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Author(s): C. Bertrand Schultz and Loren Eiseley

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PALEONTOLOGICAL EVIDENCE FOR THE ANTIQUITY OF THE SCOTTSBLUFF BISON QUARRY AND ITS ASSOCIATED ARTIFACTS

By C. BERTRAND SCHULTZ
AND LOREN EISELEY

I

THE publication of a paper by Alfred S. Romer announcing the discovery of a "fossil" camel in a Utah cave deposit of supposedly Recent age,[1] revived, on a new front, the long war over Pleistocene man in America. A reply by the late O. P. Hay[2] soon followed, and with it the conflict shifted from emphasis upon a denial, as was formerly the custom, of the authenticity of the association of man with fossil animals in America, to the question of the time of extinction of these same animals.[3]

It is here, in the opinion of the present writers, that the question threatens to linger for a long time to come. Everyone of fair judgment will now admit that there are undoubted cases of association of artifacts with the remains of animals no longer living on the North American continent. In that, at least, we have made some progress, and cleared the air sufficiently to gaze about us with less prejudice. At the same time, however, we have run upon a snag. For the assemblage of ghostly forms which once, in the opinion of paleontologists, characterized the Pleistocene, have, almost without exception, suddenly stirred in their graves and moved forward into the Recent. This, to the dismay of the "Pleistocene school," and the everlasting joy of those anthropologists who were beginning to feel a trifle hard pressed in their beliefs.

Though the writers feel that the last word has yet to be uttered in this controversy, and though they are of the opinion that the appearance of certain Pleistocene species within a more or less ancient and fabulous Recent does not, *ipso facto*, dissipate the problem of man's antiquity in America, they do realize that this new obstacle enormously complicates the question. For if so many of these extinct species extend into the Recent while the deposits continue to give evidence of some age, the problem bids fair to be insurmountable for some time to come. Hence it is with some hesitation that they offer the following account of the bison quarry at

[1] Romer, 1925, pp. 19–20.
[2] Hay, 1928, pp. 299–300.
[3] Romer, 1933, pp. 39–83.

Scottsbluff, Nebraska. But the brief preliminary paper[4] which accompanied photographs of the artifacts attracted such attention, both favorable and unfavorable, that it seems only fair to issue a complete report on a site which, whether Pleistocene or Recent, evidences a notable antiquity, and has some bearing on the archaeological as well as the geological problems of the High Plains.

II

Two discoveries of artifacts with the bones of extinct bison had previously been made in Nebraska[5] by the Morrill Paleontological Expeditions of the University of Nebraska, but under circumstances which, unfortunately, make it extremely difficult to establish beyond question the age of these deposits.[6] These discoveries had, however, been sufficient to increase interest in the problem, and Dr Erwin H. Barbour, Director of the Nebraska State Museum, had encouraged the men to be alert for any evidence. In the latter part of May, 1932, a bone bed located by Mr Ray Swanson of Scottsbluff, was called to the party's attention. The quarry was found to be situated within a few hundred yards of Signal Butte,[7] sixteen miles west and three miles south of Scottsbluff, on the north bank of Spring Creek about fifty feet east of the juncture with Kiowa Creek. Spring Creek, in trenching its course, had cut athwart an old stream channel in the gravels of which the bison bones were now exposed. This fossil stream was incised in a floor of Brule clay of Oligocene age, and its gravels varied in size from ordinary sand and gravel up to chunks of Tertiary sandstones and clays several pounds in weight. The coarseness of some of this material suggests a stream of considerable volume and possessing a strong current. Later, for some reason, climatic or otherwise, the carrying power of the stream was reduced, and a lighter load was transported as is now indicated by the overlying sand and silt. Still later the water apparently ceased to flow, and at the present time a covering of from twelve to twenty-seven feet of windblown material rests upon the remains of the old stream bed. The geology is such as to indicate a deposit of considerable antiquity, and the change in invertebrate life remarked on later in this paper suggests climatic change.

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[4] Barbour and Schultz, 1932. The term "pre-Folsom" used in this paper has been abandoned. In the opinion of the authors the theory of Yuma-Folsom sequence based on the study of technique has not so far met the test of stratigraphical evidence. It is more likely that the Yumas are knives or other implements.

