

ON THE POSTCRANIAL SKELETON AND THE OUTWARD
APPEARANCE OF *SPIROCERUS KIAKHTENSIS*
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The first remains of the *Spirocerus* were found in the vicinity of the town of Kyachta in Trans-Baikalia and described by M. Pavlova in 1910. Later on, a number of finds of bones of the *Spirocerus* were made in Mongolia and China and also in the Western part of the Pre-Baikal Region.

Below we adduce a list of all the localities, known in scientific literature, where the remains of *Spirocerus* were found.

The table makes it obvious that the greatest number of finds has been made on the territory of Trans-Baikalia and of China. All of them date back to the time of the upper Pliocene and continue up to the time of the middle and upper Pleistocene. There are reasons to believe the *Spirocerus* to have been contemporaries of the paleolithic man. Thus as V. I. Gromov (ГРОМОВ, 1940) states the skull of one of the *Spirocerus* specimens bears the traces of some incisions made with the help of stone implements dating back to the time of the Upper paleolith.

Two new finds of *Spirocerus kiakhtensis* were made on the territory of the USSR in recent years.

One of them is of special interest as it is a proof of a wider geographical distribution of the species that was ever known or supposed before. It represents a fragment of a horn core found in the deposits of a cave in the environs of the village of Ust-Khan of the Gorno-Altai Autonomous Region. The find was sent to the Zoological Institute by S. I. Rudenko and is kept there (No. 26500). In the same cave, together with the horn core were found some remains of the implements once used by the paleolithic man as well as the bones of a number of animals. Their geological age might be traced to the time of the middle or upper Pleistocene. At the present time the village of Ust-Khan is the extreme Western point where remains (of the above-mentioned animals) have been found.

Of no smaller interest are the remains of *Spirocerus kiakhtensis* found in Trans-Baikalia during the excavation-work made in search of quaternary mammals on the left bank of the river Selenga up stream at a distance of 15 kilometres from Ulan-Ude

at Tologoy mountain. Here, besides a number of skulls were also found parts of a postcranial skeleton the belonging of which can undoubtedly be traced to the *Spirocerus kiahtensis*.

Locality	Geological age	Species	Author
1	2	3	4
1. Trans-Baikalia; the vicinity of the town of Kyachta.	Pleistocene	<i>Spirocerus kiahtensis</i> M. Pavl.	М. Павлова, 1910. В. Громов, 1946.
2. Northern China; Ordos, Sjara-Ossogol.	Middle Pleistocene	<i>Spirocerus kiahtensis</i> M. Pavl.	Boule et Teilhard de Chardin, 1928.
3. Mongolian Altai.	Pleistocene	<i>Spirocerus</i> sp.	Idem, 1928.
4. China, the Nihowan basin; the Sanghanho valley.	Lower Pleistocene	<i>Spirocerus wongi</i> Teilh. et Piv.	Teilhard de Chardin et Piveteau, 1930.
5. China. Choukoutien I	Sinanthropus beds. Middle Pleistocene	<i>Spirocerus peii</i> Young, <i>Spirocerus wongi</i> Teilh. et Piv.	Young 1923. Teilhard de Chardin and Transsaert, 1938, Pei, 1939.
6. China; the Shansi Province.	Upper Pliocene	<i>Spirocerus peii</i> Young, <i>Spirocerus wongi</i> Teilh. et Piv.	Teilhard de Chardin and Transsaert, 1938.
7. China; the vicinity of Harbin	Upper Pleistocene	<i>Spirocerus peii</i> Young.	Idem, 1938.
8. Trans-Baikalia, Zai-graevskij aimack of the Buryat-Mongolian Autonomous Soviet Socialist Republic; the Muchor Tala locality.	Pleistocene	<i>Spirocerus kiahtensis</i> M. Pavl.	Сыклев, 1940.
9. Trans-Baikalia; the vicinity of the village of Kiret (60 kilometres away from Kyachta)	Pleistocene	<i>Spirocerus kiahtensis</i> M. Pavl.	В. Громов, 1946.
10. Trans-Baikalia; the vicinity of the village of Tamir (70 kilometres to the East from Kyachta)	Middle Pleistocene	<i>Spirocerus kiahtensis</i> M. Pavl.	Idem, 1946
11. The Western Pre-Baikal Region. The Tunkin depression	Lower and middle Pleistocene	<i>Spirocerus kiahtensis</i> M. Pavl.	Щербакoвa, 1954

