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Original Article

Saiga fossils in the Southern-Lower Volga of Astrakhan, Russia

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Abstract

Conservation of declining migratory species is a challenging task, as the factors that may have determined their past distribution may not determine their extant and future distribution. *Saiga tatarica* Linnaeus, 1766 is an essential element of faunistic complexes of the *Middle* and the *Late* Pleistocene (upper *Middle* and *Upper* Neopleistocene according to the Russian stratigraphic scale), and the Holocene of the lower Volga of Astrakhan, Russia (N 46º19'16'', E 47º59'27''). Saiga populations have massively declined due to human impacts. It is well known that any endangered and overwhelm antelope species can be recognized and known through the fossils of these species. In this context, fossils of saiga, preserved in collections of he Astrakhan Memorial Museum of Russia, were studied on the basis of comparative analysis of cranial characteristics, to attribute them to the exact species. Some features such as sizes and proportions of fossil skulls were studied through the morphological characters of local fossil population of saiga in the *Middle* Pleistocene to Holocene. Comparative analysis of cranial characteristics showed that remains fossils of saigas belong to the modern species, *S. tatarica*. The applied technique of the comparative analysis to determine the gender by cranial measurement of facial part of a skull showed that the fossil AMZ KP 47411 (collected from Khazarian alluvia of village Nikolskoe in 2012) represents a male of *S. tatarica*. On the other hand, comparison of saiga cranial remains among themselves from different layers of the *Late* Pleistocene did not show any significant results.

Keywords: *Middle* and *Late* Pleistocene, Holocene, saiga, fossils, Astrakhan, Russia

1. Introduction

Many ungulate migrations worldwide have been disrupted in the last two centuries due to human impacts (Bolger *et al.,* 2008; Harris *et al.*, 2009). Several studies have raised concern over the plight of migratory species and urged the need for proper monitoring and establishment of protected areas (Bolger *et al.,* 2008; Harris *et al.*, 2009). However, protection of such species is challenging because the animals occur in large numbers, are frequently on the move and are distributed over vast areas (Mueller *et al.,* 2008). Often, migratory routes vary by season and year, which makes the establishment of static protected areas challenging. Many migratory ungulates are also subjected to poaching and habitat modification, which cause changes in habitat use (Shuter *et al.*, 2010).

Saiga tatarica Linnaeus, 1766 is a critically endangered antelope which originally inhabited the vast area of the Eurasian steppe zone from the foothills of the Carpathians and Caucasus up to Dzungaria and Mongolia. They also lived in North America during the Pleistocene. At present, the nominative sub-species (*S. tatarica tatarica*) are found only in one location in Russia (steppes of the northwest Pre-Caspian region) and three areas in Kazakhstan (the Ural, Ustiurt and Betpak-dala populations) (Mallon, 2012). Some animals of the Ustiurt population migrate from south to Uzbekistan and occasionally to Turkmenistan in winter. It is extinct in China and southwestern Mongolia. The Mongolian

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sub-species (*S. t. mongolica*) are found only in western Mongolia (Anonymous, 2009, 2012).

In the *Middle-Late* Pleistocene fossil saigas were earlier allocated to different species: *Saiga binagadensis* Alekperov, 1955 (Eemian of Baku area, Transcaucasia); *Saiga prisca* Nehring, 1891 (Weichselian of Moravia); *Saiga ricei* Frick, 1937 (*Late* Pleistocene of north-western Siberia and Alaska); *Saiga borealis* Tschersky, 1876 (*Late* Pleistocene Eurasia) or *Saiga tatarica* (*Middle* and *Late* Pleistocene and Holocene of Europe) (Vremir, 2004). According to the systematic position of the fossil specimens, researchers (Bannikov, 1963; Harrington, 1981; Baryshnikov and Tikhonov, 1989, 1994; Baryshnikov *et al.,* 1990; Kahlke, 1991) stated that the status of *S. binagadensis* is still not clear. Two other *Late* Pleistocene species, *S. ricei* and *S. prisca* are not certified, being described on rather poor material without any clear diagnostic features. They are now considered as belonging to the *S. tatarica/borealis* group. The *Middle-Late* Pleistocene (large form) is considered as *S. borealis*. This species was separated from *S. tatarica* on the basis of the larger size as well as of some cranial differences (Baryshnikov and Tikhonov, 1994).

