34.2	3.1	0.8	

Table 4c. Summary statistics for bivariate figures.

Site	n	Mean	SD	SE	Range
Robusticity Index					
TAH ABU	25	39.5	4.3	0.9	32.2-49.8
TAH ABO	6	45.2	5.1	2.1	36.6-50.2
Çatal Hüyük	35	36.7	4.9	0.8	27.9-50.3
Jericho	12	38.3	3.8	1.1	31.0-43.2
Lachish	32	40.6	6.1	1.1	26.9-62.8
Elmenteita	17	44.1	7.1	1.7	33.7-58.6
Afalou	15	36.6	5.6	1.4	29.6-45.7
Area					
TAH ABU	25	308.1	61.0	12.2	211.1-501.9
TAH ABO	6	324.8	33.0	13.6	285-2-367.3
Çatal Hüyük	35	277.7	51.8	8.8	195.2-427.5
Jericho	12	351.9	64.5	18.6	248.0-406.8
Lachish	32	314.6	54.7	9.7	216.0-418.6
Elmenteita	17	363.1	49.8	12.1	280.3-444.9
Afalou	15	310.0	60.0	15.5	196.0-396.0
Coronoid Index					
TAH ABU	17	72.4	10.5	2.6	56.1-88.8
TAH ABO	4	91.8	3.6	1.8	86.8-95.2
Çatal Hüyük	31	74.0	9.3	1.6	57.2-90.1
Jericho	8	69.1	13.5	4.8	50.0-90.7
Lachish	29	63.7	8.7	1.6	52.1-79.6
Elmenteita	10	66.3	11.0	3.4	45.1-83.9
Afalou	15	58.1	7.7	1.0	46.6-71.0

Table 5. Differences between ABU and ABO samples after sex-wise standardization.

Variable	ABU			ABO			T-test		U-test	
	N	Mean	SD	N	Mean	SD	t	p	Z	p
M3-GON	19	-0.30	0.63	6	0.96	0.49	-3.25	0.0036	-2.77	0.0056
MR-COR	19	0.20	0.36	4	-0.94	0.13	2.31	0.0312	2.39	0.0167
HtFor	27	0.08	0.95	6	-0.38	1.00	1.05	NS	0.68	NS
BFor	25	-0.11	0.98	7	0.41	0.87	-1.26	NS	-1.39	NS
HtM3	28	-0.13	0.75	7	0.53	0.47	-1.61	NS	-1.55	NS
RB’	9	-0.42	0.37	5	0.76	0.09	-2.66	0.0210	-2.27	0.0234
Coronoid	14	-0.40	0.36	4	1.38	0.34	-5.05	0.0001	-2.81	0.0005
Robusticity	25	-0.21	1.14	6	0.88	0.27	-2.70	0.0115	-2.23	0.0261
Area	25	-0.03	0.89	6	0.13	0.82	-0.36	NS	-0.58	NS

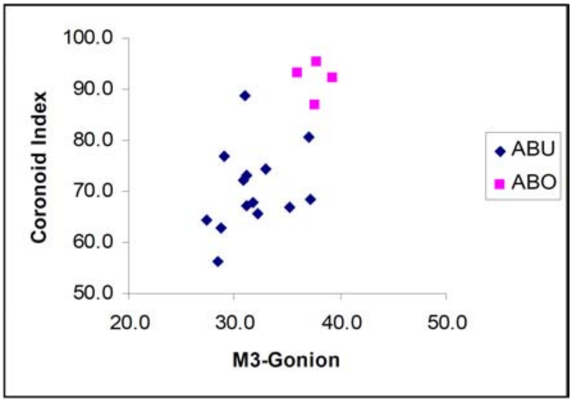

Figure 4. Ramus development of Neolithic mandibles from Tell Abu Hureyra (Coronoid Index = Ht M3/M3–Cor × 100).