The locality at the foot of the mountain Tologoy was discovered by A. I. Okladnikov in 1951. In the first year of the excavation-work carried on there 10 or 11 species of animals were found in it (Бибикова, Верещагин, Гарут, Юрьев, 1953). They represented:

Ochotona sp.
Ursidae sp.
Hyaenidae sp.
Elephas primigenius Blum.
Rhinoceros cf. *tichorhinus* Fisch.
Equus caballus L. var.?
Bison priscus deminutus V. Grom.
Megaloceros sp.
Gervus elaphus L.
Rangifer tarandus L.
Gervidae gen. et sp. indet.

Besides all that a cannon bone of some small *Bos* or antelope is mentioned.

In the following year (in 1952) excavation-work at the foot of the mountain Tologoy continued. In the same horizon the remains of *Spirocerus* were found, and among them, an almost complete skull with horn cores, two separate horn cores, five fragments of mandible, and separate upper and lower molar teeth.

Together with the skull bones were found bones of the complete right fore extremity belonging to a ruminant animal of an average size, including all the links, beginning with the humerus and ending with the final phalanges; only the II and the III phalanges of the fourth toe were lacking (Fig. 1). At the time of their discovery the bones of the extremity represented an anatomical unit in a joint state. Among the remains



Fig. 1. Bones of the foreleg of *Spirocerus kiakhtensis* M. Pavl. together with the remains of other mammals at the place of excavations in the Tologoy Mountain. (Photo by A. P. Okladnikov)

they also discovered the distal half of the left cannon bone which might have belonged to the same animal. The fragment of the right metatarsus bone (the distal end of the articular bloc) mentioned by Bibikova (Бибикова, Верещагин, Гарутт и Юрьев, 1953) as one belonging to a *Bos* or to an antelope could have possibly belonged to the same animal too.

All the *Spirocerus* bones found in the Tologoy locality were sent to the Zoological Institute of the Academy of Sciences of the USSR by A. P. Okladnikov (No. 26077 (1—39)).

The accumulation of the bones of mammals in the environs of Tologoy is connected with the deposits of a 45 metres high terrace. The layer containing bones is deposited in the lower part of the ledge at the depth of 10 metres from the surface of the earth in sandy lands covered above with loamy soils (these are the data of geologist N. A. Florentsov; see also Бибикова, Верещагин, Гарутт, Юрьев). In N. A. Florentsov's opinion the composition and the nature of the mellow soil of which the terrace is composed deny its belonging to the river type and suggest its delta or lake-land type.

One can also suppose that a certain part of the thickness containing the bones of quaternary mammals fills up the hollows in the dismembered relief of the fundamental crystalline bedrocks, which is a sign of the quick accumulation; it must have undergone in the conditions of general sinking. A great number of similarities shows a certain likeness between this thickness and the interglacial deposits in the depressions of the Baikal type (e.g. the Tunkin and the Barguzin depressions).

The presence of non-disturbed joint extremities suggests to us the idea that in this case we have to do with the place of their primary extinction, but not with the re-deposited bone stuff. The colour of the majority of the bones is cream; on some of the bones bearing stains of a yellowish or reddish tint, the colour of fresh fractures is lighter, almost white. The fossilization of bones is almost complete; when being removed they produce a sound similar to that produced by annealed clay crocks.

As to the age of the fauna of the Tologoy locality, it can be defined, judging by the composition of the material and by its condition not younger than the middle Pleistocene, or perhaps somewhat earlier.