Today in Russia, the area of distribution of saigas occupies the territory of the Republic of Kalmykia (lower Volga reaches) and Kazakhstan steppes. In the eighteenth and the beginning of the nineteenth century saigas were widespread nearly in all southern steppe regions of the European part of Russia. Also saigas were usual for the southern steppes of Western Siberia. By the beginning of the twentieth century the continuous area of distribution broke up in separate sites as a result of the increased illegal trade (Rudenko *et al.,* 2003).

In the *Late* Pleistocene, the range of saiga was more extensive and occupied nearly all of Europe. The remains of fossil saiga were known from deposits across Germany, France, and England (Neumayr, 1896). The saiga was a typical representative of faunistic complexes of the *Middle* and the *Late* Pleistocene of the lower Volga. The Pleistocene stratigraphic scheme of the Lower Volga area includes the following units arranged in chronological order: Baku (early *Middle* Pleistocene), Singil (earlier part of late *Middle* Pleistocene), Khazarian (late *Middle*-early *Late* Pleistocene), Atel (*Late* Pleistocene), Khvalyn (*Late* Pleistocene) (Stratigraphy of USSR, 1982). The fossil remains of saiga from the Astrakhan region are known from all fossiliferous beds of coastal cliffs near the villages Cherniy Yar and Nikolskoe. Cherniy Yar's coastal outcrop exposes unconsolidated Pleistocene deposits forming the following sequence (according to Gromov, 1948; Leontiev and Foteeva, 1965; Figure 1):

1. Soil – 1-1.5 m
2. Chocolate clays – thickness of marine deposits of the time of the early Khvalyn sea – 6.5 m
3. Thin loam layer with abundant thin-walled shells *Dreissena*, *Didacna praetrigonoides, D. protracta* (lies on an indistinct surface of a layer 4).
4. Rough sandy loams from plant remains (Atel layers) – 2.5 m
5. Cross-bedded light-brown sand with interlayers of brown sand and light, almost white sand (Cherniy Yar layers) – 6 m
6. Sandy clay, brown, strongly salted – 1 m
7. Interlayering of light yellow and light-brown sand and clays with inclusions of pebble and separate pro-layers of almost white sand – 5 m
8. Sandy dirty-brown, locally gypsum-containing clays with indistinct bedding (Singil layers) – 1 m
9. In the lower part of the cliff there expose clays dark gray, horizontally layered, splintered, alternating with brown clays of the same mechanical structure (Baku deposits) – 1.5 m

From the revision of fossil remains of saiga in collections of the Astrakhan Memorial Museum, a number of questions appeared. For example, field inspection of coastal exposures of the Volga River in Cherniy Yar district of the Astrakhan region in July, 2009 in "Buyeraki" site yielded the skull of a fossil saiga (AMZ KP 47410) (Figure 3). Originally it was identified as *S. borealis* (Golovachev, 2010). Subsequent comparison of this find with skulls of modern *S. tatarica* allowed questioning the correctness of the preliminary identification. The other record, the frontal part of saiga

