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XIX.—*The Mammals of Turkestan.*

By Dr. N. SEVERTZOFF.

[Continued from p. 174.]

THE genus *Ovis*, even in the restricted sense here adopted, may be divided into two groups—namely, the northern and the southern. The horns of the northern group in proportion to their thickness are shorter than those of the other group, and are thicker in comparison with the size of the animal; and consequently this group-form has a more massive head and a wider skull. The horns of very old specimens are twice and a half to three times as long as the skull, measuring the latter from the root of the fronto-nuchal edge of the horn down to the free extremities of the præmaxillæ. In the southern group the head is proportionally smaller and the horns are more elongated; their length is at least three times and even more than four times as great as that of the skull, measured in the same way as before.

The following species belong to the northern group:—

1. *Ovis nivicola* (Eschsch.?).

From Kamtschatka. This species is justly identified with *O. montana*, Geoffr., from North America. The horns begin to get narrower from the base, so that each horn diminishes regularly from the root down to the end; the frontal and nuchal surfaces are convex, the fronto-nuchal and nuchal edges of the horns are rounded; the orbital edge is only partly rounded, and if looked at from the side it forms a sharp edge, which is separated from the convex portion above the eye by an elongated groove. The length of the horns (which are very thick) is twice, at the most twice and a half, as great as that of the skull. The frontal surface of the horns is wider than the nuchal surface; the cross ridges of the same are very indistinct.

The head is large and massive; *the profile of the nose is straight, not convex.* There is no mane on the neck. The general colour is greyish brown, with a dark line along the back; the belly, the inner sides of the legs, the posterior portion of the haunches, the patch round the tail, the lower part of the chin, and a spot on the throat are white; *the front part of the legs is blackish brown, darker than the line which runs all along the vertebral column.*

Length to the root of the tail $5\frac{1}{2}$ feet, height at the shoulders $3\frac{1}{2}$ feet; length of the horns sometimes up to $2\frac{1}{2}$ feet.

Very close to *Ovis nivicola* comes another, not yet quite

identified sheep from North Siberia, from the mountains separating the basin of the river Nyjnaja Tungusca, a tributary to the Jennissey, from the basins of the Hatanga and Piasina. Several perfect specimens were obtained from there for the Zoological Museum of the Academy of Sciences by Mr. Schmidt's expedition. According to the shape of the horns, it is rather close to *O. nivicola* and *O. nahoor*, Hodgs., from the Himalayas, so much so that Blasius does not find any difference at all between the Himalayan and the American horns (Blas. Säugeth. Deutschl. p. 470), which reminds me of the general origin of all the different species of sheep.

2. *Ovis argali*, Pall., non Blas.

The horns are thick, and rather rounded at the edges; *the orbital surface is convex, without any depression whatever. The horns begin to diminish in the first third of their length*; they are almost three times as long as the skull; the frontal surface is narrower than the nuchal surface, which last is the case also with all the following species. The chords of the basal and terminal curves are not parallel, the former being more horizontal. The axil spiral of the horn would fit on an inverted cylinder. The præmaxillæ do not articulate with the nasals, from which the maxillary is separated by a little bone. *The lachrymal is small and subquadrate; its anterior edge forms a parallel line with the front edge of the malar.*

The head is flat-topped, pyramid-shaped, stout and blunt. *The neck is maneless. The skin is reddish brown; the throat, breast, and belly are darker than the vertebral line or any of the other parts of the back*; there is a white patch around the tail, *sharply defined from the body-colour, but without any darker edge round it; this white colour extends down half of the rump.* In winter it gets very soft short hair under the long rough coat.

The length of the animal from the tip of the nose to the tail ranges up to 6 feet, the height at the shoulders to 3½ feet, the length of the horns from 39 to 42 inches.

Obs. It is not yet known whether the sheep called by this name inhabiting the low hills and the Siberian Kirgies steppes (for instance the Karkalinsk, Arkatsk, and Aldgan-adirsk steppes) belong to the present species. According to the analogy of the distinction of *Musimon arkal* of Turcomania from *M. orientalis* of the high mountains, and also of the Karatau sheep from those inhabiting the Thian-Shan, it appears to me that these Karkalinsk sheep will prove to form a separate species.

The southern group :—

3. *Ovis Karelini*, nob.

The horns are moderately thick, with rather rounded edges ; the frontal surface of the horn is very convex, whilst the orbital surface is flat, getting narrower only in the last third of its length. The horns are three times as long as the skull. *The basal and terminal chords rise parallel with each other ; the axil spiral of the horn fits on a cone with the base towards the skull. The præmaxillæ and maxillaries do not articulate with the nasals ; the same is the case with the lachrymals, which latter are large and square, being rather wider than the malar, and are partly separated from the latter by a protuberance of the maxillary.*

The neck is covered with a mane of a white colour, shaded with greyish brown. The light brown colour of the back and sides is separated from the yellowish white belly by a wide dark line ; the light brown colour gets gradually lighter towards the tail, till it becomes greyish white, not forming a sharply defined round patch. On the back there is a sharply marked dark line running from the shoulders down to the loins. I did not find any soft hair under the long winter hair in October.