[5] Schultz, 1932.

[6] Strong, June 27, 1932.

[7] Strong, Publication, Smithsonian Institution, 1932, p. 69.

On August 4, 1932, the first artifact was found. It had been partially exposed by the caving off of a bank containing fossil bones. Its position was well toward the bottom of the bone bed about ten inches above the floor of Brule clay. Because of the position of the artifact, the party realized that it would be very difficult to keep *in situ*, so numerous pictures were taken in the presence of the six members of the Museum expedition. In the end, a slight jar caused it to slip from its position, though the impression from which the artifact slipped made positive its original location. Mr C. B. Schultz, who was in charge of the field party, immediately telegraphed Dr Barbour, Director of the Museum, who, in turn, informed *Science Service* in Washington, D.C., of the find. On August 6, the quarry was visited by Dr Barbour and by Dr E. H. Bell, Assistant Professor of Anthropology at the University of Nebraska. The artifact was studied, and also the site, in order to see if intrusion were possible.

A misunderstanding arose at the time the site was reported on[8] which should be clarified here for the sake of accuracy. It was stated that the artifact was "one and one-half feet below the original surface"[9] and "not sufficiently below the surface to eliminate the possibility of accidental intrusion through earth cracks or gopher holes." It should be noted now that more than ten feet of overburden had been removed and the artifact in reality had been buried at a depth of some fourteen feet. Photographs taken by the Museum field party and others show clearly the amount of overhead. As for intrusion, the chances were ruled out with the finding of three more dart points and four other fragments and artifacts during August and September.[10] These were found from four to six feet back from the original face of the bank at a depth of nearly seventeen feet, and were in the top of the gravels below the bone bed.

As for the points themselves, the photographs are largely self-explanatory, though they do not, in certain cases, reveal the full beauty of the workmanship (pl. 1). *A* is suggestive of the Folsom type, though it lacks the groove and one ear. A careful examination suggests that this ear was not broken, at least in the quarry, but that the artifact had been completed without it, perhaps due to a break at the time of making. There is a possibility that the artifact may have been readapted for use as a small knife

[8] Bell, 1932.

[9] Dr Bell and Dr Van Royen have themselves corrected this error, as in their latest paper they quote from the Nebraska bulletin on this point verbatim, and make no reference to the earlier statement (Bell and Van Royen, 1934, p. 61).

[10] Dr Bell grants this point in a recent issue of the Wisconsin Archeologist (Bell and Van Royen, p. 60).

and never used as a projectile. *C* is finely chipped, but is broken too far up the point to be of value in determining the type of base. *D* is a true and finely chipped example of the "Yuma," i.e., the ungrooved Folsom, type,[11] but *e*, with its exaggerated indentations at the base, is more suggestive of modern points. It is, however, worked down to a remarkable thinness in cross section, and flaked with considerable accuracy entirely across the blade. As for *f* and *g*, they may well be rejects. *H*, a snub-nosed scraper, has nothing distinctive about it.

It is worthy of note in passing that here for the first time[12] a Folsom and a Yuma point appeared together *in situ* in such a way that there can

7′ to 14′	Yellowish gray loess
2′ to 3′	Fine silts and sands
3′	Sands and gravels (bones and artifacts)
	Brule Clay (floor of old channel)

FIG. 1. Scottsbluff bison quarry (after fossils were removed).

be no question as to their equal age and contemporary existence among the people who produced them.

III

The geology of unglaciated western Nebraska is insufficiently known to admit of positive conclusions on the age of the quarry. Dr A. L. Lugn,

[11] It has been suggested by Drs Bell and Van Royen that Yuma points such as *d* can be easily matched from any ordinary site in Nebraska. Since Dr W. D. Strong and Mr W. R. Wedel, previous workers in the field of Nebraska archaeology, have failed to feature artifacts of this sort from ordinary sites, it would seem that there is some difference of opinion existing as to what constitutes a Yuma point. The writers insist that true Yumas are known from later sites in Nebraska only in a few obviously intrusive cases, that is, where one or two had been picked up by later peoples.

[12] Jenks, 1934, reported a second find of this sort but so far the published illustrations hardly suggest the true Yuma point.