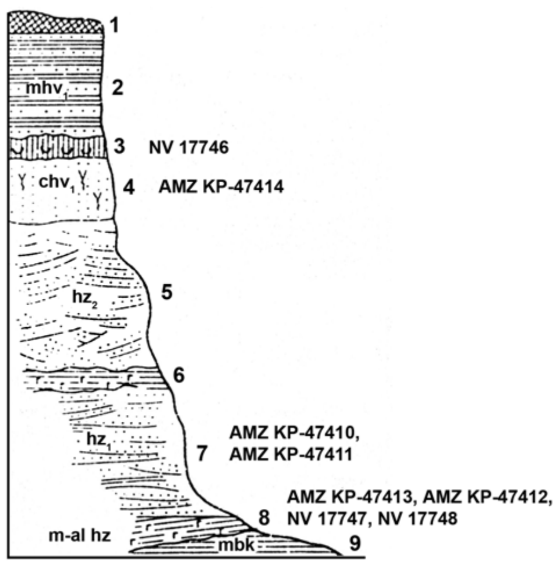

Figure 1. Cherniy Yar's exposures are presented by unconsolidated Pleistocene deposits (according to Leontiev and Foteeva, 1965): 1 - Soil (1-1.5 m); 2, mhv1 - Early Khvalyn marine deposits (6.5 m); 3 - Loam, paleosol; 4, chv1 - Atel layers (2.5 m); 5, hz2 -Upper Khazarian deposits, cross-bedded light-brown sand (Cherniy Yar layers) (6 m); 6 - Sandy clay, brown, strongly salted (1 m); 7, hz1 - Lower Khazarian deposits, alternation of light yellow and light-brown sand (5 m); 8, m-al hz - Sandy dirty-brown clays (Singil layers) (1 m); 9, mbk - Dark gray, horizontally layered clays (Baku deposits) (1.5 m)

skull, found in Khazarian fluviatile deposits near Nikolskoe in 2012 could not been attributed to gender.

From the wide age range of fossil remains of saiga collected in 2011 from Cherniy Yar and Enotaevka regions of the Astrakhan region, we here attempt to reveal possible differences of fossil as compared to a recent species based on cranial morphology. The goal of this work is to track a possible intraspecific variability of *S. tatarica* on the basis of Pleistocene fossils coming from Singil clayes, Khazarian alluvia, Cherniy Yar paleosols and Atel deposits of Southern Lover-Volga of Astrakhan, Russia (Figure 2). We also aimed at species level identification and gender attribution of the fossils under study based on comparison with the recent species.

2. Materials and Methods

In archaeozoology and paleontology remains of fossil mammals are studied in the laboratory by taken measurements and morphological comparison with other known and published fossil collections and with extant representatives of the corresponding taxa. One of the important monographs giving the standardized measuring systems for cranial and postcranial bones is the classical contribution of von den Driesch (1976). It was followed in this work. In the course of this study 17 specimens of fossil and extant Saiga antelopes were studied. Altogether 273 measurements of 38 standard characters were taken. The main fossil remains studied include the following specimens, which are housed in the paleontological collection of the Astrakhan State Memorial Museum, situated in Astrakhan, Russia:

- A partial scull of *S. tatarica* consists of occipital part and the right horn core AMZ KP 47410 (Figure 3), from Khazarian alluvia (the later part of *Middle* Pleistocene, 250-300 ka): sand pit 3 km to the south from Cherniy Yar village, N 48º07’40”, E 046º07’16” (Figure 2).
- A frontal part of a skull with two horn cores AMZ KP 47413 (Figure 5), from Singil clays (300-400 ka), 2 km south from Nizhnee Zaymishche, N 48º04’17”, E 046º08’46” (Figure 2).

Figure 2. Studied area of saiga fossils in the Southern-Lower Volga of Astrakhan, Russia: 1 - AMZ KP-47410; 2 – AMZ KP-47413, AMZ KP-47412; 3 – AMZ KP-47414; 4 – NV 17747, NV 17748; 5 – NV 17746; 6 – AMZ KP-47411.

- A frontal part of a skull with the right (Figure 5) horn core AMZ KP 47412, from Singil clays (300-400 ka), 2 km south from Nizhnee Zaymishche, N 48º04'17'', E 046º08'46'' (Figure 2).
- A front part of a skull with two tooth rows of AMZ KP 47411 (Figure 4), from Khazarian alluvia (the latter half of *Middle* Pleistocene, 250-300 ka), 2 km north from Nikolskoe, N 47º44'56'', E 046º23'04'' (Figure 2).
- A well preserved horn core AMZ KP 47414, from Atel deposits, *Late* Pleistocene, 71-57 ka), between Nizhnee Zaymishche and Solenoe Zaymishche, N 48º00'32'', E 046º08'22'' (Figure 2).
- A partially preserved horn NV 17745, NV 17746, NV 17747, NV 17748 piths, from Singil deposits, Khazarian alluvia and Cherniy Yar's buried soils, between the Cherniy Yar, N 48º10'08'', E 046º06'24'' and Solenoe Zaymishche, N 47º53'31,7'', E 046º07'34'' (Figure 2).
- A cranium without horn cores AMZ KP 47409, the *Late* Holocene, the Cherniy Yar; (Figure 6).

