Chapter 24

HORSE REMAINS FROM THE ARZHAN-1 AND ARZHAN-2 SCYTHIAN MONUMENTS

Bourova N.
The Institute for the History of Material Culture of Russian Academy of Sciences, St.Petersburg, Russia

ABSTRACT

This paper presents the first osteological study and comparison of horse remains from the two famous Arzhan-1 and Arzhan-2 Scythian monument in Tuva. In spite of the fact that the horses from both monuments belong to the same breed groups, one can observe some differences in the sizes of the horses caused probably by differences in the local environmental conditions.

Keywords: Scythian time, horse remains, osteology, Tuva region

INTRODUCTION

The investigation reported here focuses on the study of horse remains from the two famous Scythian barrows Arzhan-1 and Arzhan-2.

The Scythian barrow Arzhan-1 was discovered by M. Gryaznov in 1971-1974 in the Uyuk hollow in Tuva. Arzhan-1 is a very complicated monument consisting of 29 different archaeological burials and graves dated to the same time. As well as the tsar burial ground and graves of nobility, over 160 horse skeletons were found in this monument. All of them were stallions older than 12-15 years (Gryaznov, 1980:49, 52). According to the archaeological point of view, graves 2 and 3 with the horse remains belonged to the Arzhan culture originating from the Tuva region. This barrow is the oldest Scythian monument and is dated to the 9th century BC.

The Arzhan-2 monument is located in the Uyuk hollow not far from the famous barrow Arzhan -1. It was discovered in 2001 by the Central Asiatic archaeological expedition (Chugunov K.V.2000) and the Eurasian Department of the German Archaeological Institute (Prof. G.Parzinger and Dr. A.Nagler). The construction of this monument differs from Arzhan-1. Arzhan-2 contains a variety of archaeological materials reflecting both the

E.M. Scott et al. (eds.), Impact of the Environment on Human Migration in Eurasia, 323-332.
© 2004 *Kluwer Academic Publishers. Printed in the Netherlands.*

mode of life and the burial tradition of the ancient nomads. A collective horse burial was also found here (grave 16, 14 complete horse skeletons). The burial mound is dated to the 7th century BC.

MATERIALS AND METHODS

The horse remains from Arzhan-2 and the Arzhan-1 form the basis of the study presented.

All 14 skeletons from Arzhan-2 are in the State Hermitage Museum collection. Only stallions about 12-16 years old were found in the grave. Some horses showed pathological symptoms of disease.

Unfortunately, only a small part of collection from Arzhan-1 was kept in the collection of the Institute for the History of Material Culture RAS. According to Gryaznov (1980) 13 horse burials were found from which the remains from burials 2, 3 have been analyzed.

The methodological approaches of von den Driesch (1976), Eisenmann and Beckouche (1986) were generally used for the cranial and postcranial measurements. For each group of measurements, the range of variation and average value have been calculated. All long bones have epiphyses which are firmly fused to their diaphyses.

Skull

Unfortunately, the material from Arzhan-1 contains only one complete skull and a few pieces. In Table 1 the measurements of the horse skulls from Arzhan-2 and Arzhan-1 are presented

Table 1. Skull measurements of the horses from the Arzhan-1 and Arzhan-2 monuments

	Measures	**Arzhan-2**			**Arzhan-1**		
		n	lim	M	n	lim	M
	Skull						
1	basilar length	7	448,4-502,8	489,2	1	468	
2	palatal length	10	266,2-277,3	269,4	2	261-262,5	261,7
3	distance from palate to hormion	6	103,5-110	107,6	1	107	
4	distance from hormion to basin	5	120,7-132,8	128,4	1	116	
5	muzzle length	12	129-143,2	134,8	1	128	
8	occlusal length of the upper cheekteeth	13	154-173	166,4	3	160-161,5	160,6
9	choanal length	8	61,5-69,6	65,4	1	65	
10b	choanal breadth between the pterygoid processes	8	40,2-47,5	43,6	1	41,5	
11	breadth between the foremost points of the facial crests	9	152,6-172,3	163,3	2	155-156	155,5
13	frontal breadth	4	207,5-215	211,7	1	202	
16	breadth of the supra-orbital crest	8	49,2-63,5	56,4	1	54	

