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In search of the skeletal remains of the Kazakh Khan Abulkhair (1693–1748): General anthropological examination and craniofacial reconstruction on two possible candidates excavated from Khan Molasy site

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Abstract – This paper summarises the results of the general anthropological examination and craniofacial reconstruction of two skeletons from objects #92 and #178 of the "Khan Molasy" necropolis, a burial site situated in the Aiteke Bi region of Aktobe Province, Republic of Kazakhstan. The hypothesis proposed by archaeologists was that one of these two skeletons could have belonged to Abulkhair Khan (1693–1748), leader of the Junior Jüz between 1718 and 1748 in present day's western Kazakhstan. Aim of the anthropological examination was to help identify the skeleton of Abulkhair Khan. As a result of the general anthropological examination, neither skeleton can be excluded or be clearly identified with Abulkhair Khan, though #92 was considered a somewhat stronger candidate. The aim of the craniofacial reconstruction was to visualise Abulkhair Khan, since there was not any properly detailed authentic portrait or illustration of him preserved for the succeeding generations. With the help of anatomic-sculpting craniofacial reconstruction method we were able to reanimate two faces from the 18th century, that were of mongoloid anthropological type and in all probability the #92 belonged to Abulkhair Khan. With 15 figures and 5 tables.

Key words – Abulkhair Khan, anatomic-sculpting method, craniofacial reconstruction, identification, skeletal remains

INTRODUCTION

This paper summarises the results of the general anthropological examination and craniofacial reconstruction of two skeletons from objects #92 and #178 of the "Khan Molasy" necropolis, a burial site situated in the Aiteke Bi region of Aktobe Province, Republic of Kazakhstan. These two objects were excavated during 2009 and 2010.

The hypothesis proposed by archaeologists was that one of these two skeletons could have belonged to Abulkhair Khan (1693–1748). Abulkhair Khan, a descendant of Genghis Khan, was leader of the Junior Jüz (one of the three great tribes

– Junior Jüz, Middle Jüz and Great Jüz – of the Kazakh people) between 1718 and 1748 in present day's western Kazakhstan. He was a great leader and hero in the 1723–1730 war against the Dzungar Mongol invaders. However, he took an oath of alliance to the Russian crown in 1731, because he knew that the Kazakh people were not able to wage war against two powerful enemies (Dzungar Mongols and Russians) at the same time. But not every Kazakh leader shared this thought, and because of this oath of alliance he was considered a traitor. At the end, Abulkhair Khan was murdered in 1748 (Erofeeva 2007). He was then buried in the Khan Molasy necropolis, but the exact place of his grave became forgotten with time. Aim of the excavation was to find his resting place and skeletal remains. The archaeologists made great efforts and finally narrowed down the possible candidates to two skeletons (#92 and #178), but they could not decide with archaeological methods, which one (if any of them) could have belonged to Abulkhair Khan.

Thus, aim of the anthropological study was to help solve this question: either by excluding one (or both) of the skeletons if it is clearly not identical with the khan (i.e. if the skeleton is female or too young), or by confirming one as Abulkhair Khan if it showed all the known characteristics (i.e. traumas on the bones, which exactly match the descriptions about the death circumstances of Abulkhair Khan).

MATERIAL

The two skeletons published in this paper (#92 and #178) were excavated during 2009 and 2010 in the Khan Molasy necropolis burial site that is situated in the Aiteke Bi region of Aktobe Province, Republic of Kazakhstan. They were taken from Aktobe to Almaty, to the Central State Museum of Kazakhstan for anthropological analysis in March of 2011. Later, in August of 2011 the two skulls were brought to Hungary, to the Department of Anthropology of the Hungarian Natural History Museum for further anthropological examinations and for craniofacial reconstruction. In September of 2011, the two skulls were taken back to the Republic of Kazakhstan, where the skeletal remains were re-buried with all solemnity in the Khan Molasy necropolis.

METHODS

In the course of the anthropological examination, only methods that cause no damage to the bones were used. Skeletons were examined using metric- and macromorphology-based methods to which medical imaging methods were applied for obtaining possible further information.

When scoring morphological sex, 21 anatomical characteristics bearing sexual dimorphism were taken into account (Éry *et al.* 1963, Éry 1992).

Biological age of the two adult skeletons was estimated on the basis of surface alterations of the facies symphysialis ossis pubis (Todd 1920), the ossification of cranial sutures (Nemeskéri *et al.* 1960, Meindl & Lovejoy 1985), and the alterations of the sternal ends of the ribs (Iscan *et al.* 1984). The wear of permanent teeth was also utilised for the estimation of age group (Perizonius cit. Éry 1992, Huszár & Schranz 1952).

Cranial and longbone measurements and indices were taken according to the work of Martin & Saller (1957). Stature was calculated by the method of Sjøvold (1990), a method that controls for all geographic areas and for both sexes. Cranial indices were categorised into classes according to the recommendations of Alekseev & Debets (1964).