3. Results and Discussion

On the basis of hundreds of well preserved bones, as well as two almost complete skeletons, the morphological characters of the fossil forms of saiga are now available for study and comparison (Bannikov, 1963; Harrington, 1981; Baryshnikov and Tikhonov, 1989, 1994; Baryshnikov *et al.*, 1990; Kahlke, 1991; Spassov, 2009). There is an obvious decrease in size from the *Late* Pleistocene to the *Late* Holocene forms, however less pronounced compared to the recent one (Vremir, 2004). Individual variability is not well expressed. Based mainly on the skull morphology there are important differences compared to the extant form The *Late* Pleistocene Crimean form can be regarded as a distinct type. Comparisons with recent materials will elucidate this issue (Vremir and Ridush, 2002; Vremir *et al.*, 2003).

In this study, cranial measurements were made for species-level attribution of fossil saiga skull AMZ KP 47410 (Figure 3). Measurements of *S. tatarica* and *S. borealis* are presented in Table 1. The dimensions and proportions of a described skull from Cherniy Yar, generally correspond to average values of *S. tatarica*. The angle between frontal and parietal bones is 148° that is similar to the modern *S. tatarica* (148-142°), whereas the angle of *S. borealis* described by Alekseeva (1980), for the southeast of Western Siberia is 140-138°. Frontal and parietal part at a skull from Cherniy Yar is longer than at the modern *S. tatarica*, but it is less than at *S. borealis*. The skull from Cherniy Yar, thus, on this indicator is intermediate between *S. tatarica* and *S. borealis*.

Orbital width is calculated as the double distance from the frontal midline to posterior edge of the right orbit. The obtained value of orbital width exceeds 142 mm in case of *S. tatarica*, as well as *S. borealis* (Figure 3 and Table 1). The relation of orbital width and length of frontal and parietal part makes 146.3% that considerably exceeds this relation of *S. borealis* (132-132.6%), but it is typical for *S. tatarica*

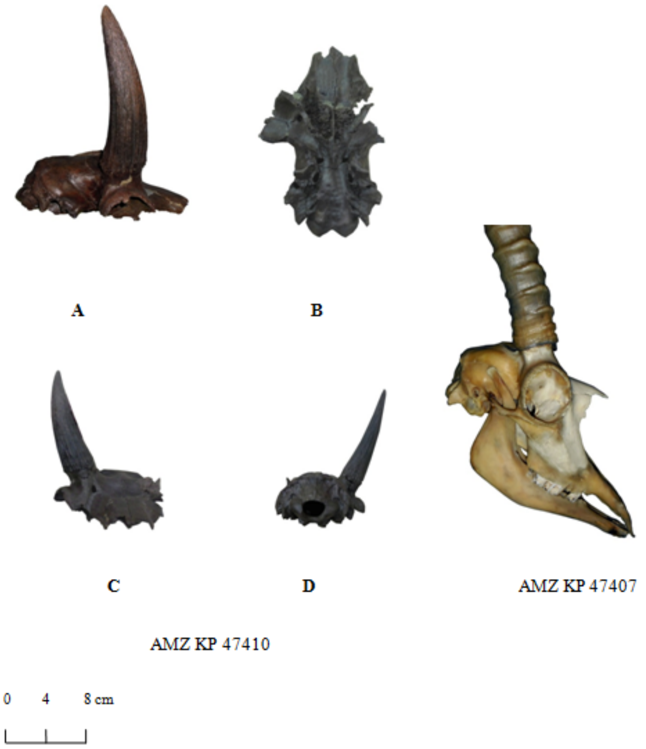

Figure 3. Fossil skull of *Saiga tatarica* AMZ KP 47410 (A-lateral, B-ventral, C-frontal and D-posterior views) and the skull of a recent *S. tatarica* AMZ KP 47407 (lateral view).