Length 5 feet 10 inches to 6 feet, height at the shoulders 3 feet 6 inches ; length of the horn 3 feet 8 to 3 feet 9 inches.

Obs. The figures of the skull of *Ovis argali* given by Blasius (Säugeth. Deutschl. p. 468) in the elongated form of the horns resemble *O. Karelini* ; but by the orbital surface of the horns, which gets regularly narrower from the base to the end, they can only be referred to *O. argali*. His diagnosis contains only such characters as are common to both species.

4. *Ovis Poli*.

The horns are very large, laterally compressed, the edges (except the nuchal one) being rounded ; the orbital surface is concave, and commences to get narrower only at the last third of its length. *The horn is more than four times the length of the skull ; the basal and terminal chords are not parallel, the latter being more horizontal than the former ; the axil spiral of the horn is cone-shaped, gradually narrowing till it reaches the skull. The præmaxillæ do not articulate with the nasals, whilst the maxillaries are separated from them by small bones. The lachrymals are very large, and protrude a little further forwards than the malars ; the anterior edges of both articulate with the maxillaries by serrated sutures.*

The form of the head is prismatic, high and narrow. All

round the neck is a pure white mane ; and along the vertebral column from the shoulders to the loin there is a dark line. *The light greyish brown colour of the sides shades off into white on the belly; there is a white patch round the tail, which is bounded above by a rather dark line ; but downwards the white extends largely over the hind part of the thighs, and shades gradually into the brown colour of the legs.* I did not observe soft under-hair below the long winter hair in the month of October.

Length 6 feet 7 inches, height 3 feet 10 inches ; length of horn 4 feet 9 inches.

5. *Ovis Heinsii*.

The horns are not massive ; they are laterally compressed, and have three sharp edges ; the inner spiral would fit on an inverted cone, with the base towards the skull. The maxillaries are separated from the nasals by a small bone ; the præmaxillæ articulate only with the maxillaries, and do not touch the nasals at all. The anterior edge of the lachrymal is rounded between the maxillary and malar, where a small process is visible ; the malar in front finishes in three rather rounded processes ; the middle one is the largest, and is about as large as the process of the lachrymal, which latter, like the malar, is broad and short.

This species is known only from skulls of middle-aged specimens with not completely developed horns. Specimens seen by me at rather a great distance appeared to be greyish brown ; but I could not exactly define the colour. The height, judging from the skulls, would be a little less than that of *Ovis Karelini*.

6. *Ovis nigrimontana*.

The horns are not massive ; the nuchal edge is very sharp, and the two other edges are not much rounded ; the frontal surface is narrow, the two other surfaces are rather concave ; the orbital surface commences to get narrower on the last third of the horn, which is three and a half times as long as the skull. The basal and terminal chords are not parallel, the latter being more horizontal ; the inner spiral of the horn is cone-shaped, getting a little narrower towards the point of the horn. The præmaxillæ articulate with the nasals, which are separated from the maxillaries by the small bone between them. The lachrymal is elongated, somewhat narrow, *with one rounded process*, and comes more forward than is the case with the malar ; the front edge of the latter is straight, and joins the lower edge in a sharp angle ; a process of the maxillary fits in between the two above-mentioned bones.

The head is pyramid-shaped, broad and blunt.

Of this species also only skulls were obtained, among which was one of an adult male. Through a telescope I saw that the colour of the animal is light greyish brown, with a white belly and rump. It is considerably smaller than *Ovis Karelini*.

7. *Ovis aries*.

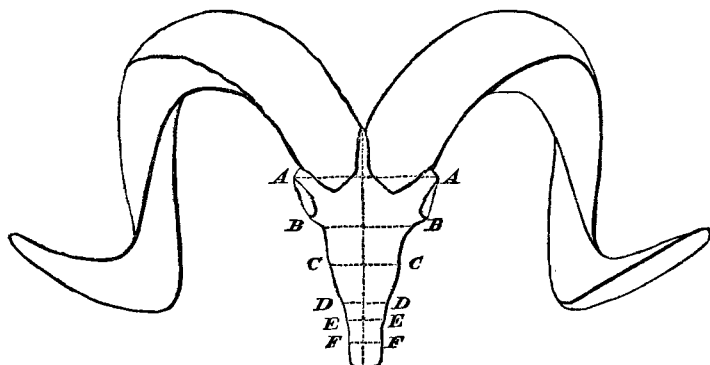
I am sorry to say I have no materials here to make comparisons between the Turkestan domestic sheep, the wild ones of that country, and the European sheep; the few skulls I collected I left in Tashkent. Some remarks regarding this will be made later on.

To complete the comparative diagnosis I here give some comparative measurements.

