

A late Quaternary goat (*Capra*) in North America?

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PALMER (1956) has reported briefly upon a partial skull (fig. 1) of a male *Capra* found in a sand-bar of the Iowa river, in the central part of the United States of America. The exact locality is in the SE 1/2 of Sec. 3, T. 83N., R. 17W., near the village of Quarry, a few miles southeast of Marshalltown, central Iowa. Unfortunately, there is no known correlation between the local geology and the location of the skull, which thus lacks stratigraphic data and cannot be placed in any chronologic frame work. However, the physical condition of the skull (patina and degree of mineralization) is similar to that of known Pleistocene fossils coming from the same stream beds. These facts, as well as the morphology of the horn cores, argue against this skull having been derived from an introduced domestic goat. If *Capra* was once native to North America, this is the first and as yet only specimen testifying to such a distribution.

There is no possibility of confusion of this specimen with either of the other two Caprinae of North America, of similar size and appearance, the "mountain goat" (*Oreamnos*) or the Canadian sheep (*Ovis canadensis*). The horns and horn cores of *Oreamnos* are much too small, and the horn cores of *Ovis canadensis* are quite triangular in cross-section, are heavier at the base, and are stouter than are those of the specimen from Iowa. Even if the horn cores were lacking, this Iowa specimen would be identifiable as a goat and not a sheep, since the



Abb. 1. Left: Partial skull and horn cores of fossil goat from Iowa, anterior view.
Right: The same, as seen from the right side.

frontoparietal (coronal) suture forms a straight line from side to side (fig. 2), whereas in a sheep this suture is a shallow interted \wedge (AMSCHLER, 1949, p. 27).

Capra has hitherto been considered to be strictly Palaearctic, with the exception of an Abyssinian population of the Nubian ibex. Five species are generally recognized (ELLERMAN and MORRISON-SCOTT, 1951, pp. 404–405), of which three (Spanish ibex, the Caucasian tur, and the markhor) do not resemble the specimen to be described, and thus are not further considered here. Of the two remaining species, the true goats, *Capra (Capra) hircus*, have two wild subspecies; *C. h. aegagrus* is native to the southern Balkans (KONSULOFF, 1926), Crete, some of the Aegean islands, and

southwestern Asia, and *C. h. blythi* is found in Afghanistan and the adjacent parts of Persia and Pakistan.

The ibexes, *Capra (Ibex) ibex*, range much wider than do the true goats, although the distribution is discontinuous; different sub-species occur in the European Alps, north-eastern Africa (including Ethiopia), Arabia and Palestine, and central Asia (including parts of Siberia). Thus, with regard to proximity, as based on present distribution, any *Capra* crossing into North America by a Bering land-bridge would be expected to have been a Siberian ibex, and perhaps this bit of evidence entered into the original naming of the Iowa goat as "*Capra (Ibex) iowensis*"; this name, however, remains a *nomen nudum*, as no formal description was presented in the original publication.

Although one of us (REED) has been unable to examine the specimen, which remains in the private collection of its discoverer, Mr. JOHN SMITH of Marshalltown, Iowa, a study of the photographs and drawings indicates that the Iowa goat was a true goat and

not an ibex. The important difference between the two sub-genera is that the front of the horn core of a true goat is sharply keeled (fig. 3) whereas that of an ibex is flattened or slightly rounded anteriorly (ZEUNER, 1955; verified by REED at the Chicago Natural History Museum).

The goat skull from Iowa has the rich nut-brown patina characteristic of many finds of extinct mammals from the river beds of that state. The skull is somewhat mineralized, and MORRIS SKINNER of the American Museum of Natural History (who examined the original) has told REED that the degree of mineralization is definitely greater than would be possible in the skull of a domestic goat, even if it had belonged to one of Iowa's first white settlers (circa 1830). It is true that heavy limy mineralization of bone can occur in a century or even less, under certain special conditions such as are found in parts of Florida (NEILL, 1957), but such conditions probably have no counterpart in the leached Iowa alluvial deposits from which came the goat being considered. Unfortunately, due to the retention of the specimen in a private collection, we have not been able to obtain samples of powdered bone for proper chemical examination.