It should be mentioned that no traces of man or man's life were discovered in the Tologoy locality. There is no doubt that all the fragments of the skull found in the Tologoy locality belong to the *Spirocerus kiahtensis* M. Pavl. Each of the straight, heteronimously twisted horn cores of a conic shape bears two prominent keels; each of the keels makes one complete turn round the axis of the horn core (Fig. 2).

We have no doubt that these extremities also belong to this genus, the proof being, that they were found together with the skull and also for some other reasons that will be mentioned further on.

As up to now, fragments undoubtedly belonging to a postcranial skeleton of *Spirocerus kiakhtensis* have not been either found or described, we find it necessary to give a brief description of the specimens we have at our disposal. The bones described here belong to a grown up animal as the signs of the knitting of epiphyses and diaphyses have already disappeared.

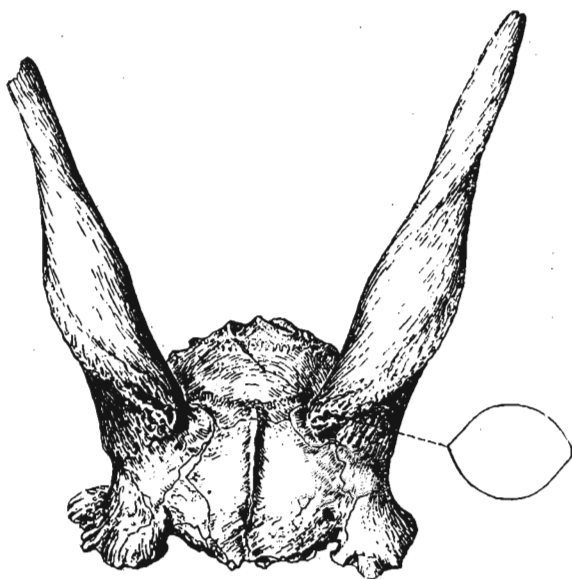


Fig. 2 *Spirocerus kiakhtensis* M. Pavl.
Skull No. 26077 from Tologoy locality. 1/4 nat. size.



Fig. 3 Skeleton of the right foreleg
of *Spirocerus kiakhtensis*
M. Pavl. from Tologoy
locality. 1/4 natural size.

To characterize the absolute length and the linear proportions of the free fore extremity of a *Spirocerus* specimen (Fig. 3) a table is adduced below. The table shows the absolute and relative length of the separate links of the extremity (in percentage figure to the whole of the length) compared to a fore extremity of the contemporary European Bison (*Bison bonasus* L.), antelope eland (*Taurotragus oryx* Pall.) and musk-ox (*Ovibos moschatus* Zimm.).

The table makes it evident that the *Spirocerus* was considerably more short legged in comparison with the specimens of *Bison* and *Taurotragus*. Only its toes, especially the two first phalanges did not in fact differ from those of *Bison* and *Taurotragus* in absolute length. The ratio between the separate links of the extremity is very peculiar. Its upper arm and metacarpus being very short, it has a relatively long forearm and toes. Specially attention is attracted by the length of the second phalange which is not only relatively but also absolutely longer than that of the high-legged antelope eland.

The Length of the Extremities of Some Hollow-horned Ruminants

	<i>Spirocerus kiahk-</i> <i>tensis</i> No. 26077		<i>Bison bonasus</i> No. 8866		<i>Taurotragus</i> <i>oryx</i> No. 26107		<i>Ovibos moschatus</i> No. 8690	
	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative
Humerus	175	21.6	309	30.2	292	27.2	233	30.6
Radius	293	36.1	328	32.1	332	30.9	259	34.0
Meta carpus bone	170	21.0	202	19.7	277	25.8	149.5	19.6
I phalange	66.2	8.1	68	6.6	69	6.4	52.5	6.9
II phalange	49.6	6.2	50	4.9	42	3.9	30.2	4.0
III phalange	57.0	7.0	66	6.5	61	5.7	37.9	5.0
The whole toe	173	21.3	184	18.0	172	16.0	120.6	15.8
The whole extremity	811	100.0	1023	100.0	1073	100.0	762	100.0

Note: 1) The calculations of the length of the humerus were made according to the size of the fragments found, and the photos taken at the time and in the place of their discovery (Fig. 1).