	<i>O. Polii</i> , adult ♂.	<i>O. Karelini</i> , adult ♂.	<i>O. Heinsii</i> , 5 years ♂.	<i>O. nigri- montana</i> , adult ♂.
Length from the nose to the tail	6 $\frac{7}{10}$ 0=1	5 $\frac{11}{10}$ 0=1	" "	4 $\frac{9}{10}$ 0=1
Height at the shoulders	3 10 0=0.58	3 6 5=0.60	" "	2 10 0=0.60
Length of horn	4 9 0=0.72	3 8 0=0.62	33 2	3 2 0=0.67
Distance between the tips of horns	3 6 0=0.53	2 8 0=0.45	31 4	2 5 5=0.52
Width of the orbital surface of horns	6 0	5 4	4 2	4 0
" nuchal surface of horns				
" frontal surface of horns				
Length of the skull	1 1 0=1	1 1 3=1	11 4=1	10 8=1
A The greatest width of the skull	8 0=0.57	7 0=0.52	6 7=0.58	6 0=0.56
B Width at the posterior molars	4 2=0.30	4 4=0.33	3 7=0.33	3 8=0.35
C " middle molars	4 2=0.30	3 7=0.28	3 5=0.31	3 5=0.32
D " anterior molars	2 7=0.19	3 1=0.23	2 4=0.20	2 5=0.23
E " anterior part of maxillæ	2 4=0.17	2 5=0.19	2 4=0.20	2 1=0.19
F " præmaxillæ	1 7=0.12	1 3=0.10	1 3=0.11	1 3=0.12
*A Length of skull to A	2 8=0.20	3 5=0.26	2 5=0.22	2 2=0.20
*B " " B	5 6=0.40	6 3=0.47	4 8=0.42	4 4=0.40
*C " " C	8 0=0.57	7 9=0.59	7 0=0.61	6 9=0.64
*D " " D	9 7=0.69	9 6=0.72	8 4=0.73	8 4=0.78
*E " " E	10 2=0.72	10 5=0.79	9 4=0.82	9 2=0.85
*F " " F	1 0 6=0.90	1 0 4=0.95	10 5=0.90	10 2=0.94
Ridge round the base of the horn	1 3 0			

In this list the measurements of the general size of *Ovis nigrimontana* are calculated from the skull and by the proportion of the length of the skull to the length of the body as far as the base of the tail. These proportions are nearly the same in *O. Polii* as in *O. Karelini*, in which these calculations agree with the actual measurements.

I have not enough material at present to form a completely correct conclusion as to the specific value of the above average measurements of the skull for specimens of different ages.



I annex here a list of the comparative measurements of not quite adult specimens:—

	♂ 2½ years, <i>O. Polii.</i>	♂ 4½ years, <i>O. Polii.</i>	♂ 4½ years, <i>O. Karelini.</i>
Length from the nose to the tail	5 11 0 = 1·00	5 9 0 = 1·00	5 9 0 = 1·00
Height at the shoulders	3 6 0 = 0·59	3 5 0 = 0·59	3 5 0 = 0·59
Length of the horn	2 6 5 = 0·42	3 2 0	2 7 = 0·46
Distance between the tips of the horns	2 3 0 = 0·38	2 9 0	2 2 6 = 0·38
Width of the orbital surface of horns	4 7½	4 5	4 2½
" nuchal surface	?	?	?
" of horns	?	?	?
" frontal surface of horns	?	?	?
Length of the skull	1 0 6 = 1·00	1 0 6 = 1·00	11 6 = 1·00
Greatest width, A	7 4 = 0·59	7 2 = 0·57	6 6½ = 0·57
Width B	4 0 = 0·32	4 2 = 0·33	3 8 = 0·33
" C	3 8 = 0·30	4 0 = 0·32	3 4 = 0·29
" D	2 8 = 0·22	2 7 = 0·21	2 5 = 0·22
" E	2 4 = 0·19		
" F	1 4 = 0·11		
Length *A	2 6½ = 0·21	2 4 = 0·19	2 4 = 0·21
" *B	5 6 = 0·44	5 1 = 0·40	4 9 = 0·42
" *C	7 9 = 0·63	7 5 = 0·60	6 6½ = 0·57
" *D	9 3 = 0·74	8 7 = 0·70	8 6 = 0·74
" *E	10 1 = 0·80		
" *F	1 0 0 = 0·95		
Ridge round the base of the horn			

From these Tables it will be noticed that the cross measurements of the skull, taken separately, show the specific distinctions only in adult specimens; and even then they are not important or considerable, except the sharp projections of the lachrymals of the adult *Ovis Polii*. But the proportions (or the measurements stated in decimal numbers) are constant in all ages, although they are not so distinct in young animals as they are in adult.

As regards the different species, *O. Heinsii* by the general shape of the skull is nearer to *O. Polii* of equal age than to *O. Karelini*, and differs from the former very little; but, as already stated, the shape of the different parts of the skull separately and the spiral of the horns of *O. Heinsii* and *O. Polii* furnish the most striking differences.