Dental examinations were made under artificial light. Data were recorded using the methods of Szikossy (1993). The frequency and progress of carious lesions, the number of cysts, abscessi and pre-mortem tooth loss, and the level of abrasion were documented. The number of incisors and canines with enamel hypoplasia was also determined. To characterise the progress of carious lesions the method of Szikossy & Bernert (1996) was applied. To typify the level of abrasion, the scale with six degrees (marked with numbers from one to six in this paper) produced by Huszár & Schranz (1952) was used.

The manuals of Ortner & Putschar (1981) and Pap (1992) were applied for describing traumas and alterations of the bones.

Computer tomographic records were obtained with a multislice spiral CT scanner (Philips Brilliance CT 16 slice, Software Version 2.3).

Craniofacial reconstruction offers a much more direct approach to the plausible outlook of historic individuals and it has some truly tangible material basis, first of all the anatomy of the face. The essence of the method used was the reconstruction of mimic and masticatory muscles (Sjøvold 1981, Sobotta 1990, Árpás 2006, Kustár & Árpás 2007, 2008). The muscle volumes were deduced from the grade of expressedness of muscle insertions. Soft tissue thickness was estimated at 45 measuring points on the skull, according to the data of Röhrer-Ertl & Helmer (1984) modified by Kustár & Skultéty (1996). All the important anthropometric and morphologic traits were studied on the original skull. The facial features were modelled according to the morphological correlations of the hard to soft tissue of a face following the guidelines (Gerasimov 1949, 1971, Kustár & Skultéty 1996, Prag & Neave 1997, Taylor 2001, Stephan 2002, 2003, Stephan & Simspon 2008, Rynn *et al.* 2010).

We achieved the 3D prototyping of the skull. First the 3D image of the original skull from the CT slice–data were prepared. The Zcorp Designmate CX Colour 3D printer was used for creating the model from powder and adhesives (Kustár *et al.* 2011).

RESULTS

Individual number 92

Condition of the remains

The skull is intact, except the pars basilaris and pars lateralis of the occipital bone that are damaged, and part of the right zygomatic arch is missing. The mandible is considered to be intact; though its condyloid processes suffered post-mortem damage, they had been restored by the time of the examination. Several teeth fell out from their dental sockets during the decay of the body and were lost in the soil. Some teeth are glued into the dental sockets.

In general, the postcranial skeleton is in relatively good condition. Roughly half of the thoracic vertebrae bear post-mortem damage. The cervical vertebrae and the first lumbar vertebra are missing, as are many of the hand and foot bones. The ribs are very fragmentary and incomplete. The scapulae and hip bones are only slightly damaged. The longbones are in good condition, save both femora whose parts were drilled and removed due to sample collection for earlier DNA analyses.

Time of burial

The bones are no longer greasy to the touch, but have a high organic content. The individual was likely buried in several layers of clothing, and likely in a coloured shirt. The organic material in the clothing had a considerable decomposing effect on the bones. Based on the condition of the bones, in a rough estimate, the individual must have been buried at least 150 years ago, but no more than 400 years ago. A more accurate result, including that in which season the burial happened, could not be given with the available resources.

Sex determination

Individual 92 was a male. Of the 21 morphological locations used for estimating sexual dimorphism, 19 suggested the individual to be male (12 showed moderate masculinity, and seven marked masculinity), and two were neutral (Table 1).

Biological age estimation

The individual was estimated to be an elderly male. On the basis of surface alterations of the facies symphysialis ossis pubis, he was over 50. The cranial sutures used for age estimation are almost completely fused. The teeth are strongly worn, and many teeth were lost pre-mortem. Similarly, the overall condition of the spine and joint surfaces confirms the result of the applied age estimation methods. On the other hand, the limb bones are relatively heavy and have no

visible signs of osteoporosis, while the muscle attachment sites suggest this individual was still physically very active, so it is unlikely that he was quite elderly. Having taken all this into consideration, this individual's age was estimated to be between 55 and 65 years.

Size and body shape

This individual is somewhat taller than burial number 178, has wider shoulders and hips, and had a strong body shape. The upper extremities are strong but not robust, and the muscle attachment areas are well defined. The right arm (both the upper arm and forearm) was more muscular than the left, thus presumably he

Table 1. Degree of sexualisation of the examined traits on the two skeletons from Khan Molasy necropolis. (−2 = markedly feminine, −1 = moderately feminine; 0 = indifferent, +1 = moderately masculine, +2 = markedly masculine)