2) The measuring of the humerus of the *Bison bonasus*, *Taurotragus oryx* and *Ovibos moschatus* was made from the distal end of the articular bloc up to the proximal point, seen in the photo representing the extremity of a *Spirocerus* specimen.

There is a certain likeness in size and proportions between the *Spirocerus* specimen and the musk-ox. The extremities of the latter are somewhat shorter than those of *Spirocerus*, but that can be ascribed to the fact that the specimen of the musk-ox under study might have been a female. The other points of likeness between these two animals are the relative length of the forearm and the shortness of the metacarpus, but as to the length of the fore toes, the *Spirocerus* differs from the musk-ox more than from the other species to which it is being compared here.

The massive character of its long bones makes the *Spirocerus* to be an example of an animal which in a striking manner combines the peculiarities both of an ox and of an antelope. Thus the humerus surpasses in breadth not only the similar bone of the eland and of the musk-ox, but also that of the European *Bison*. A great breadth of the metapodials is characteristic for the representatives of the Bovina tribe, but it is noteworthy that the *Spirocerus* surpasses in this respect even the European *Bison*, as the corresponding index (namely the ratio between the longitudinal and the transversal diametres) is much lesser with the *Bison*. By the breadth and the flatness of its metacarpus bone the *Spirocerus*

kiahtensis is second only to the musk-ox which possesses an extremely wide, short and flat cannon bone. As to the size of the radius *Spirocerus* occupies an intermediary position, as to the relative breadth of the distal end it differs very little from the eland. The digits of the *Spirocerus* are altogether of the "antelope" type. The first and the second phalanges are not only long but also thin, yielding in their massive character even to the eland and only the relative breadth of the distal (third) phalange bears more likeness to that of the European *Bison*.

Proportions of Separate Bones of the Fore Extremity of *Spirocerus*, *Bison*, *Taurotragus* and *Ovibos*

	<i>Spirocerus kiahtensis</i>	<i>Bison Bonasus</i>	<i>Taurotragus oryx</i>	<i>Ovibos moschatus</i>
A. Width (transversal diameter) of separate bones in percentage figure to the whole of the length:				
1. The distal bloc of the humerus	41.1	30.4	26.4	25.3
2. The radius in the middle of its length	14.0	15.4	12.1	12.0
3. The widest part of the distal end of the radius	21.1	26.0	21.8	23.2
4. The metacarpus bone in the middle of its length	20.6	20.5	11.9	22.3
5. The distal bloc of the metacarpus bone	35.8	34.9	21.7	38.3
6. The phalanges of the proximal end:				
a) I phalange	40.0	54.9	43.5	51.6
b) II phalange	52.6	73.0	66.0	74.8
c) III phalange	41.1	44.3	35.2	54.6
B. The ratio of the frontback diameter of the metacarpus to the transversal diameter at the level of the middle of length (in %).	62.9	66.7	76.7	49.4

Teilhard de Chardin and Piveteau (1930) provisionally referred to *Spirocerus wongi* the metacarpus bone found together with the skull bones of *Spirocerus wongi* in the Sangkhan-ho strata as to one belonging to this species. But by its size and oblong shape it is nearer to the large ram (perhaps of the *Ovis schatungensis* Matsum.) than to the *Spirocerus*. Calculated according to a photo, the relative breadth of the bone in the middle of its length does not exceed 11% and at the level of the distal bloc it is not more than 19%, that is considerably lesser than it is with the extremity of the ruminants found in the Tologoy locality and studied by us. According to V. Gromova (ГРОМОВА, 1953) the index of the relative breadth of the distal end of the metacarpus with the *Ovis* genus ranges within the limits of 15.8—19.7%, thus showing more likeness to the index of the bone found in Sangkhan-ho.