Anatomically, the skull and horn cores are those of a typical male wild goat (*Capra*

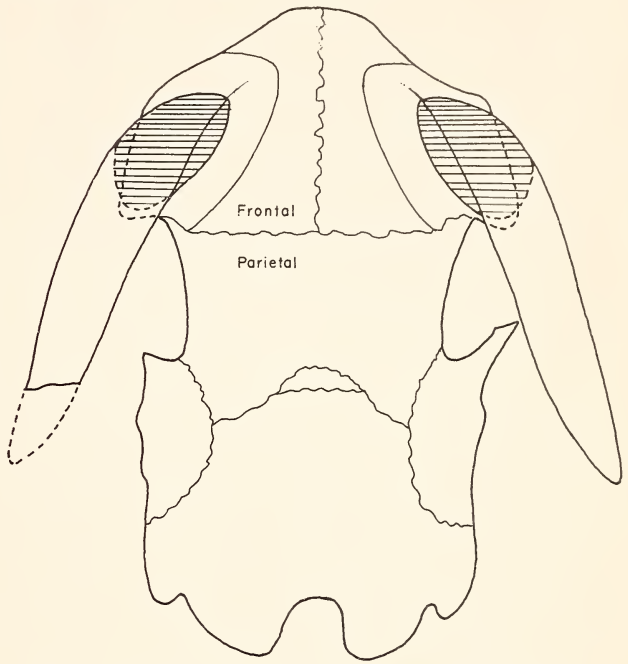


Abb. 2. Drawing of dorsal view of the skull of the fossil goat from Iowa, showing the straight fronto-parietal suture and cross-sections of the horn cores; each such section is shown parallel to the plane of the paper and is located about three inches above the top of the cranium.



Abb. 3. Left: Partial cranium, with intact horn cores, of a male wild goat (*Capra hircus aegagrus*) from the Zagros Mts. of northern Iraq. Anterior view. — Right: The same, as seen from the right side.

placement of the horn core on the skull, the Iowa goat is similar to a male goat, preserved in the Rijksmuseum van Natuurlijke Historie, Leiden, of the feral or semi-feral population found on the Isle of Joura, in the Aegean Sea. At one time these goats from Joura were thought to represent a distinct species, but the present opinion is that they are descendants of domestic goats of the prehistoric Bronze period or mixtures of domestic and wild goats (ZEUNER, 1963, p. 143). The cross-section of the horn core has a similar shape in the Iowa goat and in the goat from Joura (figs. 2 and 5)¹. The horns of the Joura goat, however, are twisted, and diverge sharply from each other.

We have not been able to find a specimen of *Capra hircus blythi* in which the horns could be removed from the cores, so we cannot state positively that all wild individuals of *Capra hircus* show a part of the medial surface when viewed directly anteriorly.

Although domestic goats were first scimitar-horned, as would be expected due to their derivation from *C. h. aegagrus*, almost all domestic goats since the beginning of the Bronze Age have had twisted horns (ZEUNER, 1955, 1963), presumably because of artificial selection for this particular character by early herdsmen. Today, only a few populations of straight-horned domestic goats remain, such as those studied in the Caucasus Mts. by AMSCHLER (1929).

It is clear, thus, that a straight-horned goat from Iowa would have to be representative of one of the following actual or hypothetical populations: 1. a wild goat intro-



Abb. 4. The same individual as in fig. 3, but with the horns on the horn cores.

¹ For a discussion of the shapes of horn cores of wild and early domestic goats, see ZEUNER (1955) and REED (1959).

duced from Macedonia, Greece or southwestern Asia within the last century or so; 2. a domestic goat from one of the straight-horned flocks of the Caucasus Mts., or one of the other rare flocks of scimitar-horned domestic goats of the last 130 years or so; 3. a domestic goat from twisted-horned stock, but with a wild-type mutation for straight horns; 4. a domestic goat from stock introduced into Mexico about 1530 and known to have diffused among Indians of the American Southwest; 5. a wild goat native to North America.