		Individual number 92	**Individual number 178**
	Sexing traits	Value	Value
1.	Tuber frontale et parietale	+1	+1
2.	Glabella. arcus superciliaris	+1	+1
3.	Processus mastoideus	+1	+1
4.	Protuberantia occipitalis externa	+2	+1
5.	Planum occipitale	+1	+1
6.	Margo supraorbitalis	+2	+1
7.	Arcus zygomaticus	+1	+1
8.	Facies zygomaticus	+1	+2
9.	Corpus mandibulae	+1	+1
10.	Trigonum mentale	+2	0
11.	Angulus mandibulae	+1	+1
12.	Caput mandibulae	+2	+1
13.	Pelvis major	+1	+2
14.	Pelvis minor	+1	+2
15.	Angulus subpubicus	0	+1
16.	Foramen obturatum	0	0
17.	Incisura ischiadica major	+1	+1
20.	Sacrum	+1	–
21.	Caput femoris	+2	+2
22.	Linea aspera	+2	+1
23.	Sulcus praeauricularis	+2	+2
	Mean	+1.24	+1.15

was right-handed. The right clavicle is stronger than the left. The muscle attachments of the pelvis and upper leg are well developed, implying regular horseback riding. Below the knee the muscle attachments are much less developed.

Based on the tibia, the height was calculated to be 169.07 cm, while based on the humerus its value is 173.08 cm (Table 2). Thus individual 92 was most probably around 170 cm tall in life.

Skull metrics and morphology

Metric data and major indices of the skull (Figs 1–2) are presented in Table 3. According to the indices, the skull is long (length-width index: dolichokran) and high (length-height index: hypsikran; height-width index: hyperhypsikran), the forehead is medium wide (transversal-frontoparietal index: metriometop). Cranial capacity is very large (hyperaristenkephal). The face and upper face are narrow (leptoprosop, lepten). The orbital cavities are medium high (mesokonch), nasal width is medium (mesorrhin).

From a superior view the skull is ovoid, and from a posterior view is "house-shaped". The forehead and the occipital are curved. The orbits' shapes are intergrade between the rounded and rectangular forms. The nasal bones are protrud-

Table 2. Longbone measurements according to Martin & Saller (1957) and stature according to Sjøvold (1990) of the two skeletons from Khan Molasy necropolis. Where two bones were available from the same type, stature was calculated from the mean of their length

Bone/ Martin No.		**Individual number 92**		**Individual number 178**	
	Side	length (mm)	stature (cm)	length (mm)	stature (cm)
Clavicle/1	Left	158		150	
	Right	159		145	
Humerus/1	Left	334	173.08	–	
	Right	333		322	167.76
Ulna/1	Left	280		–	
	Right	–		–	
Radius/1	Left	258		–	
	Right	260		–	
Femur/1	Left	–		457	169.71
	Right	–		–	
Tibia/1a	Left	371	169.07	365	167.43
	Right	369		–	
Fibula/1	Left	–		–	
	Right	–		–	

ing from the facial plane. The apertura piriformis is anthropin, and the spina nasalis anterior is small. There is a marked fossa on both sides of the maxilla between the apertura piriformis and the incisors' sockets. The degree of alveolar prognathism is quite large. There is no torus maxillaris or torus mandibularis. No shovel-shaped incisors. Canine fossa is shallow.

Dentition

Originally, this individual had 31 teeth. Twelve teeth (mostly molars) were lost during life (pre-mortem tooth loss), so by the time of death 19 teeth remained. Of these, eight were lost in the soil during the decay of the body (post-mortem tooth loss), thus altogether 11 teeth are examinable (Table 4). None of the teeth are carious, but the sign of a cyst or abscess (about the size of a pea) is observable on the mandible at the socket of the lower left second premolar. The average level of abrasion is four (exact value is 4.2) on the six degrees scale. Alveolar bone loss can be seen by some teeth, probably due to the effect of long standing periodontal disease. Both lower canines have slightly expressed linear enamel hypoplasia, which is the result of disturbances of the ameloblasts (the cells responsible for creating the enamel layer of a tooth) usually by non-specific stresses (i.e. by nutritional stresses or by long lasting feverish diseases) during tooth development.

Figs 1–2. Skull of burial number 92, 1 = frontal view, 2 = lateral view

Table 3. Measurements according to Martin & Saller (1957) and Alekseev & Debets (1964) indicesof the two skulls from Khan Molasy necropolis

	Individual number 92			Individual number 178	
Martin No.	Value		Martin No.	Value	
1	191		1	178	
5	–		5	109	
8	146		8	149	
9	99		9	96	
10	125		10	123	
11	134		11	139	
12	115		12	120	
17	–		17	141	
20	126		20	118	
40	–		40	96	
43	111		43	108	
45	137		45	140	
46	104		46	103	
47	131		47	124	
48	79		48	78	
51	44		51	43	
52	37		52	32	
54	28		54	29	
55	59		55	60	
62	48		62	47	
63	–		63	45	
65	119		65	135	
66	101		66	104	
69	34		69	36	
70	67		70	59	
71	35		71	40	
	Value	Class category		Value	Class category
38	1642	hyperaristenkephal	38	1502	aristenkephal
8:1	76.44	dolichokran	8:1	83.71	hyperbrachykran
17:1	–	–	17:1	79.21	hyperhypsikran
17:8	–	–	17:8	94.63	metriokran
9:8	67.81	metriometop	9:8	64.43	stenometop
20:1	65.97	hypsikran	20:1	66.29	hypsikran
20:8	86.30	hyperakrokran	20:8	79.19	metriokran
47:45	95.62	leptoprosop	47:45	88.57	mesoprosop
48:45	57.66	lepten	48:45	55.71	lepten
52:51	84.09	mesokonch	52:51	74.42	chamaekonch
54:55	47.62	mesorrhin	54:55	48.33	mesorrhin
63:62	–	–	63:62	95.74	brachystaphylin