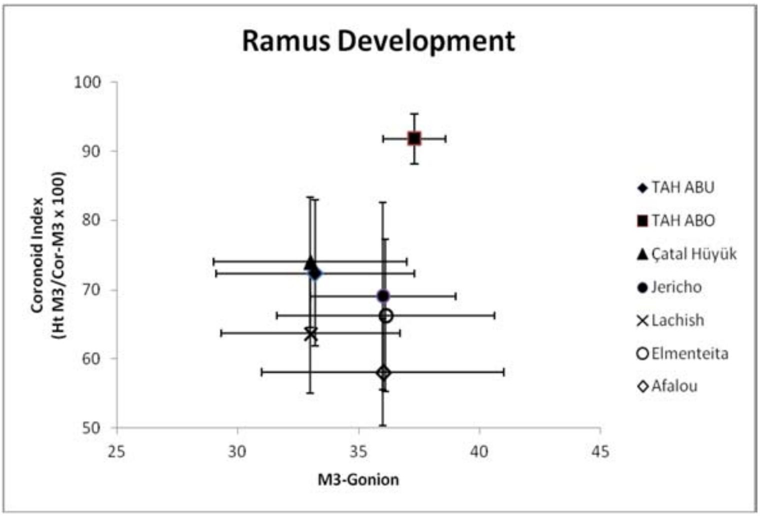

Figure 5. Ramus development of mandibles from Abu Hureyra and comparative samples. Mean and one standard deviation of each sample, see **Tables 4b** and **4c**.

ABU and ABO. Clère et al. (1985) also found features of the ramus to be discriminant when comparing Neolithic and Natufian with modern samples. Traditionally, ramus features have been associated with muscular development, disregarding the important role of the ramus in craniofacial growth (Green & Armelagos 1972). A broad ramus is an important architectural characteristic, which is developed in dolichocephalic crania as a result of a forwardly directed posterior cranial base (Enlow et al. 1971a, b; Bastir et al. 2002), and is especially developed in sub-Saharan populations (Brauer 1978;

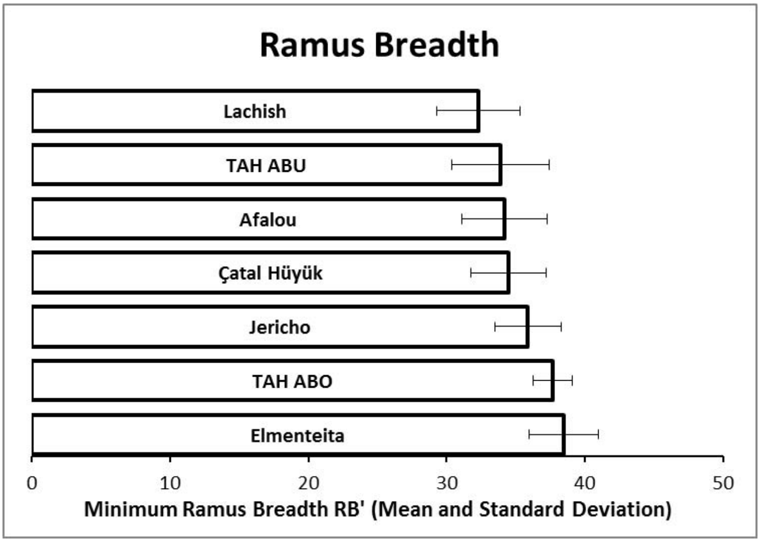

Figure 6. Minimum ramus breadth (RB') of mandibles from Tell Abu Hureyra and comparative samples.

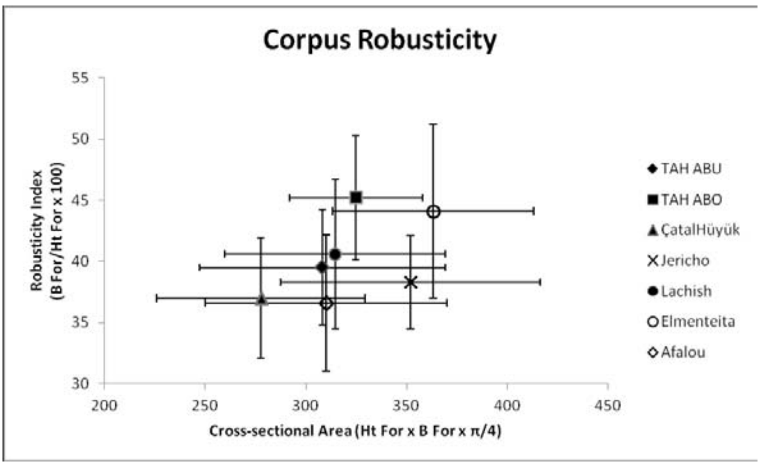

Figure 7. Variation in corpus robusticity of mandibles from Tell Abu Hureyra and comparative samples.