There is much more probability in referring to the metacarpus bone represented by Teilhard and Piveteau (1930) (see Table XIII, Fig. 4) as to one belonging to the *Spirocerus* type, though they themselves considered this bone to have belonged to a representa-

tive of the Ovibovini tribe (which has not been clearly defined so far). It is somewhat bigger than the metacarpus found in the Tologoy locality (its length being 192 mm) but by its relative breadth calculated from the photo (17.4% in the middle and 29.5% at the distal end) it is nearer to the specimen which is the object of our studies.

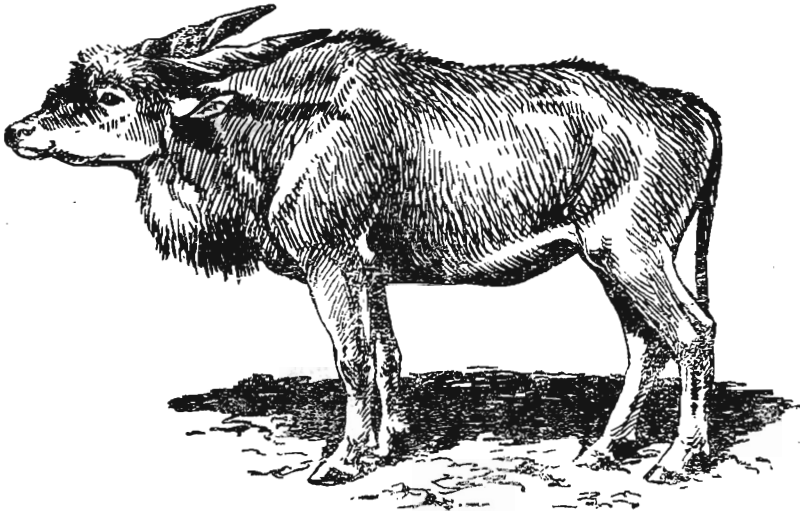


Fig. 4. *Spirocerus kiahtensis* M. Pavl. Reconstruction. Sketch by E. Zaharov. About 1/12 natural size.

There is no doubt that the extremity studied and described by us belongs to the *Spirocerus*. Firstly the size of the bones corresponds more or less exactly to that of the skull judging by the remains of the latter. The shape and the texture of the metacarpus bone completely deny the idea of its belonging either to the deer or to the majority of the hollowhorned ruminants. The os cannon of that type (short, wide and flat) is observed only with the goats (*Capra*), with the takin (*Budorcas*) and also with the musk-ox (*Ovibos*) and the representatives of the Bovina-tribe. The belonging of the extremity to the first three species must be completely excluded for the metacarpus found in the Tologoy locality is of a much bigger size. According to Teilhard de Chardin's and Piveteau's (1930) statements the length of the metacarpal bone of a male musk-ox is 154 mm.

Note: The length of the metacarpal bone of the only specimen of a grown up female *O. moschatus* Zimm. (No. 8690) is 149.5 mm; as to the goats and the takin with them this bone is still shorter. Besides that, among the other bone remains found in the Tologoy locality no remains of the three above-mentioned species were found; whereas the bones of the *Bison* (*Bison priscus* Boj.) were discovered there. However, the belonging of the extremity described by us to this species must be completely denied as its bones are much smaller than these of *Bison priscus*. As it has already been mentioned above, all the bones of the *Spirocerus* are much smaller even if compared to those of the

contemporary European *Bison*. Moreover, the Tologoy *bison* was much bigger in size than the contemporary one; the length of the smallest of the metacarpus bones of the *Bison priscus* found in the Tologoy locality was 245 mm, and the radius bone 377 mm, that is, 1.5 times greater than the length of the bones referred to by us as belonging to the *Spirocerus*. The bones of the extremity described by us also differ from the bones of all the other animals by a number of plastic characters and in particular by the shape of the articular surface, but lack of space makes it impossible for us to dwell on the question.