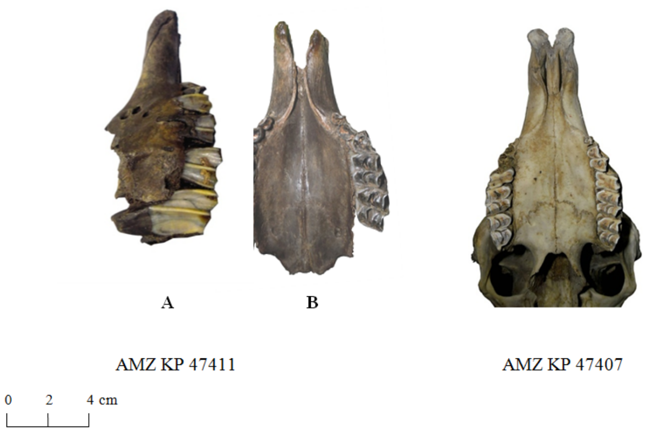

Figure 4. Facial part of skulls of a fossil *Saiga tatarica* AMZ KP 47411 (A-lateral and B-ventral views) and of a recent *S. tatarica* AMZ KP 47407 (ventral view).

(135.6-149.5%). Thus, with a larger frontal and orbital width as well as longer parietal length (concerning extreme limits for *S. tatarica*) the ratio of these measurements sizes remains within characteristic for *S. tatarica*.

The minimal distance between lateral edges of horn cores is 102 mm. It is slightly longer than extreme values at modern *S. tatarica*, but is characteristic for *S. borealis* (Table 1). The ratios of the minimal distance between lateral edges of horn cores to the maximal width at posterior edges of orbits (71.8%) is much lower, than at *S. borealis* (74.5-76.1%), and

Table 1. Comparison of the parameters of a fossil skull of saiga AMZ KP 47410 (Cherniy Yar, 2009) with skulls of *Saiga tatarica* and *S. borealis* from *Late* Pleistocene deposits of the Crimea and Western Siberia (measurements after Shpansky, 1998).

Measurement (mm), index (%)	*Saiga tatarica*				*Saiga borealis*	
	Cherniy Yar ♂ B& (fossil) AMZ KP 47410	Crimea Baryshnikov (*et al.*, 1990) (n=16)	Min-max (Shpansky, 1998)	Recent species (collected from AMM and ASU) (n=7)	River Vilyui Holotypes (Chersky, 1876)	Western Siberia (Alekseeva, 1980) (n=2)
Length of frontal and parietal part from anterior edges of orbits to an occipital tuber	97	-	82-94	94.24±0.813	96	100-101
Length of part behind horns from posterior edges of the horn bases to an occipital tuber	62	-	54-64	62.12±1.208	63	71-72
Maximal width of a skull at posterior edges of orbits	142	-	118-134	129.90±2.993	134	132-134
Minimal distance between lateral edges of horn cores	102	-	88-98	99.94±3.725	98	98-103
Minimal distance between medial edges of horn cores	51	-	46-62	51.70±1.221	53	55-64
Length of the horn core by the greater curvature	143	140	102-150	155.00	133	130-147
Length of the horn core by a straight line	135	125	98-150	149.00	-	118-144
Antero-posterior diameter of the horn bases	37	27-35	32-35	34.10±0.557	33	32-37
Latero-medial diameter of the horn bases	32	27-32	29-32	29.80±0.515	29	28-32
Angle of horn cores divergence	48°	-	37-47°	39.75±1.931	42°	42-50°
Angle between frontal and parietal bones	148°	-	148-142°	139.67±0.333	-	140-138°
Minimal width of a skull behind the horns	69	-	-	69.30±1.158	-	75-78
Maximal skull width (at the mastoids)	85	-	-	83.30±1.480	-	92-93
Width of occipital condyles	47	-	-	45.20±1.319	-	53-56
Height of an occiput from the upper edge of an foramen magnum	26	-	-	29.60±2.315	-	29-30
Ratio of parameters 3:1 (%)	146	-	136-150	137.98±2.148	139	132-133
Ratio of parameters 2:3 (%)	44	-	43-52	47.86±1.183	47	52-55
Ratio of parameters 6:1 (%)	147	-	117-172	163.10	138	130-146
Ratio of parameters 4:3 (%)	72	-	72-77	76.84±1.393	73	75-76
Ratio of parameters 7:6 (%)	94	89	94-97	92.20	-	91-98
Ratio of parameters 9:8 (%)	86	92-98	86-91	88.64±2.577	-	87-88