Villiers 1982; Enlow et al. 1982). A narrow ramus, vertical coronoid and prominent chin derive from a long naso-maxillary complex.

The ABO pattern, i.e., a broad ramus, corpus robusticity and mylohyoid line position can be related to the horizontal growth of the middle cranial fossa and/or posterior cranial base. In a different way, a narrow ramus, associated with the vertical orientation of the coronoid process and the high deposition of bone at the anterior basal border, are features derived from a long nasomaxillary complex, which characterizes the ABU mandible pattern. Thus, the variation of the mandible morphology strongly suggests the presence of two different craniofacial architectural patterns in the Abu Hureyra Neolithic population.

An uneven spatial and temporal distribution of the two morphs is identifiable at the site. The ABU morph is the more common and is found at all levels in all the trenches with the exception of Trench A, where the specimens preserved belong to the ABO morph. There is a specimen in Trench E that approaches the ABO morph and a number of mandibles of intermediate type were recognised; and their inclusion accounts for the greater variation of the ABU group. Interestingly, specimens of the ABO morph are found only in Trenches A and B phase 8, Periods 2B and 2C dated 9300 to 7500 cal BP (Moore et al. 2000). The ABO morph therefore appears somewhat late in the sequence. Legge and Rowley Conway (2000) report a major change in fauna in trench B from phase 8 when a switch from gazelle to caprine abundance occurs (Moore et al. 2000:425).

Three ABO type mandibles were found in trench B phase 8. They were buried in the large building with a charnel room at the end (Moore et al. 2000: 203). The accumulation of burials in a burial pit under the floor and in the charnel room within the building was most unusual. From the fragmented nature of the skeletons they appeared to be secondary burials. Moore (2000:279) wondered "why were these people buried together, and how did they die? Is it possible that they were members of a corporate group, and for this reason were buried in one grave?" The charnel room was the only example of such an installation at Abu Hureyra.

TrA 73.2771a, a female who displays the ABO morphology, has grooves across the incisor teeth and has been identified as a basket maker whose incisor teeth had become grooved through the habit of passing reeds from side to side over them (**Figure 2**). Molleson (1994) wondered if she could have come to Abu Hureyra with specialist craftsmen, specifically as a basket maker. The potential morphological adaptations to this activity were considered. The action of gripping the reed with the anterior teeth would cause the lateral pterygoid muscles to protrude the lower jaw and to bring the incisors edge to edge. These muscles attach to the fovea below the neck of the condyle (Dean & Pegington 1996:100-101). Other muscles, the temporalis, masseters and medial pterygoids, attach to the gonial region of the ramus or to the coronoid process. They function mainly to close the jaw during mastication in which the molar teeth are being used. They would also be involved in crushing reeds to make cord or string and indications of cord making have been observed in several ABU jaws from Abu Hureyra including TrE 73.2952 (**Figure 1**) (Molleson 1996, 2006). The coronoid process is expanded anteriorly but not in the gonial region. The masseter is also involved in protruding the mandible. A double edge to the anterior border of the coronoid process where the temporalis muscle is attached could be the consequence of prolonged use in such a task-related activity. The possibility that such task-related activities could modify the ramus is acknowledged. The distinctive characteristics of the ABO morph coronoid are observed in both adult and in juvenile jaws that do not show any modification of the incisor teeth. Although further work is needed to clarify these aspects of the mandibles, these task-related observations do not contradict the hypothesis advanced here.

The ABU morph corresponds to the morphology that is founding the area today, as is shown in the strong similarity between the ABU and Abu Hureyra modern samples. Likewise, the ABU and Lachish samples show similarities, especially related to ramus development (**Figure 5**). Hershkovitz et al. (1995) noticed that a straight ramus border is the most common in modern Mediterranean populations. Therefore continuity between the ABU morph and more recent populations can be recognised. The human remains from other Neolithic sites, such as Tell Ramad (Syria) and Horvat Galil (Galilee) can also be assigned to this morphological pattern.