Table 4. Basic dental data of individual number 92 from Khan Molasy necropolis. (OK = tooth present, PO = post-mortem loss of tooth, PE = pre-mortem loss of tooth, 0 = tooth did not erupt/no tooth germ, C = carious tooth)

Upper left quarter				**Upper right quarter**			
Tooth type	Status	Abrasion	Note	Tooth type	Status	Abrasion	Note
I^1	OK	5	wear affected mostly the palatal surface	I^1	OK	4	wear affected mostly the palatal surface
I^2	OK	5	–	I^2	OK	4	–
C	OK	5	–	C	PO	–	–
P^1	OK	4	–	P^1	PO	–	–
P^2	OK	5	unusual wear on mesial surface	P^2	PO	–	–
M^1	PO	–	–	M^1	PO	–	–
M^2	PE	–	–	M^2	PE	–	–
M^3	PE	–	–	M^3	0	–	–
Lower left quarter				**Lower right quarter**			
Tooth type	Status	Abrasion	Note	Tooth type	Status	Abrasion	Note
I_1	PO	–	–	I_1	PO	–	–
I_2	PO	–	–	I_2	PE	–	–
C	OK	4	linear enamel hypoplasia	C	OK	3	linear enamel hypoplasia
P_1	OK	4		P_1	OK	3	–
P_2	PE	–	cyst/abscess of pea size	P_2	PE	–	–
M_1	PE	–	–	M_1	PE	–	–
M_2	PE	–	–	M_2	PE	–	–
M_3	PE	–	–	M_3	PE	–	–

Optimal tooth number	PO		PE		OK		C	
N	N	%	N	%	N	%	N	%
31	8	25.8	12	38.7	11	35.5	0	0.0

Trauma and pathology

In general, many of the joints show osteoarthritic changes (but usually not so severe) that could have been the result of the elderly age and/or way of life.

The sternal and acromial ends of both clavicles are arthritic. The costal cartilage of both first ribs have ossified and fused to the manubrium sterni. The margin of the glenoid cavity by both scapulae are somewhat rimmed, while the proximal epiphysis of the right humerus has a very distinctive rim. The examinable hand bones are all arthritic, some of the metacarpals even show eburnation too (Fig. 3). The knee joints are also arthritic, especially the proximal end of tibiae (around the medial condyle), which have marked rims. The vertebrae show clear evidence of chronic physical strain. Several thoracic vertebrae have wedge-shaped body from lateral view, and the cranial and caudal surface of these vertebral bodies are quite concave. The small apophyseal and costovertebral joints in the thoracic region are intact. Lumbar vertebral bodies have lowered height and osteophytes, and their small joints are arthritic (Fig. 4). L5 has partial spondylolysis.

Four left-side ribs have healed fractures, all at their angle region. Most probably these were caused at the same time by the same event (i.e. by falling down or by a strong blow/kick), but they reossified and healed completely (Fig. 5). Sign of another trauma, in the form of a cut, can be seen on the lower edge of the left maxilla (on the zygomatic process), vertically in line with the infraorbital foramen (Fig. 6). This sharp cut was suffered around the time of death (peri-mortem), as it does not show any sign of healing and the colour of the cut's inner surface is identical with the outer bone surface's colour. However, this wound by itself was not lethal. On the left zygomatic bone there are two extra cuts, but they are post-mortem as the colour of these cuts are much lighter and "cleaner" than the surrounding parts. Probably they were made accidentally during excavation or lab work.

Computer tomographic examination did not show any additional trauma or pathological alteration on the skull.

Craniofacial reconstruction – Characteristic features of the skull and the reconstructed face

The facial skeleton is high and narrow. The forehead is slightly inclined. The superciliar arch is cut in half. The eyebrow is protruding and arched. The nasal root is wide and of medium depth. The nasal bridge is outstanding and of sand-glass shaped that is broadening out downwards. The nasal profile is wavy. The bridge of the external nose is slightly convex. The nasal apex is rounded and the nasal wings are wide and flattened. The orbits are cornered. Due to the open shape of the orbits the eye-folds are thick. The lower margins of the orbits are protruding. The zygomatic bones are high and rough, they are of frontal position. The zygomatic arches are narrow but thick. The cheeks on the reconstructed face are standing out. The teeth are of medium size. The bite pattern shows deep bite pattern and alveolar prognathy can be seen. As a conclusion of the bite pattern the upper lip is more protruding than the lower one. The mandible is high and