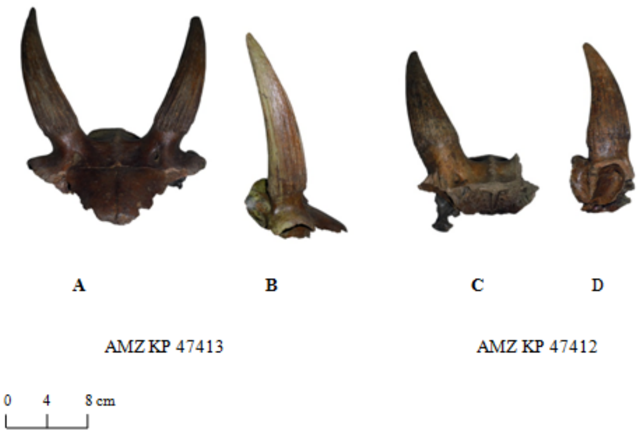

Figure 5. Fossil remains of skulls of fossil Saiga tatarica: A, B – AMZ KP 47413; C, D – AMZ KP 47412; A, C – frontal view; B, D – lateral view

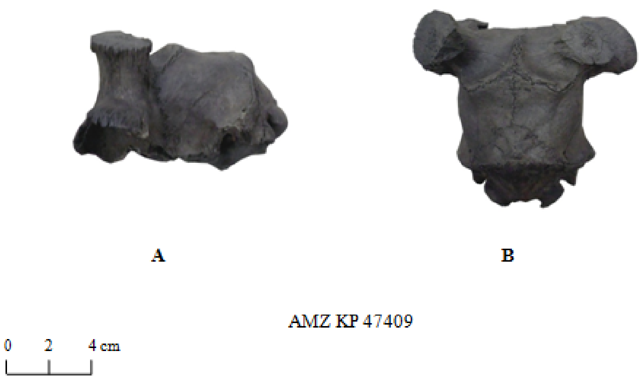

Figure 6. Sub-fossil skull of *Saiga tatarica* AMZ KP 47409 (the *Late* Holocene, the Cherniy Yar area), A- lateral and B- dorsal views.

even there are slightly less than extreme values characteristic for the modern saiga form (72-77.1%), but comes closer to its lower limit. Thus, and this proportion remains are typical for *S. tatarica*.

Distinctive features of this skull are also antero-posterior diameter of the basis of the horn core and an angle of horn cores divergence. Both of these indicators (37 mm and 48°, respectively) exceed averages similar at *S. tatarica* (32-35 mm and 37-47°) a little and come nearer to the maximum sizes, characteristic for *S. borealis* (32-37 mm and 42-50°). Other proportions and the sizes are typical for a modern form of saiga *S. tartarica*.

Thus, the fossil skull AMZ KP 47410 (Figure 3) corresponds on the parameters by the main sizes and proportions typical for the modern *S. tatarica*, but thus has a number of some features: the increase of frontal and parietal length and the orbital width, widely placed horn cores with a big angle of a divergence, anterior-posterior diameter of the basis of the horn core, approached to the maximum limit for *S. borealis*, and a little underestimated relation of the minimal distance between external edges of horn cores to orbital width. Probably, these morphological signs were typical for local fossil population or they are specific features of this fossil skull.