Each of the first four possibilities is inherently improbable, since Iowa was not settled by pioneers who might have had wild goats from the eastern Mediterranean, nor did the early settlers in Iowa generally have goats, since the goat was not a popular animal with the westward-moving migrants of the early nineteenth century in

Table 1

Measurements on the goat skull collected in Iowa

Length of horn core along front of curve, from center of basal notch to tip	265 mm.
Estimated width between horn tips	162 mm.
Distance from the lower border of the foramen magnum to the foramen at the rear of the nasals	153 mm.
Maximum width of skull between upper borders of orbits	112 mm.
Width of skull at the narrowest point above orbits	90 mm.
Horizontal width of the foramen magnum	25 mm.
Diameter of a horn core at base	140 mm.
Maximum width at rear of skull	92 mm.

the United States. Any such early nineteenth-century goat, even if present, would be most unlikely to be from any but common domestic stock, and thus would have had spiral horns. Domestic goats derived from Spanish imports of the sixteenth century would also have had twisted horns, and they did not extend beyond the southwestern United States, as none of the Plains Indians had goats. Lastly, the degree of mineralization and the type of patination — so similar to that of known Pleistocene fossils including *Symbos* and *Ovibos* — argues against the skull belonging to any goat of the last century and a half.

We conclude, thus, that the skull here discussed and figured most probably represents a true goat, native to the late Quaternary of North America but extinct before the discovery of the Western Hemisphere by Europeans. It is true that the occurrence of a wild goat in Iowa is peculiar, since Iowa is an area of plains and low rolling hills, and lacks mountains. When first explored by white men, Iowa did not even have wild sheep, which will typically extend their range much further from mountains than will goats. However, we do not know what disturbed distributions may have been imposed upon mountain-inhabiting mammals during a period of glaciation, but we are reminded that Alpine ibex of the Würm glacial period descended from their mountains and that their bones and graphic representations have been found in non-mountainous regions. Even so, we must confess to a feeling of inadequacy in trying to explain the presence of a true wild *Capra* in Iowa. Peculiar, too, is the fact that no remains of goats have hitherto been found in the extinct fauna of North America and that true goats, *Capra (Capra)*, are not known today in central or eastern Asia. It is our hope, thus, that more fossils of true goats will be found in North America and also in eastern Asia.

When we first began considering the problem of a goat native to North America, we thought that perhaps some of the numerous petroglyphs in the western United States might be of wild goats. None such had ever been identified as goats by the

ANTERIOR



Abb. 5. Cross section of the left horn core of a male goat from the Isle of Joura, Greece, drawn from a specimen in the Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands. $\frac{1}{2}$ natural size, the section having been drawn one third of the distance from the base of the horn core to the tip.

anthropologists studying these petroglyphs,



Abb. 6. Reproduction of a petroglyph of what appears to be a goat-like animal; the original was on a rock adjacent to the Columbia River, near Wishram, Washington, USA (Photography by courtesy of Dr. CARL G. HELLER, who comments that, in contrast to many associated petroglyphs, this one appeared to be "very old.").

we knew, since the picture of any animal with sweeping horns and a short tail was automatically labeled by them as wild sheep (*Ovis canadensis*). Our first inspection of the published literature on western American petroglyphs seemed to verify our suspicions, as many of the drawings identified as "sheep" definitely appeared to be drawings of goats. Such an animal (fig. 5) has two distinctly goat-like characters, each of which is definitely not typical of *Ovis canadensis*: the horns extend in a sweeping arc over the back (not curled around the side of the head as in North American sheep), and the tail is UP (not down, as is universally true of sheep).² Such drawings are found in Washington, Oregon, Idaho, Nevada and California (MALLERY, 1893, Pls. iii and iv, figs. 89 and 1092; DOCKSTADER, 1961, Pl. 6³; CRESSMAN, 1937; ERWIN, 1930, Pl. 43; HEIZER and BAUMHOFF, 1962, many figs.).

In spite of these numerous and widespread rock-drawings of animals which appear to be definitely goat-like, we have finally concluded that most probably the Indians were actually drawing sheep. We have reached this conclusion, one exactly opposite to that of our first assumption, for the following reasons: 1. Nowhere did we find such a goat-like figure clearly represented with a beard. 2. All such repre-

² For observations on this fact that *Ovis canadensis* does not hold its tail up we are indebted to W. B. DAVIS, A. F. HALLORAN, L. F. MCCANN, H. B. MILLS, F. M. PACKARD, R. E. PILMORE, and C. C. SPENCER. Each of these gentlemen has studied *Ovis canadensis* for years, and not one has ever seen one sheep with its tail up. A sheep will raise its tail slightly to defecate, or sometimes slightly when alarmed, but never is the tail carried upright as it is typically in goats.