17	muzzle breadth at the posterior borders of the I^3	12	70-77,2	73	1	68	
17b	least muzzle breadth between the interalveolar borders	12	45,3-58	51,2	2	45,5	45,5
18	vertex length	7	540.5-556,7	546,7	1	558	
20	height of the external auditory meatus	6	12,7-21	16,1	-	-	
23	anterior ocular line	11	369,5-398,7	387,6	2	373-382	377,5
25	facial height in front of P^2	10	95,5-115	104,2	1		
	occlusal length of P^2	12	33,4-40	36,6	2	35,9	35,9
	breadth of P^2	12	22,5-26,7	23,2	3	20-22,5	21,5
	occlusal length of the protocone P^2	-	-	-	3	9-9,6	9,2
	occlusal length of P^3	13	23,6-27,3	26	3	26,5-27	26,8
	breadth of P^3	13	24,3-28	26,6	3	25,2	25,2
	occlusal length of the protocone P^3	12	9,3-13,6	11,4	3	10-11,2	10
	occlusal length of P4	12	22,5-27	25,2	3	24,5-25,5	25,1
	breadth of P4	12	25,5-29,7	27,5	3	25,5-27,8	26,6
	occlusal length of the protocone P4	11	10-14,8	12,3	3	11-11,8	11,3
	occlusal length of M^1	13	20,2-25,4	23	3	21,5-23	22,2
	breadth of M^1	13	25,4-28,8	27	3	26-27	26,5
	occlusal length of the protocone M^1	12	10,3-14,3	12,2	3	11-11,3	11,1
	occlusal length of M^2	13	21-25,2	23,5	3	22,8-23	22,9
	breadth of M^2	13	24-27,6	26,1	3	23,9-25,6	24,5
	occlusal length of the protocone M^2	12	11,3-15	13,4	3	12-13	12,6
	occlusal length of M^3	13	25,5-31,5	27,8	3	28,3-30	29,1
	breadth of M^3	13	21,5-26,2	24,3	3	21,8-24,5	23,1
	occlusal length of the protocone M^3	12	12,4-16,5	14,4	3	12,9-14,5	13,7
	Lower jaw						
	greatest length	11	432-463	413,4	4	388,3-443	417
	greatest length of the angular part	13	123,5-142	131,4	4	118-133	127,3
	length of the diastema	12	77,5-109,2	95,4	3	75-101	91
	occlusal length of the lower cheekteeth	14	72-84	79,1	3	70-77	72,4
	height of the vertical ramus	12	212,8-238	221,5	3	206,1-230	205,7
	occlusal length of P2	13	29,5-35	32,2	2	30-33	31,5
	breadth of P2	13	13,5-19,5	16,4	2	16-18,2	17,1
	postflexid length of P2	13	8,8-16,7	14,3	2	11,2-12,8	12
	occlusal length of P3	14	25-28,4	26,8	3	25-27	26
	breadth of P3	14	16-20,8	18,1	3	16,2-17	16,5
	postflexid length of P3	14	3,5-14,7	11,4	3	9-11	10,1
	occlusal length of P4	14	21,7-27,2	25,3	3	24,2-26,1	24,9
	breadth of P4	14	15,8-21	18,7	3	16-18,8	17,6
	postflexid length of P4	14	6-13,6	11,1	3	8,8-9	8,9
	occlusal length of M1	14	22,3-25,6	24,1	4	22-23	22,6

	breadth of M1	14	15-20	17,5	4	16-17,1	16,4
	postflexid length of M1	14	4,4-13,6	8,3	4	4,5-8	6,8
	occlusal length of M2	14	22,8-26,3	24,6	4	23-25	23,8
	breadth of M2	14	14,4-18,6	15,5	4	16-17	16,4
	postflexid length of M2	14	5-11	8,5	4	6-8,3	7,6
	occlusal length of M3	14	29,6-34	31,7	4	31-34,5	32,1
	breadth of M3	14	13,1-16,5	15,1	4	13,5-15	14,1
	postflexid length of M3	14	7,2-10,4	9,2	4	7,2-10	8,5

n - number of specimens; lim- minimum and maximum observed value; M - mean

One can see the similarities in the range of variations. Following V. Eisenmann (1986) differences between the logarithms (base 10) of the standard (E.hemionus oager) and the logarithms of the other form were calculated and plotted. Figure.1 compares the means of the horse crania from the two Scythian monuments. The horses from two monuments seem to have very similar crania.