The alteration of the skull according to the age depends principally upon the development of the horns; and consequently the decimal numbers of the measurements in the different ages of one species do not alter so considerably as their measurements in inches do. As all the measurements of the skull alter according to the animal's age, the diameters of the skull even diminish in their proportion to the length of same, as the frontal grows rather more quickly than any other parts.

The changes of the different parts of the skull according to the different ages are most numerous in *O. Polii*; and I will just mention how useful these changes are in determining the age of the animal by means of the gradual development of its horns and the different parts of its skull. The former are the more trustworthy, because in growing the horns do not lose their annulations, but retain them, sharing their gradual development. The horns are separated from the skull by an annulation, which does not disappear but is gradually pushed forward by the one that is growing next to it; and this is the way in which the sulcations are formed, which are deepest on the frontal surface of the horn.

The growth of the horns is not equally quick at all seasons of the year; in winter they grow more slowly and weakly, whilst in spring with the fresh food they again grow very fast and strong. In spring the annulation at the base of the horns grows more quickly than it is able to elevate the one before it; and consequently the space between them forms a sharp impression round the horn. These impressions indicate the annual increase of the horns, and enable one to count by them the number of years the animal has lived. There are, however, some circumstances which render the reckoning liable to error; and these are the following:—

1st. The annulations of the horns are not always sepa-

rated by these furrows with uniform distinctness. Frequently, from want of food or from illness, narrow annulations are formed round the horn besides those caused by the annual interruption of their growth in winter, which they much resemble.

2nd. In addition to these irregular annulations there are other secondary annulations, separating those indicating the annual increase of the horns. The furrows formed by these differ from those dependent on the annual increase of the horns in their not being so deep and in their not extending all round the horn. They are, when present, nearly always distinguishable.

3rd. Finally, the rings formed whilst the animal is young are not so distinct as those formed when it is adult, as with advanced age the rings get thicker. These early rings, in getting towards the end of the horn, sometimes get rubbed off and the horn itself gets blunt with advanced age; this is the case in particular with *O. Polii*, because of the inner spiral of the horns getting wider towards the end of the horn; consequently only the minimum of the animal's age can be fixed—for instance, that the animal is not younger than ten or twelve years, but how much older is doubtful. In specimens which are not above ten years old the age can usually be correctly ascertained, although sometimes this cannot be done without difficulty. Very little confidence can be placed in the determination of an animal's age by the ankylosis of the different bones of its skull, this latter being an uninterrupted process.

The proportions between the development of the horns and the ankylosis of the skull-bones give also specific characteristics which are in most cases constant, although some specimens of one and the same species differ slightly in that respect; but this is more or less the case with all mammals.

In examining the skulls of different species I find that the bones of the skull of an *O. Polii* about two and a half years old are more firmly ankylosed than those of specimens of *O. Karelini* and *O. Heinsii* of about four and a half or five years of age. The above specimens of *O. Polii* and *O. Karelini* are complete, so that the age can be checked by the horns as well as by the general size of the animal; and this shows that *O. Polii* has not nearly reached its full size, whilst *O. Karelini* has fully done so; but notwithstanding this, from the examination of the skull alone, the latter would have appeared to be the youngest.

It cannot be admitted that *O. Karelini* and *O. Heinsii* grow twice as quickly as *O. Polii*, and that at the same time the bones of their skulls ankylose more slowly: the one seems to disprove the other. It is more likely that the parts of

the skull of different species ankylose at different ages; and this corresponds with the development of the horns—that is, with the specific differences in their size and weight.

The larger the horns are, the sooner do the different bones of the skull ankylose, of which I convinced myself in comparing *O. Polii*, *O. Heinsii*, and *O. Karelini*, all of the same age, viz. about four to five years; consequently it may be said that the ankylosis of the different parts of the skull is in proportion to the size of the horns. This is shown also in the above list of measurements.

The same skulls also show that the horns begin to grow massive and the forehead to develop only after the animal becomes adult—namely, when it attains an age of four and a half years, which period of its development is also marked by other circumstances. In examining the skulls which one often finds among the rocks and even in the plains about Narin and Aksay, I noticed that most of them belonged (according to the horns) to beasts of from four to six years of age, very seldom to younger or older individuals, and exclusively to the male sex. This shows that these skulls belonged to sheep which did not die on account of their great age, but from violence; nor is it likely that they were killed by wolves, as these latter would most probably concentrate their attacks upon the young or female animals. Here the question arises, why do they die principally at that age, and only male specimens?

The answer to this is best given by the consideration of the locality where the skulls are usually found—namely, in pairs under steep cliffs, from which the animals in all probability fell and killed themselves whilst fighting: this would, of course, be most generally the case with the young, weak-horned males, which had only lately reached an adult age.

The females and young do not fight; and should an old and a young male have an encounter, the former, in most cases, naturally conquers.