Associate Professor of Geology in the University of Nebraska, who has made a careful study of the Nebraska Pleistocene, and whose lack of bias has been well indicated by his careful and non-committal study of the two previous finds,[13] has this to say, however:

> The deposit located near the base of Signal Butte and described by Barbour and Schultz is difficult to date. Most geologists who have visited the site are agreed that it most certainly belongs to the Pleistocene epoch. Molluscs found in the deposit are quite similar to those found elsewhere in the Upland formation. When all the somewhat inconclusive evidence is considered, the deposit seems to be not older than late Kansan, and it does not seem to be as late as Wisconsin. Apparently its age is late mid-Pleistocene, that is, post-Kansan, pre-Wisconsin.[14]

It is not expected by the present writers that such a dating will be acceptable to many archaeologists. It is given by them as the opinion of a competent geologist whose specialty is the Nebraska Pleistocene. It may be that other geologists will differ, but until further pronouncements by authorities are forthcoming, this tentative dating must at least be quoted —a dating, incidentally, which is supported by Baker.[15]

It would have been far less embarassing to the authors of the present paper if a post-Wisconsin dating had been vouchsafed by the geologists consulted. Archaeologically, this would be more plausible, but the dating of the site is a geological as well as an archaeological problem, and the geological evidence is of prime importance. It is obvious, however, that one difficulty which confronts such datings is our lack of information concerning the antiquity of *Homo sapiens*, an antiquity which bids fair to be extended in the light of recent knowledge.