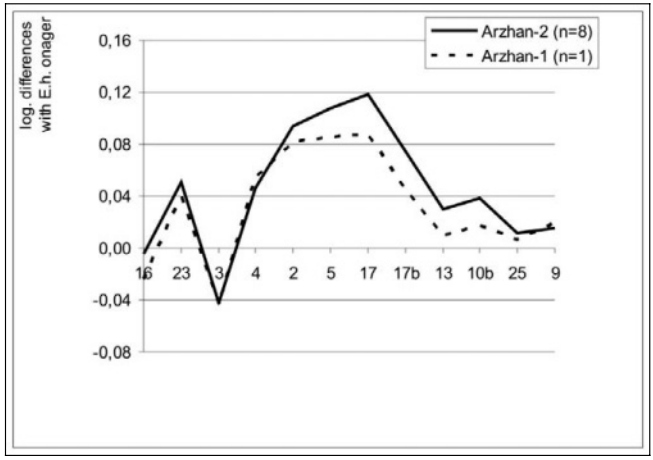

Figure 1. Ratio diagrams of the cranial measurements (means) of horses from Arzhan-2 and Arzhan-1 compared to E. hemionus onager

Teeth

Measurements of upper teeth included occlusal length (OL) and breadth for each tooth and occlusal length of the protocone (PL) (Table 1). The protocone index (PL×100/OL) was also calculated for each tooth. Measurements of lower jaw teeth included occlusal length (OL) and breadth and postflexid length. (Table 1).

The comparative diagrams of mean occlusal length of upper jaw teeth, protocone lengths, protocone index and occlusal length of lower jaw teeth plotted in Fig.2,3,4,5 show that there are no significant differences in the size of teeth.

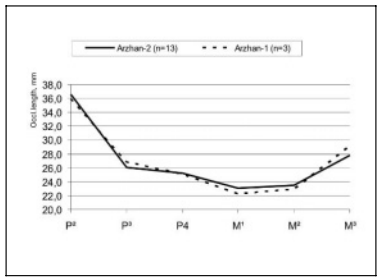

Figure 2. Mean occlusul lengths in mm of the upper cheekteeth of horses from the Arzhan-2 and the Arzhan-1

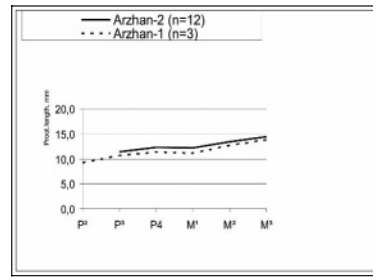

Figure 3 Mean protocone lengths in mm of the upper cheekteeth of horses from the Arzhan-2 and the Arzhan-1

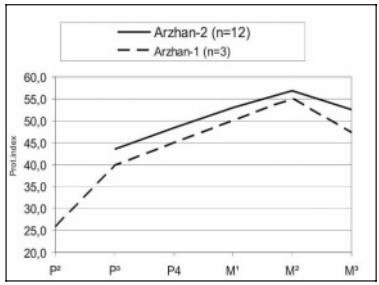

Figure 4 Mean protocone indices for the upper cheekteeth of horses from the Arzhan-2 and the Arzhan-1

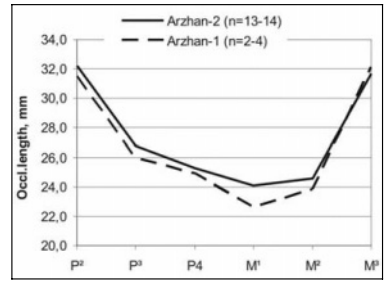

Figure 5 Mean occlusal lengths in mm of the lower cheekteeth of horses from the Arzhan-2 and the Arzhan-1

Post-cranial skeleton

Another situation can be observed when we compare the postcranial elements. (Table 2). The lengths of bones such as the femur, tibia, metacarpus and metatarsus from Arzhan-2 are greater than those from Arzhan-1 (Table 2). Among the extremity bones, the main focus was given to metacarpals and metatarsals.