Fig. 3. Osteoarthritic changes including eburnation on the capitulum of the 5th metacarpus. Left hand. Burial number 92

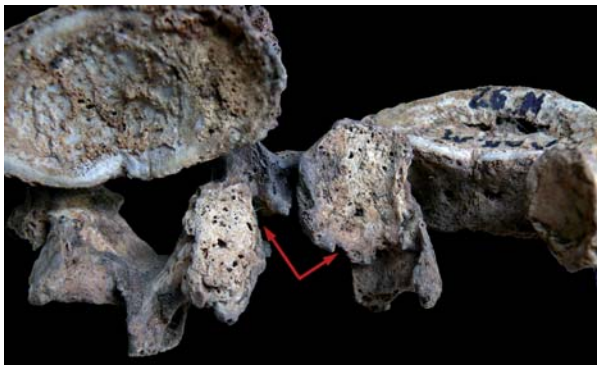


Fig. 4. Arthritic small apophyseal joints (marked by arrows). 4th and 5th lumbar vertebrae. Burial number 92

robust. Due to the strong and rough angles of mandible the chewing muscles are also strong. The occipital surface and mastoid processes are robust, so the neck is fairly strong muscled. Due to the several visible mongoloid features on the skull – such as shape of the nasal root, the orbits, and the zygomatic bones – we reconstructed Mongolian folds over the eyelids (Figs 7–8).

Fig. 5. Two left-side ribs with healed fractures (marked by arrows) at their angle region. Burial number 92

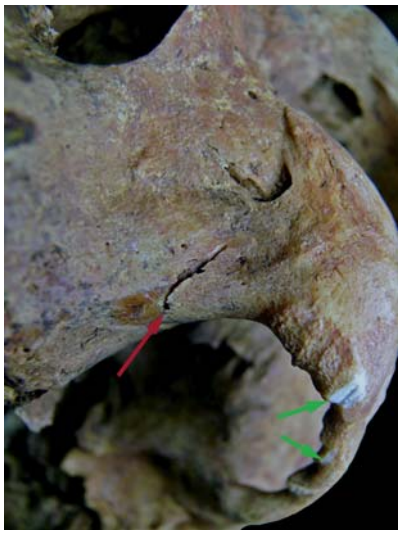


Fig. 6. Peri-mortem cut on the left maxilla (marked by red arrow). Two post-mortem cuts (marked by green arrows) on the left zygomatic bone. Burial number 92

Individual number 178

Condition of the remains

The skull is intact, save the infratemporal surface of both maxillae and the right mastoid process that are slightly damaged. The mandible is intact. A large number of teeth fell out from their dental sockets during the decay of the body and were lost in the soil. A couple of teeth are glued into the dental sockets. The base of the skull, a large part of the mandible and to a smaller extent the clavicles are speckled by blue discoloration stains, probably due to long standing contact with some kind of material.

In general, the postcranial skeleton is in good condition. Roughly half of the left ilium, the body of L5, and parts of longbones (i.e. right femur) are missing as they were used as samples for earlier DNA analyses. In addition, the left patella, the proximal end of the left humerus, and several hand and foot bones are missing. The right ribs are quite fragmentary and incomplete. Otherwise the postcranial bones are intact or suffered only slight post-mortem damages.

Figs 7–8. Craniofacial reconstruction of the male from grave No. 92, 7 = frontal view, 8 = lateral view

Time of burial

No soft tissue remains, but some of the bones, especially the base of the skull, are still greasy to the touch. Presuming average conditions, in a rough estimate, the individual must have been buried at least 100 years ago, but probably no more than 300 years ago. A more accurate result, including that in which season the burial happened, could not be given with the available resources.

Sex determination

Individual 178 was a male. Altogether 20 sexual dimorphism-showing morphological traits were examinable on the skeleton. From them, 18 suggested the individual to be male (13 showed moderate masculinity, and five marked masculinity), and two were neutral (Table 1).

Biological age estimation

The individual died in his late maturus or early senium age. On the basis of surface alterations of the facies symphysialis ossis pubis he was over 45, while according to sternal end of the fourth rib he was most probably between 54 and 64 years old. The cranial sutures used for age estimation show significant closure, but they are not as fused as in burial number 92. This individual's teeth are quite strongly worn, but the number of pre-mortem lost teeth is very low. The condition of the spine and joint surfaces corresponds to the result of the applied age estimation methods. Similar to burial number 92, the muscle-attachment sites are well developed and limb bones are not osteoporotic. This suggests the individual was physically very active. Having taken all this into consideration, this individual's age was estimated to be between 50 and 65 years.