In all cases where two skulls are found together, one is older than the other; this shows that whilst fighting not only the one that was beaten fell from the cliff, but also that its stronger antagonist overbalanced itself whilst charging its enemy.

I have also found single skulls, and that not rarely; these belonged to younger males (generally, however, over four years of age); they show that the victor was an old male with much larger horns than the animal killed.

About Narin the skulls are generally found under precipices; a few, however, also on the plains. The latter have

been dragged there by wolves, which, as well as the vultures, feed on the flesh and skeletons of the dead sheep. The vultures only eat the flesh on the skulls; but the wolves gnaw off the nasal portions, where the bones are thinner. Sometimes, but not often, complete skulls are found.

These skulls also show when the breeding-season of the animals commences. In June the skulls look old, and in October still older; but in October I also found one skull which had not yet become white, and was marked with blood: consequently this is the time when the breeding-season begins, which very likely lasts also through the month of November. In October a specimen of *O. Poliï*, killed by me, had very large and full testes; but I am sorry to say that, because of the hard frost, I could not make a microscopical examination of the semen.

In Karatau I saw in June through a telescope a female *O. nigrimontana*, the only sheep that occurs there, with a young one, which must have been born in spring; and consequently the rutting-season takes place in the autumn.

The above remarks apply to all the species of Turkestan sheep which inhabit the mountain-ranges, with the exception of wooded districts.

I will now proceed to give more exact descriptions of the new species of sheep inhabiting Turkestan.

Ovis Karelini.

I have named this species after the worthy explorer of Central Asia—who was also the first to obtain specimens of this sheep, in the Ala Tau, near Semiretchje, about 1840. These specimens have, up to the present, been considered identical with *O. argali*. I separated it from the latter on comparing my two complete specimens, and three others, which were brought by Karelin, with the true East-Siberian *O. argali*, of which latter the Moscow University Museum possesses one complete specimen and three skulls.

The three surfaces of the horn of *O. Karelini* are convex, the orbital surface not so much so, however, as the two others.

The edges are rounded, particularly the fronto-nuchal one, so much so that it can hardly be called an edge. The frontal and nuchal surfaces do not form an angle where they meet at the base, but run into one another in a curve; but a little above the skull the horns get their regular triangular shape. The orbital surface of the horns is only once and a half as wide as the line drawn from its centre towards the fronto-nuchal edge; and the nuchal surface is wider than the frontal one, but not so wide as the orbital surface. The rising

chords of the horns are almost parallel, and form with the other chords the following angles—the basal chord 45° , the terminal chord 52° ; and the median chord is parallel with the axis of the skull. The inner side of the horn would fit on an inserted cone with the point towards the outside, slightly inclining forwards and downwards. The sulcations on the horns are meandering but parallel and pretty regular; the horn with advanced age does not project much forward over the forehead, but only becomes rather rounder in accordance with the horn-core. The facial portions of the frontals are rounded; anteriorly they present three forward projecting processes, the centre of which is wide and forms half the anterior rim of the orbit, pointing towards and fitting in between the nasal and lachrymal bones.

The length of the forehead is a little less than its width measured between the orbits. The nasals are very wide at their base, and at about half their length get half as narrow; after that their sides run parallel to each other almost down to their ends, where the bones form a sharp angle; the profile of the snout is gibbous.

The lachrymal forms the anterior rim of the orbit, and extends almost over its entire floor; the lower rim of the orbit, however, is formed by the malar.

The malar is considerably smaller than the lachrymal, and forms a rounded process projecting forward in the maxilla, which on its part sends upwards a small process fitting in between the lachrymal and the malar; the latter bone is rather thin.

In adult specimens the maxillary is separated from the nasals by a small bone, which in time, however, ankyloses with the nasals. In young animals this little bone separates only the anterior part of the maxillary, whilst the other end articulates with the nasals and also with the præmaxillæ. When the animal gets older the occipital ridge rises and becomes larger, the forehead gets wider by the outward extension of the orbits, and consequently also the lachrymal grows in proportion. The maxillaries get rather higher between the grinding-teeth and the nasals, which latter become more convex.

These alterations take place in all species; and being dependent upon the development of the horns, this process continues until extreme age, not stopping at the time when the animal becomes adult. Almost all the different bones of the skull ankylose in the above mentioned-manner, and, although late, always simultaneously.

The mane, which extends all round the neck, is short, and

only grows when the animal becomes adult; it looks almost more like thick wavy hair than any thing else; its length does not exceed 3 to $3\frac{1}{2}$ inches. This mane spreads all over the front part of the shoulders; on the back of the neck the hair is shorter, not exceeding 2 to $2\frac{1}{2}$ inches.