Table 2 Comparison of the measurements of postcranial elements

Measurement	Arzhan-2			Arzhan-1		
	n	lim	M	n	Lim	M
Humerus, length	6	277-300	293	1	274	
breadth of diaphysis	6	35-37,2	36,2	1	34,2	
Radius,lenght	14	324-350	336,4	-	-	-
breadth of diaphysis	6	38-41	39,5	-	-	-
Femur,lenght	14	386-412	398,7	21	345,2-383	367,5
breadth of diaphysis	6	40-47	43,8	21	34,9-46	36,3
Tibia,lenght	14	342-372	354,8	1	332,4	
breadth of diaphysis	6	39-43	41,5	1	39	
Metacarpus,lenght	14	218-240	227,4	6	219-229,6	223,7
breadth of diaphysis	6	33-41	35	6	31,5-33,5	32,3
Metatarsus	14	262-281	268,8	4	256,6-263	260,9
breadth of diaphysis	6	31-33	31,5	4	28,9-31,2	29,5

n - number of specimens; lim- minimum and maximum observed value; M – meaning

First there are some differences in the measurements. The greatest length of the metacarpals from Arzhan-2 is between 218 mm and 240 mm, the average is 227.4 mm, whereas 219 mm to 229.6 mm with an average of 223,7 mm is more characteristic for the horses from Arzhan-1 (Table 2). The greatest length of metatarsals from Arzhan-2 is 262 – 281 mm with an average of 268,8 mm and for Arzhan-1 it is 256,6 – 263 mm with an average of 260,9 mm.

DISCUSSION AND CONCLUSIONS

Thus, from the data presented, it is clear that the horses from Arzhan-2 differ somewhat from Arzhan-1 mainly in some larger dimensions. However, there are differences in the length of the long bones which may reflect the values of shoulder heights. According to Vitt's classification the horse could be divided into following groups (Table 3).

Table. 3 Comparison of a shoulder height

Height in cm	112-120 very small	120-128 small	128-136 < average	136-144 average	144-152 > average
Arzhan-1	9,60%	47,60%	42,80%		
Arzhan-2			7,10%	85,80%	7,10%

The horses from Arzhan-2 were larger-bodied animals. The horses from Arzhan-1 were considerably smaller. There were even very small individuals (shoulder height below 120 cm) among them.

The question naturally arises as to whether the horses were of the same breed group.

Based on the basal length of the skull Vitt V. (1952) classified four groups of horses from the Pazyryk and the Sibe monuments. Inside these groups he created the skeleton profiles for each group calculating the average dimensions of the post-cranial elements. The diagrams of the skeleton profiles were used as one of the pieces of evidence that all the animals belonged to the same breed group and that the differences between groups I and IV can perhaps be the result of the different ways in which horses were kept (Vitt, 1952).

In agreement with the reasoning of V. Vitt, the comparative skeleton profiles were created (Fig. 6).

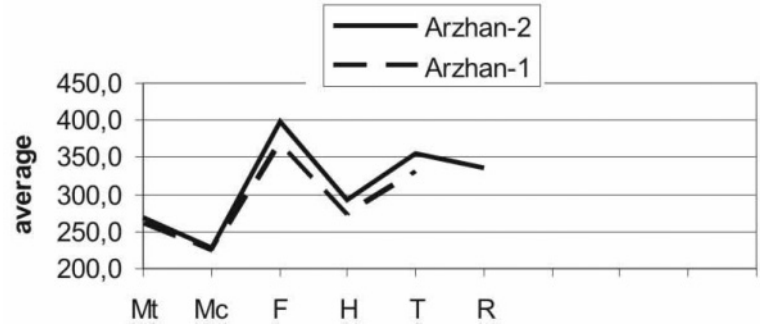

Fig.6 Skeleton profile

On the whole, one can see that diagrams obtained have more or less equal values and look very similar. Thus, in spite of the range of variation a general resemblance between horse skulls, teeth and extremity bones from both barrows can be observed.

Analyzing the data presented here it is possible to propose that the same breed group of horses existed in Arzhan-2 and Arzhan-1. If this view is correct, one can suggest some reasons for the observed size differences.

First of all, probably, the differences in size can be linked with different environmental conditions.

Considering this suggestion the metapodial indices ((Mt/F)*100) were examined which can be used as one of the indicators of changes in paleoenvironments. The larger metapodial indices indicate an arid environment; the smaller indices characterize a more humid climate (Vitt, 1952).