Size and body shape

This individual is a little bit shorter than burial number 92, has narrower (but still quite wide) shoulders and hips. He too had a strong body shape. The upper extremities are strong, as well as the forearms. The deltoid tuberosity on the right humerus is particularly well defined. The right arm, as was in the case of individual number 92, was more muscular than the left, so most probably this person too was right-handed. The muscle attachments on the hip bones and on the upper leg bones are very well developed, even more than by the other skeleton, and some of them have strong enthesopathy (i.e. on the iliac crest, on the tuber ischiadicum, on the trochanter major and minor), indicating extensive use and implying supposedly regular horseback riding. Calculated stature is 169.71 cm based on the femur, 167.43 cm based on the tibia, and 167.76 cm when calculated from the humerus (Table 2). Thus, individual 178 was most probably around 168 cm tall in life.

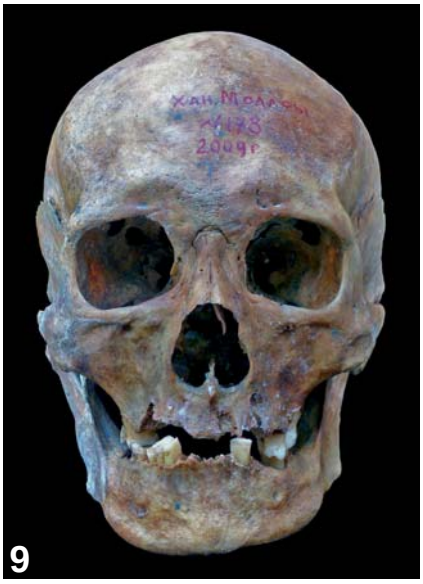
Skull metrics and morphology

Metric data and major indices of the skull (Figs 9–10) are presented in Table 3. According to the length-width index the skull is very short (hyperbrachykran), based on the height-width indices is medium high (metriokran), and according to the length-height indices is high/very high (hypsikran/hyperhypsikran). The forehead is narrow (transversal-frontoparietal index: stenometop), cranial capacity is large (aristenkephal). The face is medium wide (mesoprosop), upper face is narrow (lepten), but falls close to the medium wide (mesen) category. The orbital cavities are low (chamaekonch), nasal width is medium (mesorrhin).

From a superior view, the skull is ovoid, and from a posterior view is "house-shaped". The forehead and the occipital are both curved. The orbits' shapes are rectangular. The lower margin of the apertura piriformis shows slightly expressed sulcus praenasalis, the spina nasalis anterior is small. The level of alveolar prognathism is small. Moderate torus maxillaris and marked torus mandibularis. Canine fossa is incospicuous.

Dentition

Originally, individual number 178 had 29 teeth. Two teeth (upper right central incisor and lower left second premolar) were lost during life (pre-mortem tooth loss), so by the time of death 27 teeth remained. However, many of them were lost post-mortem, 16 in number, thus altogether 11 teeth are examinable



Figs 9–10. Skull of burial number 178. 9 = frontal view, 10 = lateral view

(Table 5). None of them are carious. Sign of one cyst or abscess, about the size of a pea, is present at the left maxillary canine's socket. The average level of abrasion is 4.7 on the six degrees scale, so wear of dentition is very advanced. Similarly to burial number 92, this person also has alveolar bone loss, mainly around the molars, probably due to the effect of a long standing periodontal disease.

The unusual position of the maxillary left second premolar and first molar is worth mentioning. The top of the first molar's crown falls in line horizontally with the second premolar's neck, as the latter's crown reaches far beyond the occlusal plane. Still, the mesial half of the premolar's crown has almost no wear compared to the other teeth (a possible explanation is that the opposite mandibular left second premolar, which was lost pre-mortem and could have worn the maxillary premolar down, fell out during early adulthood), only its distal part is worn down. In addition, the mesial surface of the first molar's crown impresses into the premolar's neck, deforming the latter.

Trauma and pathology

Like burial number 92, this individual has moderate osteoarthritic changes in many of his joints that could have been the result of elderly age and/or way of life. Thus, the right shoulder-joint is arthritic with a marked rim around the humeral head (Fig. 11). The acromial end of the clavicles (Fig. 12) and both knee joints (with rims around the joint surfaces) are arthritic, just as the foot and hand bones. The erosion seen on the hand bones are much less severe than in individual number 92. The margin of the acetabulum on both hip bones is somewhat rimmed. Small bony spurs are visible at the sacroiliac joint. The vertebrae are slightly osteoporotic, and show clear evidence of chronic physical strain and the degeneration of the spine with aging. On the cervical section of the spine, all vertebral bodies have spondylodiscitis from the caudal surface of C3 to the cranial surface of C7. C3–C7 have pinked bodies. The right inferior articular process of C2 and its counterpart, the right superior articular process of C3 show arthritic changes, just as the right inferior articular process of C3 and the right superior articular process of C4. The latter two also have eburnation on their articular facets (Fig. 13). The thoracic section of the spine is in better condition than the cervical and lumbar sections. No Schmorl's nodes are seen. The bodies of T5–T10 have small osteophytes. Their small apophyseal and costovertebral joints are generally intact or have only small marginal rims. Lumbar vertebral bodies L2–L4 have bony spurs, while L5 has spondylolysis (only the vertebral arch is examinable as the body was taken away due to sample collection for earlier DNA analyses.) The sacral canal is open on the sacrum's last two segments.