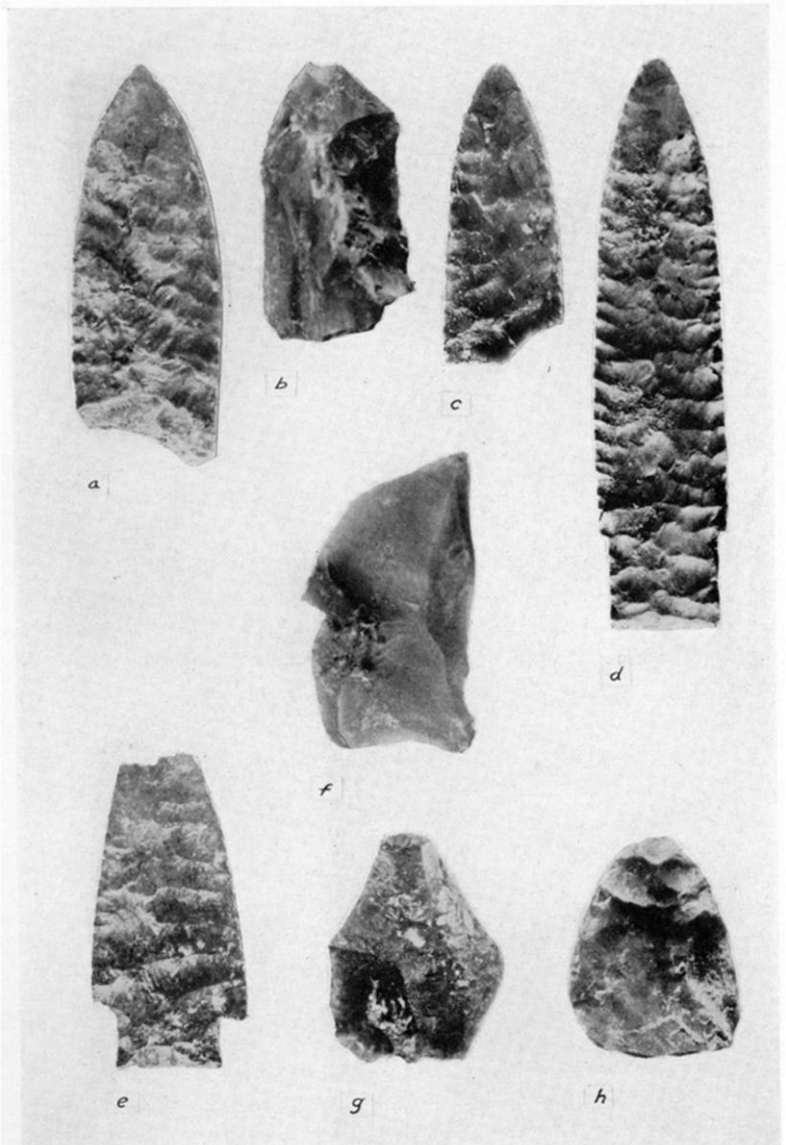
IV

The deposit of bison bones in which the artifacts were found was exceedingly dense, surpassing in this respect the quarry at Folsom, New Mexico. In the quarry at the base of Signal Butte there was literally a stratum two to four feet in thickness and extending for some thirty feet, composed of skulls, jaws, and other skeletal parts including some complete legs still in articulation. This latter point is important. No re-deposited material could have been so laid down that any bones would remain in alignment. Cases of such articulation immediately rule out any question

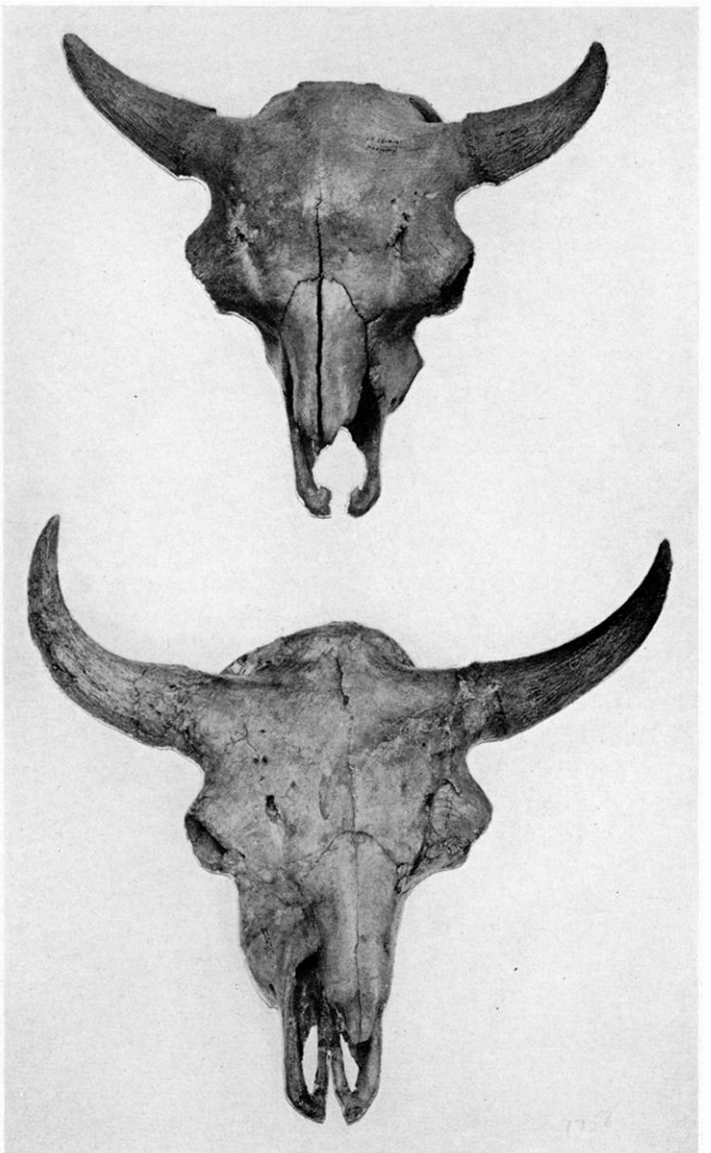
[13] Strong, June 27, 1932.

[14] Lugn, Bulletin of Nebraska State Museum, in press.

[15] Baker, *in litteris:* "Not later than Yarmouth and the basal beds possibly Aftonian." Mr Baker has, however, indicated elsewhere the possibility that certain of the Yarmouth loess deposits beyond the Wisconsin area may prove to be Peorian in age.



Eight artifacts from the Scottsbluff bison quarry (lettered in the order found).



Comparison of bison skulls: Scottsbluff bison quarry. Upper: *Bison bison* Linnaeus (from Nebraska). Lower: *Bison occidentalis* Lucas, referred. (From Scottsbluff bison quarry, skull slightly crushed but no restoration: Nebraska State Museum, No. 2-10-6-32).

of late wash. Whatever the age of the site, its covering has been laid down by the normal process of wind deposition since the stream ceased to flow.