The forehead, the front portion of the head to half its length, and the cheeks are brownish grey; the spot above the eye and the lower portion of the head are pure white; the muzzle is black; the horns are greyish brown, shaded with yellow. The nape is blackish brown; the line along the spine is of an earth-brown colour; the mane is white, intermixed with greyish hair. The breast and legs are white; the back, the shoulders, sides, and thighs are light brownish; on the sides close to the shoulders there is a white spot; and on each leg there are two brown lines from the body down to the feet on the hind legs, and down to the knees on the front legs.

As regards the light-brownish colour, it is purest on the back on each side of the spine, commencing almost from the shoulders and reaching to the loins; on the front part of the shoulders below the mane it fades into greyish brown; and on the sides behind the white spots it is shaded with an olive-colour which is darker than on the back, but is slightly mixed with white. On the thighs this brown colour commences to get white, the hind parts of which are pure white. The belly is yellowish white, which colour is separated from the sides by a wide blackish-brown line. The tail and a small patch round it are also yellowish white, this colour gradually shades off into brown on the sides; above the tail there is a small dark spot.

The female is similar to the male and has also the characteristic dark lines on the sides. Her horns are rather shorter than her head and have more-rounded edges; the curve of the horns forms only one third of a circle; and they diverge towards their points. She is smaller than the male, measuring 5 to $5\frac{1}{4}$ feet in length, and is 3 feet high at the shoulders.

O. argali, with which species it always has been confounded, is altogether different from the present species in the shape and structure of the horns and the skull; but the most striking differences are in the colour and in the mane; besides these there are also some other differences. But as *O. argali* is neither a new species, nor does it inhabit Turkestan, I shall mention here only the following characteristics: the skull-bones behind the orbits ankylose very early; but the front parts are not ankylosed even in specimens of from seven to eight years of age, whilst the different parts of the skull of *O. Karelini* ankylose simultaneously.

O. Karelini inhabits all the Semiretchje Altai and also the Saplisky Altai, but is not so common there as it is in the mountains between Turgeli and Kaskelen; it has been lately driven out of the latter locality by the Cossack sportsmen, and has gone to a higher elevation, namely the Kebin steppe above the range of trees. East of Turgeli, on the bare mountains and plains near the rivers Chilik and Keben, *O. Karelini* is still very abundant, except in localities which are covered with trees, extending from Chilik as far as Lantash. Further, it inhabits all the neighbourhood of Issik-kul; it is rather rare on the northern part of the Thian-Shan, which is thickly covered with trees. I also met with numerous flocks in the steppes of the Narin, where they find such an abundance of food on the meadows and shelter among the rocks; these localities are about 12,000 to 13,000 feet above the sea-level.

O. Karelini is sometimes also met with on the mountains separating the Narin from its tributary the Atpash, as far as the plains between the rivers Kurtka and Chatir-kul; but from the eastern sources of the Atpash down as far as the Chatir-kul it is only found in company with *O. Poli*.

O. Karelini does not inhabit the rocks and mountains exclusively, like the genus *Capra*; it is also not satisfied, like the latter, with the small tufts of grass on the rocks, but wants more extensive feeding-grounds, and is therefore driven out of certain localities more easily than is the case with *Capra*. In the neighbourhood of Copal, for instance, goats are abundant in the central steppes of Kara, whilst the sheep have been driven out from these places and only visit them late in the autumn. In places where good meadows and rocky places are found, sheep can be met with at any elevation from about 2000 or 3000 feet in the southern portion of the Semiretchje Altai, near the river Ilia, to about 10,000 feet at the rivers Lepsa, Larkan, Kora, Karatala, and Koksa, and even to 11,000 or 12,000 feet in the neighbourhood of the Upper Narin. They are found at a much lower elevation in winter, whilst in the summer they withdraw again to the highest mountains. I do not know if the sheep which are so abundant in the hills on the western shores of the river Chu, opposite the Tokmack, belong to the present species or to *O. Heinsii*.

Ovis Poli.

This species was founded upon horns obtained by Wood at the sources of the Amu-Darja, on the high plains near Lake Serikul, at an elevation of about 16,000 feet—consequently about the same locality where Marco Polo mentions that he met with some large wild sheep. To the same species

Wagner (Schreber's 'Säugethiere,' Fortsetz. v. A. Wagner) assigns also the skulls and horns observed by Barns in Buchará: he says, "The horns are more slender, longer, and more compressed than those of *O. argali*, and are curved in a rather larger circle; but these characters, as mentioned before, are also found in *O. Heinsii* and *O. nigrimontana*." The horns of *O. Polii* are strongly compressed; on the orbital surface there is a furrow between the two convex portions of the surface; there is also a similar depression on the frontal surface running parallel with the fronto-orbital edge; in young specimens this is sharply marked, but with the advance of age this furrow gets deeper and wider. The nuchal surface of the horn is flat; consequently the fronto-nuchal edge is sharp and forms a triangle with a rounded point. In the section at the horn's base the width of the orbital surface is twice the line drawn from the middle of it across the horn to the fronto-nuchal edge; the width of the frontal surface is almost equal to that of the nuchal surface.