No trauma was observable on the bones, and computer tomographic examination did not show any additional trauma or pathological alteration on the skull.

Table 5. Basic dental data of individual number 178 from Khan Molasy necropolis. (OK = tooth present, PO = post-mortem loss of tooth, PE = pre-mortem loss of tooth, 0 = tooth did not erupt/no tooth germ, C = carious tooth)

Upper left quarter				**Upper right quarter**			
Tooth type	Status	Abrasion	Note	Tooth type	Status	Abrasion	Note
I^1	PO	–	–	I^1	PE	–	–
I^2	PO	–	–	I^2	PO	–	–
C	PO	–	cyst/abscess of pea size	C	PO	–	–
P^1	PO	–	–	P^1	PO	–	–
P^2	OK	4	unusual position with M1	P^2	PO	–	–
M^1	OK	4	–	M^1	OK	5	–
M^2	PO	–	–	M^2	OK	5	–
M^3	PO	–	–	M^3	0	–	–
Lower left quarter				**Lower right quarter**			
Tooth type	Status	Abrasion	Note	Tooth type	Status	Abrasion	Note
I_1	PO	–	–	I_1	PO	–	–
I_2	PO	–	–	I_2	PO	–	–
C	OK	5	–	C	OK	5	–
P_1	OK	5	–	P_1	OK	4	–
P_2	PE	–	–	P_2	OK	5	–
M_1	OK	5	–	M_1	OK	5	–
M_2	PO	–	–	M_2	PO	–	–
M_3	0	–	–	M_3	0	–	–

Original tooth number	PO		PE		OK		C	
N	N	%	N	%	N	%	N	%
29	16	55.2	2	6.9	11	37.9	0	0.0

Craniofacial reconstruction – Characteristic features of the skull and the reconstructed face

The face is low and of medium wide. The forehead is strongly reclined. The superciliar arch is prominent and divided in two parts. The eyebrows are jutting and of broken line shaped. First they run upward than go on horizontal line. The nasal root is wide and shallow. The nasal bones are flat and sand-glass shaped,

that is broaden out downwards. The nasal bridge is slightly prominent and the nasal profile is concave. The nasal aperture is wide. Beneath its lower margin sulculs praenasalis can be seen. The bridge of the external nose is straight and the apex is wide and rounded. The nasal wings are wide. The orbits are low and angled, open shaped and their lower margins are protruding. The eye-folds are

Fig. 11. Marked rim around the head of the right-side humerus. Burial number 178

Fig. 12. Osteoarthritic changes on the acromial end of the right-side clavicle. Burial number 178

Fig. 13. Osteoarthritic changes including eburnation on the small apophyseal joints (marked by arrows) of the 3rd and 4th cervical vertebrae. Burial number 178

thick. The zygomatic bones are high and frontal of position. The zygomatic arches are gracile and medium wide. Both canine fossa is filled in. The zygomatic area on the face is notably salient. The upper front teeth were post-mortem missing, that we replaced with wax. The rest of the teeth were strongly abraded. The lips are of medium plump. Following the bite pattern – that shows mandibular prodonty – the lower lip is slightly more protruding than the upper one. The body of the mandible is low but strong. Its angle is striated with the well developed musculature. The pogonion is projected but the shape of the chin is rounded. The chin on the reconstructed face is moderately protruding. The occipital surface and the mastoid processes are medium developed. The external protuberance of the occipital bone is slight. Consequently the neck was moderately strong. Due to the several visible mongoloid features on the skull – such as shape of the nasal root, the orbits, and the zygomatic bones – we reconstructed Mongolian folds over the eyelids (Figs 14–15).

Hair, beard and moustache of both cases were reconstructed after we finished the craniofacial reconstruction. We modelled the hair and the facial hair onto the plaster casts of the reconstructed faces, according to the given illustrations. Since we have not had any idea of the original state of nourishment we estimated medium level of nourishment.

CONCLUSIONS

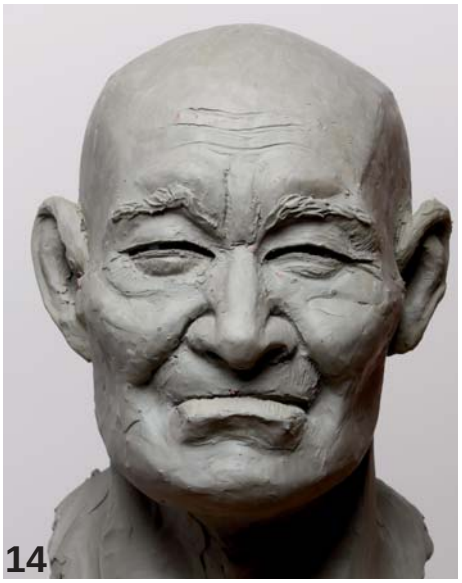
An assumption was that one of the examined skeletons could have belonged to Abulkhair Khan. According to historical sources, the khan was murdered at 55 years old, and was buried in August 1748. There is no undoubted information about the circumstances of his death, but historical sources maintain that first he received a strong blow to the head and then was stabbed (in his chest) to death while lying on the ground.