Many hundreds of pounds of material were secured, and though many of the skulls were badly crushed, ten were obtained in a restorable condition. Four of these are now on exhibition at the Nebraska State Museum. As has been pointed out by Romer and Figgins,[16] the taxonomy of the American bisons is in a state of some confusion which only considerable study will resolve. Nevertheless a number of distinct species are recognized, and while the nomenclature varies and has, in some cases, resulted in the too frequent designation of new species, it remains true that the Scottsbluff bison are distinct in several important particulars, notably the length, slenderness, and different curvature of the horn cores. J. D. Figgins has recently named what he considers to be a new type of bison from Folsom, New Mexico. The type specimen was at one time regarded by Hay as *Bison occidentalis* and by Figgins as possibly the female of *Bison taylori*, but the Scottsbluff bison, which are considered by Figgins to be representatives of this same type, removes that possibility. Figgins has designated these bison as *Bison oliverhayi*. For an exact anatomical description and photograph the reader is referred to his recent paper.[17]

These bison are extinct, but the date of their disappearance cannot be ventured. We know them from one specimen at Folsom and a number at Scottsbluff. The deposits in which they occur can certainly not be called recent in a narrow sense, but beyond that it is a question for the geologist to answer. It is well to point out in passing, however, that in suggesting a case for the survival of extinct bison into what he designates as sub-Recent time, Romer's documentation[18] is most scanty, and relies largely on the assumption that all cases of association, such as that reported by Williston,[19] are of no "great geological antiquity." This statement, in the opinion of the writers, is more or less confusing. It has been the endeavor of archaeologists to establish the time of man's arrival in North America. This may have occurred prior to the last glacial advance or later, but in neither case has any "great geological antiquity" been assumed by any but a few

[16] Romer, 1933, p. 53; Figgins, 1933, p. 17.

[17] Figgins' paper (1933).It is a trifle early to determine beyond doubt whether the species appellation *oliverhayi* will stand in the literature or whether further paleontological study will establish these bison as *occidentalis*, or at least as no more than varietally distinct from the latter. Hence the designation on Plate 2. In either case they are extinct. Figgins' paper contains an excellent discussion of some of the points involved, and in addition the reader is referred to Hay (1913, p. 173), and to Hay and Cook (1930, pp. 28, 30).

[18] Romer, 1933, pp. 79, 80, 82.

[19] Williston, 1902, pp. 335–37.

extremists. The matter of some thousands of years' difference in arrival does have significance to the anthropologist, however, and lends importance to the effort to determine whether that arrival can be dated as pre- or late Wisconsin, or into the young Recent of the last ten thousand years. In view of Johnston's suggestion[20] that "a route for migration through the Mackenzie River valley has been open, let us say for 25,000 or 30,000 years," a respectable antiquity is possible for these "post glacial" bison of the Great Plains region—an antiquity which could fairly be called late Wisconsin and Pleistocene.

In the case of Williston's find this assumption of a sub-Recent dating is certainly open to question, the site having been reputably diagnosed as Pleistocene[21] and containing, besides *Bison occidentalis*, *Elephus columbi*, and *Platygonus compressus*. These last are reported from the drifts, but still possess significance. The Folsom quarry has so far proved undatable. Cook, after a study of the Wolf Creek, Texas, find, pronounced the latter undoubtedly Pleistocene, although an unbiased opinion today must consider the validity of the faunal evidence in terms of the possibility of survival. It would seem to be reasoning in a circle to suggest that the Folsom and Wolf Creek finds are Recent because dart points were associated with the remains. It is better to let the dating remain unsolved for the time being, than to make use of such an assumption.

O. P. Hay[22] commented that he knew of no extinct bison except one peculiar species, *Bison sylvestris*, which survived the Wisconsin glacial stage. In 1930 Hay[23] recorded *Bison sylvestris* as still the only extinct form which can be considered as Late Wisconsin. This bison is so far known from a single fragmentary specimen whose type, judging from the pictured remains, would seem difficult of determination.[24] The circumstances of the geology in this case are not such as to inspire confidence, as Hay himself did not visit the scene of the find, and comments merely that the specimen was "found in a Tamarack swamp at some place not yet exactly ascertained in Huron County, Ohio."[25]

In the case of *Bison occidentalis*, the present writers know of one soli-

[20] Johnston, 1933, p. 44.