The Outward Appearance of the *Spirocerus* and its Life-Conditions

The data which we possess though not being comprehensive allow us to create a certain idea of the outward appearance of the *Spirocerus* (fig. 4). Apparently the *Spirocerus* was an animal of an uncommon and awkward build. In its build it represented a rare combination of the peculiarities of an *antelope*, of a *Bos*, and of a big goat. Unfortunately we have no data as to the vertebral column of the *Spirocerus*, but judging by the size of the skull it was a big and rather a heavy animal and its massive extremities speak for the *Spirocerus* having been short-legged. The head of the *Spirocerus* must have reminded the head of the antelope eland (*Taurotragus oryx* Pall.), it having straight horn cores bent back and heteronimously twisted and a narrow pointed muzzle.

The thick and nonpneumatized bones of the skull and the massive compact horn cores, especially, give the idea that the head of the *Spirocerus* was heavy and was kept low as well as its neck. The consequence of it was the intensive development of the ligamentum nuchae and of the muscles keeping up its head, which was undoubtedly connected with the lengthening of the spines of the front pectoral vertebrae. That is why the withers of the living animal might have been comparatively high, while the sacrum was low.

The extremities were thick and massive. Apart from their being a proof of the fact that the animal was short-legged, the extremities were remarkable for the shortness of the upper arm and especially of the metacarpus and metatarsus while having a comparatively long forearm and toes.

The habitus of the *Spirocerus* must have borne a certain likeness to that of the musk-ox (*Ovibos moschatus*) or the takin (*Budorcas taxicolor* Hodgs). There is nothing especially astonishing in it, if one takes into consideration and keeps in view the shape of the incisors of the *Spirocerus* (Young, 1932, p. 72, pl. XXIV) and hence its belonging to the subfamily Caprinae (Сокoлoв, 1953).

It is difficult to say something concrete about the type of hair the *Spirocerus* was covered with, but by analogy with such recent Bovidae as the *Bison* and the musk-ox, we can suppose that the head and the neck of the *Spirocerus* were covered with thick and long hair; the tube-like protruding rims of the orbits like those of the *bison* and of the musk-ox are likely to have been connected with the lengthening of the hair surrounding the eyes.

As to the *Spirocerus*' way of living and the conditions of their existence, we can suppose that they were inhabitants of some half-open space or of mountains.

The corresponding fauna gives no definite answer to this question but still speaks in favour of the first supposition, as we find no typical mountain forms in the Tologoy locality—the place of the primary extinction of the *Spirocerus*. If we reject the idea of the corpses having been carried down by mountain streams, we can justly suppose that the *Spirocerus* as well as the *Bos* and *Bison* inhabited such places where open glades, they could graze in, alternated with forests in which the animals found shelter. At any rate the extremities of the *Spirocerus* being very massive and having extremely short metapodials were not adapted for the animals to live in the conditions of an open landscape or to run fast.

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О ПОСТКРАНИАЛЬНОМ СКЕЛЕТЕ И ВНЕШНЕМ ОБЛИКЕ *SPIROCERUS KIAKHTENSIS* M. PAVL.

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Резюме

В 1952 году при раскопке местонахождения четвертичных млекопитающих у горы Тологой. в Забайкалье на берегу р. Селенги в 15 км вверх по течению от Улан-Удэ, был найден полный череп и кости передней конечности от плечевой кости до конечных фаланг пальцев включительно. Кости конечности были обнаружены в виде анатомического целого, в сочлененном состоянии.

В скелете *Spirocerus kiahtensis* сочетаются признаки быка и антилопы. При коротком плече и очень короткой широкой пясти предплечье и пальцы, особенно вторые фаланги, были длинны и тонки.

Можно предполагать, что *Spirocerus kiahtensis* был довольно крупным, но коротконогим Животным с головой и рогами антилопы каньни и телосложением, напоминавшим мускусного быка.

По образу жизни он вероятно был обитателем полуоткрытых пространств или горных ландшафтов. К быстрому бегу был не способен.