The Near East is considered to be an important region for population movement, as a corridor from Africa to Asia and Europe. A complex network of microevolutionary processes is understood to have taken place in the populations of this area during the Upper Pleistocene, Neolithic and post-Neolithic times (Tangri et al. 1994). The North African movement as represented here by Afalou may ultimately go back to Europe as suggested by Mesolithic remains in northern Greece. Abu Hureyra Neolithic and modern samples have a narrow ramus breadth. Migrations from Africa in post-Neolithic times are well documented (Risdon 1939) so that the similarity of the modern group from Abu Hureyra to Bronze Age Lachish with its known affiliations to Egypt is not surprising.

A survey of the average minimum ramus breadths of mandibles from Late Pleistocene Nubian, Natufian and North African Mesolithic, Neolithic and Abu Hureyra modern samples indicates that two different groups can be distinguished (**Table 6**). The African Mesolithic jaws have a distinctly broad ramus, similar to Ohalo II N2 and Nazlet Khater; the ABO morph approaches this group. A major point is the conspicuous similarity between the Ohalo II N2 and ABO patterns. A broad ramus, an anterior border of the ramus strongly convex antero-posteriorly and the height of the body relatively constant along the entire body are the most evident similarities. Interestingly, a similar set of traits is present in the Mesolithic samples from Wadi Halfa and Jebel Sahaba; and the mandible of the Nazlet Khater skeleton from Upper Egypt shows a very similar morphology (Thoma 1973, Vermeersch et al. 1984). According to Hershkovitz et al. (1995), the similarities between Ohalo II and Nazlet Khater mandibles are striking. Thus, we suggest that African influences were operating in the Near East during Neolithic times.

Table 6. Variation in Minimum Ramus Breadth (RB') of the mandible.

Sample	Males					Females				
	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Wadi Halfa[1]	9	41.0	1.11	39	42	13	40.2	3.46	35	47
Jebel Sahaba[2]	15	43.3	2.6	38	48	12	39.6	1.90	35	43
Taforalt[3]	12	40.3	3.27	35	46	12	34.8	3.10	29	39
Columnata[4]	7	37.2	1.82	36	40	5	34.2	3.27	32	40
Early Natufian[5]	13	37.8	2.95	34	44	6	34.6	2.49	32	38
Late Natufian[5]	6	34.8	1.77	33	38	5	34.4	2.50	32	39
Natufian[5]	39	37.5	3.09	31	44	16	34.3	2.53	30	39
South African[6]	507	35.2	3.16	26	44	63	33.1	3.00	27	39
Spitalfields	21	31.6	3.01			21	27.7	2.29		
Nubia[7]	20	34.1	3.04			20	32.7	3.46		
Gaboon[7]	17	33.9	2.53			16	33.0	2.07		
Poundbury[7]	25	33.2	2.95			25	29.8	2.09		

[1] Greene & Armelagos 1972 [2] Anderson 1968 [3] Ferembach 1966 [4] Chamla 1970
[5] Belfer-Cohen et al. 1991 [6] Villiers 1968 [7] Sung Jung 1993

Summary and conclusions

In this study, we have attempted to characterise the mandibles from Abu Hureyra. The purpose of this study was to locate the variation in the jaws. Given the fragmented nature of the material and limited sample sizes the results are tentative.

Detailed analysis of the mandibles from Tell Abu Hureyra, Syria, together with data from comparative material from Mesolithic and younger sites, identified several traits of the mandible corpus, ramus and shape of the coronoid process that differ between groups.

At one extreme, the ABU morph, the ramus is high and narrow; the coronoid process is thin with the apex consistently orientated upward; the gonial area is proportionally small in relation to the size of the mandible; the corpus is deep at the level of the mental foramen and low at the level of M3; the mylohyoid line is steeply inclined. In bivariate analyses of the ramus morphology and corpus robusticity, this pattern grouped with mandibles from Çatal Hüyük and Lachish.

At the other extreme, the ABO morph, the ramus is low and broad, making a closed angle with the corpus; the anterior border of the ramus is curved strongly; the coronoid process is orientated anteriorly and in bivariate analyses this pattern clustered with samples from Jericho, Afalou and Elmenteita. The gonial area is square and developed strongly. The height of the corpus is similar at the level of the mental foramen and at M3; the mylohyoid line is low in relation to the alveolar margin and is parallel to the alveolar border below M2 and M3.

In ramus breadth, the ABO group approaches East African Elmenteita; the ABU group Afalou from North Africa as well as Neolithic Jericho and Çatal Hüyük. The indications are that some of the people at Abu Hureyra could have had their origins in East Africa, others in North Africa.

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