³ It is interesting to note that in the review of DOCKSTADER's book in *Science* (Jan. 5, 1962, pp. 32-34) the animals depicted in Pl. 6 were called goats, whereas in the book itself they are — probably correctly — termed sheep. In this particular petroglyph the upraised tail is goat-like but the horns are much more as in sheep than in many such rock-drawings. (

sentations are within the natural range of *Ovis canadensis*. 3. Numerous remains of wild sheep have been recovered from prehistoric archeological sites in this same area, but no remains of wild goats have been identified there. 4. HEIZER and BAUMHOFF believe that for the area studied by them, these petroglyphs of sheep were made in approximately the first fifteen centuries of the Christian era, and we suspect that any native American goat may have been extinct by that time. Lastly, the very multiplicity of these goat-like drawings, with their long curving horns and upright tails, in correlation with the facts outlined above, most probably means that the pre-Columbian Indians actually were drawing sheep, the caprine known to be numerous in the area, but they were making the drawings look more like goats than like sheep.

There remains, however, the possibility that *Capra* was available to prehistoric American Indians, both for hunting and drawing. Perhaps some of the bones of Caprini recovered from early archeologic sites might prove on close examination to belong to *Capra* instead of to *Ovis*, the genus to which such bones are invariably referred. The sharp-keeled horn core of a goat, curved in one plane in a sweeping arc, is an obvious contrast to the bulkier, rounded, and spirally-curved horn core of *Ovis canadensis*. Also the straight fronto-parietal suture of the goat is in contrast to the ^-shaped one of the sheep. Other skeletal differences are not so apparent and require detailed and expert analysis (PERKINS, 1959).

Table 2

Arguments for and against inclusion of *Capra* (*Capra*) in the Quaternary fauna of North America, as based on the specimen here being considered

Arguments for	Arguments against
	1. Lack of any stratigraphic evidence
	2. Lack of any other remains of <i>Capra</i> in the fossil fauna of the Western Hemisphere.
	3. The terrain where found (Iowa) is not typical of that of wild goats.
4. Degree of mineralization and patination agrees with other fossils of known Pleistocene age.	
5. Unlikelihood of such mineralization and patination having been acquired by a skull of a domestic goat in Iowa in the last 100-130 years.	
6. Anatomically, the skull resembles closely that of a wild male goat (<i>Capra hircus aegagrus</i>).	6. There is agreement in some details of morphology of horn cores with an individual of a feral or semiferal population on the Isle of Joura, Greece.
7. Very small chance that a wild <i>Capra h. aegagrus</i> would be imported into Iowa, the skull mineralized and patinated, and then found.	
8. Little possibility that early settlers had goats; any such goats, if present, would have had twisted horns.	

Summary

We have attempted to balance the available evidence in Table 2. When we consider everything together, we think that *most probably* the skull of *Capra (Capra)* sp. here discussed represents an extinct native North American population. However, the evidence is not conclusive and we must render the Scotch verdict of *NOT PROVED*. Final proof can come only with the finding of bones of a wild goat in North America in strata of known pre-Columbian age.

Zusammenfassung

Wir haben versucht, die verfügbaren Daten in Tab. 2 gegeneinander abzuwägen. Wenn wir alles zusammen berücksichtigen, glauben wir, daß höchstwahrscheinlich der hier diskutierte Schädel von *Capra (Capra)* sp. eine ausgestorbene indigene nordamerikanische Population repräsentiert. Der Beweis ist jedoch noch nicht schlüssig. Endgültiges kann erst gesagt werden beim Auffinden von Knochen einer Wildziege in Nordamerika in Ablagerungen von sicher vorkolumbianischem Alter.

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Range extension of *Microtus guentheri* in Greece¹

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As a result of a recent collection of mammals in Greece in order to study their geographical distribution and systematic, the known range of *Microtus guentheri bartingi* Barrett-Hamilton, 1903 has been extended. Earlier investigators believed that the range

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