Based on the general anthropological examination, the skeletons could be excluded if they belonged to a woman, to a person clearly too young or too old to be Abulkhair Khan, or if they had sign of a significant physical defect that the khan never had. On the other hand, one of the skeletons could be identified as the remains of the khan if every known detail about him (age at death, time elapsed since burial, injuries suffered at death according to the historical descriptions), in ideal case, corresponded.

Burial number 92 was an elderly male who died most probably between 55 and 65 years of age, and was buried, in a rough estimate, 150–400 years ago. This individual was around 170 cm tall, had a strong body shape, was right-handed, and his muscle attachment sites suggest that he was quite physically active even around his death, and probably spent a lot of time on horseback in his life. He had

no significant physical defect that left a trace on the bones, and the alterations found on the skeleton (osteoarthritic joints, degeneration of the spine, pre-mortem lost teeth) are considered normal for his estimated age. He broke four of his ribs during his life, but all healed in time. However, he has no sign of trauma on his skull from blow to the head, and no peri-mortem injuries from a sharp weapon can be seen on his ribs. On the other hand, many of his ribs are fragmentary or missing, and it is possible to suffer a stabbing to the chest without any damage to the ribs. As regards for the blow to the head, he could have worn a helm and/or the blow was not strong enough to damage the skull, or there was no such hit to the head. Still, he has a peri-mortem injury on the skull: a cut on the left maxilla that he received shortly before, or exactly around, the time of his death. This suggests that this person could have died a violent death, but this wound was not lethal in itself. Having taken all this into consideration, burial number 92 cannot be excluded, but neither can be clearly identified with Abulkhair Khan, though we considered him a somewhat stronger candidate than burial number 178.

Burial number 178 was also an elderly male who died between about 50 and 65 years of age, and was buried, in a rough estimate, 100–300 years ago. He was around 168 cm tall in life, thus only a little bit shorter than individual number 92. Similarly to the other skeleton, burial number 178 also had a strong body shape, was right-handed, and based on his muscle attachment sites was quite physically



Figs 14–15. Craniofacial reconstruction of the male from grave No. 178, before the phase of sculpting up hair and beard, 14 = frontal view, 15 = lateral view

active even around the time of his death, and probably spent a lot of time on horseback in his life. Furthermore, he had no significant physical defect that left traces on the bones, and the alterations found on his skeleton (osteoarthritic joints, degeneration of the spine) are considered normal for his estimated age. He has no trace of any trauma on his bones, but notes mentioned for burial number 92 about the lethal injuries described in the historical sources are valid also for this skeleton. Consequently, burial number 178 and 92 are similar to each other in age, in body height, in the presumed body shape, in physical condition, and they probably had the same way of life. Having taken all this into consideration, burial number 178 cannot be excluded, but neither can be clearly identified with Abulkhair Khan.

By itself, the general anthropological examination was not able to clearly match one of the skeletons with Abulkhair Khan, but neither could it exclude any of them. Fortunately, further possibilities were at hand that could help solve the question. There are known living direct descendants of Abulkhair Khan on the paternal line, thus, if proper DNA sample can be taken from the bones, it becomes possible to identify the skeleton with genetic methods. In addition, as there are clear differences in some of the main metric and morphological features of the skulls between burial number 92 and 178, their facial reconstruction may also help in solving the problem. Unfortunately, however, there is not any well enough detailed genuine picture of Abulkhair Khan available for comparison.

A genetic (Y-DNA) examination was carried out by scientists of the Institute of General Genetics and Cytology (Almaty, Kazakhstan) using DNA samples taken from the bones and from living direct descendants of Abulkhair Khan (along the paternal line). This showed that the skeleton of burial number 92 belonged to Abulkhair Khan himself or to someone on his paternal line with a chance of 99.7% (Dzhansugurova *et al.* 2011).

Thus, it can be concluded, considering the results of the general anthropological examination in addition to the Y-DNA examination, that the skeleton of burial number 92 belonged most probably to Abulkhair Khan.

The anatomic-sculpting craniofacial reconstructions serve as a good illustrations for the anthropologic evidences. Both reconstructed faces are of mongoloid anthropological types, supporting the postulated historical and anthropological background of the research. Furthermore, after the craniofacial reconstructions were presented to the Kazakh scientists of the project, it was noted by them, that the reconstruction of burial number 92 shows remarkably similarities in its appearance to one of the known descendants of Abulkhair Khan (Anonymous 2011). Thus, the anatomic-sculpting craniofacial reconstructions too could provide secondary evidence to further strengthen the results of the general anthropological and genetic examinations.

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