Here the lowest value of metapodial index of the horses from Arzhan-2 is 64.5, the highest – 69.6, the average being 67.3, while the values for the horses from Arzhan-1 are the following: 68.5, 73.2 and 71.6 respectively. The difference in metapodial indices is in accordance with our suggestion.

The decrease of horse metapodial indices between the 9^{th} – 7^{th} centuries BC probably shows the effect of climatic shifts to more humid conditions. The climate state will influence the vegetational system which also could be reflected in the animal size.

Of course, it is necessary take into consideration, that differences in the horses' constitution and in size could be as a result of husbandry, of feeding and of harnessing (e.g. the different ways in which they were put to use and were kept).

The question of the time, the place and the ancestor of the domestic horse is still open to discussion. There is an opinion that the domestic horse's ancestor was the tarpan , a wild horse that became extinct in the late 19th century (Heptner et al., 1961; B**ö**k**ö**nyi,1978). N. Spasssov and N. Iliev (1997) proposed the hypothesis of a polyphyletic origin of the domestic horse, which existed in coexistence with the tarpan (*Equus gmelini*) and the broad-hoofed horse (*Equus germanicus transilvanicus* (=*E. latipes*)). These two species can be simultaneously regarded as ancestors of the domestic horse. Here the comparison of the horse skulls from Arzhan-2, Arzhan-1, *E,gmelini*, *E.przewalskii* and *E.caballus cf. germanicus* are presented (Fig. 7, 8, 9).

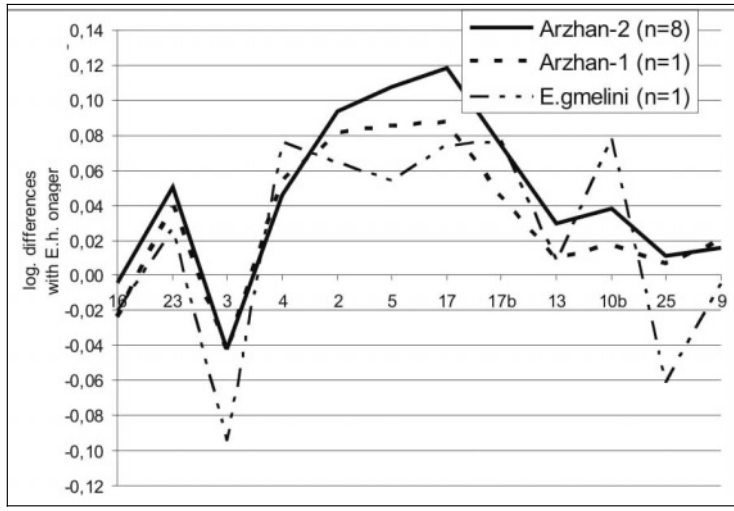

Figure 7 Ratio diagrams of the cranial measurements (means) of horses from the Arzhan-2 and the Arzhan-1 and E. gmelini compared to E. hemionus onager

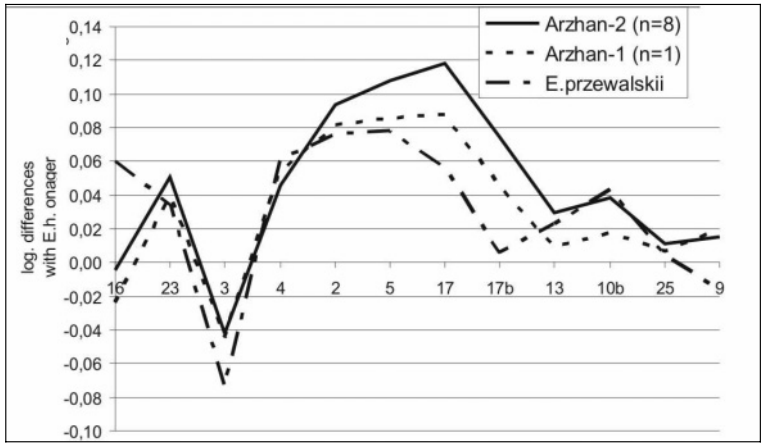

Figure 8 Ratio diagrams of the cranial measurements (means) of horses from the Arzhan-2 and the Arzhan-1 and E.przewalskii (Eisenmann V.,1986) compared to E. hemionus onager