The angle formed by the basal chord with the axis of the skull shows 41° , or is more than three times the angle formed by it with the median chord, namely 12° , but is much less than that of the terminal chord, which shows 60° ; both rising chords are long.

The spiral of the horn fits on an inserted cone the point of which is turned towards the skull and the base to the outside; the axis of this cone points towards the front, and still more so when the animal advances in age. The inner surfaces of the horns join almost at a right angle, with a rather blunt point in young and a very sharp one in old specimens, namely from 3° to 4° . The ridges of the horns are meandering and irregular, a great portion of them branching off in two or more branches.

The occipital ridge is pointed and forms in its section a sharp angle with a slightly rounded point; the forehead, commencing from the bridge of the nose, rises very steeply; out of the three processes of the frontal, the anterior one (just above the eye) is very small and sometimes disappears altogether, so so that only the two others remain. The length of the forehead, from the base of the horns as far as the upper extremities of the nasals, is scarcely more than two thirds of its width between the orbits. This proportion differs very little according to the animal's age, as the length and width of the forehead increase equally quickly; the forehead of *O. Karelini*, on the contrary, grows more in length than it does in width, and consequently the proportions of these measurements alter very much in the different ages of the animal.

The edges of the nasals are almost parallel at their base, and only at their free extremities form a sharp angle; the nose is convex.

The lachrymals are more developed than in any other species of sheep; they occupy all the front part of the orbit, filling up the front and bottom of it, and articulating with the anterior process of the malar. There are three Wormerian bones; the upper one joins the occipital process of the frontal bone (if there is one); all these three bones are turned towards the interior of the orbit, in which they form a wide irregular polygon with a serrated suture. The uppermost is the narrowest, but alters much in width and usually ends in a sharp point; the middle one fits into the maxillary by two points, and one is attached to the lower jawbone; the lachrymal itself is in the middle flat bone.

The malar varies in its size; but its facial portion is always large, sometimes, however, only half the width of the lachrymal; and, reckoning from the orbit, it is a little shorter; its front edge is toothed and has two or three processes; these, however, are usually very short. The malar itself is thick. The maxillary is separated in old specimens completely, and in young only partly, from the nasals. This species differs from *O. Karelini* in the alterations of the skull according to age, as well as by the development of the frontals, also by the fact that whilst the head grows higher the lachrymals do not grow in width, but only in length.

The different parts of the skull ankylose simultaneously; and, as already mentioned, this process takes place very early; and in connexion with this it may be noticed that the alterations of the skull according to age take place only up to the time when the animal becomes adult, after which period only the horns continue to grow and the forehead becomes rather more convex, although this latter is hardly perceptible.

The mane of adult specimens covers the same parts as it does in *O. Karelini*, viz. the throat, the sides of the neck, and the front of the shoulders; it is, however, much longer, the hair being from 6 to 7 inches long; on the spine it is from 3 to 4 inches in length, and gets shorter as it approaches the nape. The distribution of the white and the dark colour is on the whole the same as in *O. Karelini*; but the colour of the head is more blackish brown, and all other light-brown parts of *O. Karelini* are darker in the present species (namely, of a greyish brown colour shaded with red); the sides are darker and more grey than the back, intermixed with some white hair; the upper front portion of the shoulders close to the mane is

light-coloured; the white spots on the side of the shoulders are like those of *O. Karelini*; also the blackish brown nape and rather lighter spine are similar in both these species. The white spots about the eyes are wider in *O. Polii*, and extend to the front of the lower eyelids; the mane is snowy white, without any mixture of brown hair in it; the belly is white, which colour gradually shades off into a greyish brown on the flanks, without a black line separating the two colours from each other; the white colour of the hinder portion of the body extends over the hind legs and the tail, on which latter neither a black nor a brown spot is to be seen. The reddish colour of the loins is marked by a wide greyish brown line, which separates it from the white colour of the back part of the body, as well as to some degree from the greyish brown thighs, on which latter and the sides it can be seen that the brown hair is mixed with some white; along the spine there is a dark line from the shoulders to the loins.

Such is the coloration of *O. Polii* in winter during the month of October, whilst in summer it appeared to Mr. Semenov, who saw these sheep at Han-tengri, to be darker.

A young male, two and a half years old, is greyish-brown on the upper portions of the body, without the reddish tint of the adult animal; in the remaining parts it fully resembles the adult, with the exception of the greyish brown colour extending further on the loins; and the sides and neck are also of this colour. At this age there is no mane, and only on the nape and partly also between the shoulders the hair is rather longer and of a blackish brown colour; there is also no dark line on the spine; but the marking of the loins resembles that of the adult.

When the animal has attained the age of two and a half years, the horns already form half a circle; all the edges are sharp and the sides flat.

The female is unknown.