According to the data (Table 1), some measurements for *S. tatarica* are absent (the Paleolithic of the Crimea is presented by only horn cores) that gives incomplete picture for the comparative analysis of a fossil and recent species. To find out possible cranial differences between a fossil skull AMZ KP 47410 (Figure 3) and the same modern local population (and also to define the provision of local population in the general dispersion of cranial characteristics of *S. tatarica*) selection of skulls of the saigas got in different years in the Astrakhan region from collections of the Astrakhan Memorial Museum (AMM) and a Zoological Memorial Museum of the Astrakhan State University (ASU) was made. Average values of cranial measurements for modern Astrakhan population of saiga are presented in comparison with extreme values (min-max) for *S. tatarica* (Shpansky, 1998) and measurements of a fossil skull AMZ KP 47410 (Figure 3) from Cherniy Yar (Table 1).

Table 2. Cranial measurements of facial part of *Saiga tatarica* skulls (fossil and extant skulls).

Measurement (mm)	AMZ KP 47411	♂ (extant) n=4	♀ (extant) n=3
Distance from anterior edges of premolars to a palatal bone (points P – Po)	42.50	41.38±1.491	37.67±0.882
Distance from posterior edges of dental row to a palatal bone (points Po – Pd)	35.00	32.88±1.087	29.00±1.732
Palatal width at the level of posterior edges of M3	56.00	55.00±1.354	51.07±3.541
Palatal width at the level of anterior edges of P2	25.00	33.50±2.102	28.33±2.848
Length of a tooth row (measurement along alveoli)	71.00	68.43±2.213	63.00±2.082
Length of a premolar row P2-P4 (along alveoli on a labial side)	21.00	23.18±1.580	23.40±2.386
Length of a molar row M1-M3 (along alveoli on a labial side)	50.00	49.93±0.536	43.60±0.600
The maximal width of the palatal (on outer edges of alveoli)	75.00	70.88±1.586	62.67±4.096
M3 (length/width)	20.0/12.0	22.0-18.7//12.0-11.0	20.0-16.0//12.0-10.0
M2 (length/width)	17.0/12.0	18.5-15.2//13.0-9.5	17.0-13.5//11.5-9.0
M1 (length/width)	13.0/11.2	16.5-10.2//11.0-12.5	16.0-10.2//10.5-9.8

From the data in Table 1 it is clear that almost in all features the local modern population approaches the maximal cranial sizes. By some characters it somewhat exceeds parameters of *S. tatarica* in general (length of horn cores, an angle of a divergence of the parietal plane from frontal). However the relation of length of the horn core by a straight line to length on the greatest curvature is lower than extreme values, which is a typical for *S. tatarica*. The maximal width of a skull in modern local population considerably surpasses similar average value of orbits of a fossil AMZ KP 47410 (Figure 3), probably being specific feature of this skull. The ratio of length of the horn core of the greatest curvature to length of frontal and parietal part is lower, than in modern population, but remains within extreme values. The base of horn core at the fossil skull is more massive, than at modern representatives. Horn cores are more curved.

It is extremely rare to find facial part of a skull of saiga because of its fragility. There is a well preserved frontal part of a fossil saiga skull (AMZ KP 47411 (Figure 4). This skull is not attributed to gender. The comparative analysis of cranial measurements of this specimen with similar measurements of selection of skulls of females and males of modern *S. tatarica* (from the AMM and ASU collections) was carried out for clarification of its gender.

According to Table 2 data, the facial part of a skull belonged to the large adult male of *S. tatarica* having a number of cranial anatomic features of distinguishing it from the modern one. These are the narrower width of the palate at the level of oral edges of P2 and a little truncated length of a premolar row.

The comparative analysis of the last records of the remains of skulls and the horn cores of a fossil saiga founded *in situ* in various fossiliferous layers of Cherniy Yar coastal exposures was carried out a clarification of intraspecific variability of *S. tatarica* (Table 3).