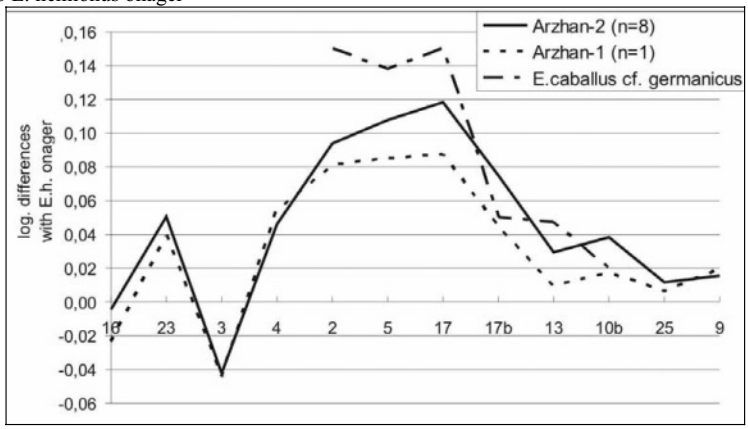

Figure 9 Ratio diagrams of the cranial measurements (means) of horses from the Arzhan-2 and the Arzhan-1 and E. caballus cf. germanicus (Eisenmann V.,1986) compared to E. hemionus onager

The figures show that these horses differ both in proportion and in size. The present study is preliminary and based on a limited amount of material thus we are unable to conclude anything definite about the ancestor of the Arzhan' horses. We can conclude that the horses from Arzhan-2 and Arzhan-1 could belong to the same breed group. It seems to be highly probable that the differences between the horses from Arzhan-1 and Arzhan-2 were due both to climatic changes and to an improvement in forage, and also as a result of the different ways in which they were put to use and were kept. The question about the ancestor of the Arzhan' horses is still open to debate.

ACKNOWLEDGEMENTS

I am pleased to express my gratitude to Drs. K. Chugunov (The State Hermitage Museum) and N. Bokovenko (The Institute for the History of Material Culture of RAS) for the possibility of studying of horse remains from archaeological excavations. I am especially grateful to Professor Dr. L.H. van Wijngaarden-Bakker (University of Amsterdam, AAC, Department of Zooarchaeology) for her help and N. Spasskaya (Zoological Museum of Moscow State University) for her helpful comments.

This project has been supported by NWO-047/009.005.

REFERENCES

B**ökö**nyi, S The ealiest waves of domestic horses in East Europe. Journal of Indo-European Studies 1978; 6: 17-76

Chugunov K.V., Nagler A., Parzinger H. The gold grave from Arzhan. Minerva 2002; 13(1): 39-42.

Grebneb I., Vasil'ev S., Horses from Pazyryk Culture Monuments of Southern Altai. In "*The guarding gold gryphons"*.. Novosibirsk, ed. Polos'mak N, 1994 (In Russian).

Gryaznov M .*Arzhan*, Leningrad. Nauka. 1980.(In Russian).

Driesch, A. von den, *Das vermessen von Tierknochen aus Vor-und Fruhgeschichtlichen Siedlungen*. Munchen, 1976.

Eisenman V. Comparative Osteology of Modern and Fossil Horses, Half-asses, and Asses. Meadow, Verpmann. Equids in Ancient World. Beihefte zum Tubinger Atlas des Vorderen Orients. – Reihe A., Wiesbaden, 1986.

Eisenman V., Beckouche S. Identification and Discrimination of Metapodials from Pleistocene and Modern Equus, Wild and Domestic// Meadow, Verpmann. Equids in Ancient World. Beihefte zum Tubinger Atlas des Vorderen Orients. – Reihe A., Wiesbaden, 1986.

Heptner V., Nasimovich A. and Bannikov A. *Mammals of the USSR*. , Moscow, 1961 (1). (In Russian)

Spassov N., Iliev N. The Wild Horses of Eastern Europe and the Polyphylethic Origin of the Domestic Horse. Anthropozoologica. 1997(25-26):.753-761.

Vitt, V.O. The horses of the kurgans of Pazyryk. Soviet Archaeology Journal. 1952; (16): 163- 206 (In Russian)