O. Polii was met with by Mr. Semenov on the high plains near the snow-covered summits of the gigantic mountains of Han-tengri, at the sources of the rivers Karkara, Tekes, and Sari-jaws. These places form the most northern limits of its range, which, to the south-west, extends as far as the Narin, the upper Syr-Darja, and the tributaries of the Kashgar-Darja at the frontier of Turkestan. I found skulls of *O. Polii* within a distance of from 10 to 12 versts to the north of the above-mentioned rivers, at the Ulan, about the mountains of Atpash; here it lives together with *O. Karelini*, but only in very limited numbers; and these localities form the narrow line where these two species are found together.

On the high plain of the Aksay only *O. Polii* is to be met with, and is very abundant there; here it usually keeps in the mountains of Bos-adir, on the left or north shore of the Aksay, and feeds on the hilly meadows situated close to the above place; further north it has not been obtained yet.

This animal is not a regular inhabitant of the mountains and rocks, but of high-situated hilly plains and meadows, where the *Festuca*, *Artemisia*, and *Salsolæ* form its principal food. It only takes to the mountains for concealment, but even then avoids the more rocky localities, as, for instance, the Kok-Ria near the Aksay, where I only found the *Capra skyn*.

The lowest elevation where it is to be met with on Han-tengri is about 10,000 feet, namely in the Kar-Rara and Tekes; but even here it is rare, mostly inhabiting the more level parts of Han-tengri, which are covered with grass, near the range of perpetual snow, about 11,000 feet above the sea-level. On the Aksay the limits of its range are formed by the river of the same name, between the mountains of Kok-Ria and Bos-adir, at an altitude of 9500 feet; to about the same height it descends also in the Atpash, going, however, as high as the perpetual snow, about 13,000 to 14,000 feet. Mr. Wood found the horns of this species about the river Amu-Darja, at an elevation of about 16,000 feet.

I do not know its distribution beyond the above localities; some information regarding this might perhaps be obtained from the zoological portion of the work by the Brothers Schlagintweit. It is probable, however, that *O. Polii* does not go further than the Karakorum mountains, between the Indus and the Tarim, as south of the Karakorum the range of the Himalayan sheep commences. As yet I cannot fix how far it occurs towards the east.

Wherever *O. Polii* has been met with it has been found inhabiting the same localities during the summer and winter; the latter season, though cold, is remarkably free from snow, the winter clouds being intercepted by the lower mountains before reaching the elevations inhabited by the sheep. I saw this species on Han-tengri and Aksay in small scattered flocks of from five to ten individuals—unlike *O. Karelini*, which species I have seen in flocks of hundreds in the neighbourhood of the Narin. Old males are often met with singly, separated from the flock, not wandering to a great distance, but keeping within sight of the herd they belong to, to which they apparently act as sentinels.

An old specimen obtained by me was thus separated from the flock on the look-out. The herd itself often goes about scattered and not at all so close to each other as is the case with

O. Karelini. Of one of these flocks I shot a specimen, now in my collection; and the animal fell only to the second bullet.

The old male killed by me I hit five times, each time with a good-sized bullet; and only the sixth bullet brought it down, having penetrated to the heart.

The first bullet hit the animal between the hind legs in the left testicle, the right one not being damaged at all; the pain of this wound impeded the animal in running; and even then two men had to follow it for about one hour. Two bullets had struck the horns; one of the two bullets was flattened and only left a mark on the horn, whilst the other partly buried itself in the horn and afterwards fell out without doing any considerable damage. Each time the horn was struck by the bullet the animal fell to the ground, but within a minute rose again. Neither of the two following bullets sufficed to stop the animal in its flight, although one of them penetrated the liver and the other the lung; and it was only on receipt of the sixth bullet (which, as already mentioned, penetrated the heart) that the animal succumbed. These particulars give a slight idea of the strength and tenacity of this sheep.

In order to get a shot at it is necessary to approach it from behind some rock; this is easily done at the Aksay, where the sheep are not pursued at all, and therefore do not avoid spots which afford hiding-places for a man; but on the plains of Han-tengri, which in summer are regularly visited by the different Kirgees tribes, these sheep are very cautious, as is also the case with *O. Karelini* on the Upper Narin, in which locality we saw great numbers of the latter species, but could not obtain any specimens.

The speed of *O. Polii* is very great; but the difficulty in overtaking wounded specimens may be partly attributed to the distressing effect of the rarefied air upon the horses, while it has apparently no effect whatever on the sheep.

The Cossacks here say that the wild sheep and goats in jumping from one rock down to another alight on their horns. This seems very improbable to me; but still there is also some reason to believe it—namely, that in jumping the head with the heavy horns might make the animal lose its balance.

The weight of an old specimen killed and gralloched by me was too much for a strong mountain-camel, the animal requiring four hours to accomplish four versts, and being obliged to lie down several times during the journey. At low elevations a camel can carry 17 poods with ease, but in these lofty plains not more than 11 or 12 poods; the entire weight of a male *O. Polii* will therefore be not less than 16 or 17 poods; the head and horns alone weigh over 2 poods.

[To be continued.]