The conducted measurements revealed no tendencies of changing of cranial characteristics for *S. tatarica* in the time range of late *Middle* to early *Late* Pleistocene (Singil to Atel interval). All proportions and the dimensions vary within average values. Only two fossils are distinctly distinct in morphometric features: the skull AMZ KP 47412 (Figure 5) from Singil deposits with strongly built short horn cores and *Late* Pleistocene skull AMZ KP 47409 (Figure 6) with the enlarged posterior part. Deviations of both skulls are currently accounted for individual variability. Unfortunately, poor preservation of the fossil remains did not allow analyzing many cranial measurements. The general parameters for all finds were only the greatest and smallest diameters of horn cores and their ratio. Among these indicators it is possible to note some tendency in increasing of horn cores curvature, but it is premature to draw definite conclusion based on limited material. It is likely that a more extensive samples attributed to specific layers will give the chance of detection of variability of cranial indicators of the fossil saiga, connected with changes of climatic and ecological situation throughout the *Middle* and *Late* Pleistocene.

Table 3. Measurements of fossil skulls and horn cores of *Saiga tatarica* (the *Middle* and *Late* Pleistocene, and *Late* Holocene), collected from Astrakhan Memorial Museum.

Measurement (mm)	Skull (Singil deposits) KP 47413	Skull (Singil deposits) KP 47412	Skull (Khazarian alluvia) KP 47410	Skull (*Late* Holocene) KP 47409	Horn core (Singil deposits) NV 17747	Horn core (Singil deposits) NV 17748	Horn core (Atel deposits) KP 47414	Horn core (Singil deposits) NV 17746
Maximal width at the posterior edges of orbits	135.0	-	142.0	139.0	-	-	-	-
Maximal width between lateral sides of the horn bases	110.0	122.0	102.0	114.0	-	-	-	-
Minimal distance between medial sides of horn cores	55.0	52.0	51.0	58.0	-	-	-	-
Length of the horn core by the greater curvature	163.0	150.0	143.0	-	-	-	156.0	-
Length of the horn core by a straight line	155.0	147.0	135.0	-	-	-	147.0	-
The maximal diameter of the horn base	35.0	43.5	37.0	34.5	36.0	34.0	35.0	40.0
The minimal diameter of the horn base	28.0	36.0	32.0	32.0	31.0	29.0	30.0	33.0
Angle of horn cores divergence	36°	48°	48°	-	-	-	-	-
Distance between tops of horn cores	147.0	144.0	172.0	-	-	-	-	-
Ratio of parameters 9:8 (%)	80.0	82.7	86.4	92.8	86.1	85.3	85.7	82.5
Ratio of parameters 8:7 (%)	22.6	29.6	27.4	-	-	-	23.8	-
Ratio of parameters 7:6 (%)	95.1	98.0	94.4	-	-	-	94.2	-

In addition to the fossil of *S. tatarica* remains around Cherniy Yar location, a large number the sub-fossils remains are found. That testifies to its recent abundance in this territory. The saiga was eliminated in the second half of the twentieth century by human extensive agricultural activity. The excessive illegal trade in the nineties the twentieth century has also contributed to a sharp reduction of number of population and threatened this specie to disappear (Rudenko *et al.,* 2003).

4. Conclusions

On the basis of the conducted researches, it is possible to draw the following conclusions:

1. Field researches allowed to find fossil remains of saiga in the south of Lower Volga Area.
2. The comparative study of cranial characters showed that fossils saigas remains belong to *S. tatarica*.
3. Local recent population approached to the maximal cranial sizes known for *S. tatarica*.
4. The present applied technique of the comparative analysis to find out sex by cranial measurement of facial part of a skull showed that fossil AMZ KP 47411 (Khazarian alluvial, Nikolskoe, 2012) belong to male of *S. tatarica*.
5. Comparison of cranial parameters (Table 3) of fossil saiga remains from some of *Middle* and *Late* Pleistocene levels did not show significant differences between cranial characteristics. This conclusion should be checked when a larger collection of fossils will be available.

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