[21] Osborn, 1909, p. 88.

[22] Hay, 1923, p. 257, 258. In 1924 (p. 200), however, Hay indicated a find from Manitoba of *occidentalis* in an apparent Wabash deposit. No further mention of it was made in 1930 and it seems to have escaped attention. Whether this represents Hay's final opinion we do not know. The writers were unaware of this find until after the completion of this paper.

[23] Hay, 1930, p. 282.

[24] Hay, 1915, pl. 30.

[25] *Ibid.*, p. 516.

tary case of survival into what may possibly be regarded as Recent, and doubtless as post-Wisconsin time, in Minnesota. This is a find in a peat bog on the Wisconsin drifts near Crosby, Minnesota, as recorded by Leverett.[26] This specimen was identified and discussed by Hay. The bones were found during some hydraulic mining operations which had exposed about thirty feet of drift, and above this, six to eight feet of peat. The bones were found at or near the bottom of this latter material. The drift was regarded by Leverett as having been laid down about the middle of the Wisconsin stage. How long after this the bones were buried, Hay thinks it impossible to say.[27]

It is also a point not without interest that the Morrill Paleontological Expeditions of the University of Nebraska, after years of intensive fossil collecting throughout the state, have yet to record a find of an extinct bison from a site which can be definitely identified as Recent. Moreover, they have yet to record the discovery of Folsom type points in association with *Bison bison.*

The work at Signal Butte carried out by the Smithsonian Institution, under the active leadership of Dr William D. Strong, revealed a very ancient site in the lowest level: a site which Dr Strong is inclined to regard as early Recent.[28] There has been no mention of extinct forms of life being found in this archaeologically rich layer on the butte, yet this site lies but a few hundred yards from the bison quarry, and one would suppose that the ancient butte dwellers, if they lived at approximately the same time, hunted the same bison. The age of the butte site thus suggests, if anything, an even greater age for the quarry.

These facts are not listed with the intention of maintaining that extinct bison never lived on into the Recent, but they are given in order to point out how questionable the issue still is, and founded on what frail evidence is the theory of their recent survival. If documentation for survival is so scanty, even though we accept what we have, the infrequency is such as to make the appearance of dart points in so many of these cases the more surprising, for the scarcity of recent occurrence would suggest that these animals were becoming very rare.

In addition, it must be taken into consideration that it is not one bison, i.e., *Bison occidentalis,* closely allied to the recent species, which appears in these cases, but both *Bison figginsi* and *Bison taylori,* besides the recently added *Bison oliverhayi.* This is an impressive assemblage of bisons

[26] Leverett, 1932, p. 144.
[27] Hay, 1924, p. 208.
[28] Strong, 1933, p. 282.

alone and must tell heavily against any theory which would push what must have been dying species at the close of the Wisconsin glacier very far into the Recent. The Recent deposits of the Plains have so far yielded no trace of survival after the close of the pluvial period coincident with the withdrawal of the Wisconsin ice.

Neither, to venture somewhat far afield, does the Great Basin yield such clear-cut evidence of Recent survival as seemed apparent to Romer when, on the basis of certain studies of J. Claude Jones, he placed the Lahontan fauna which includes *Felis atrox*, horse, camel, and elephant into an antiquity of "between 2,000 and 4,000 years ago"[29] at the most.

Admittedly there is reason on other grounds for postulating a comparatively late survival of the camel and horse in the Southwest, but survival cannot be regarded as definitely proved which uses one interpretation of the highly debatable geology of Lake Lahontan as a major piece of evidence. Moreover, such a young antiquity as Jones indicates should, if the fauna is correct, have revealed further and obviously Recent finds even in Basket Maker sites. Dr Ernst Antevs, one of the most outstanding authorities on the Pleistocene, is extremely critical of Jones' views, and feels that the low salinity of certain neighboring lakes upon which Jones based part of his study have no bearing on Lake Lahontan. In concluding his monograph, Antevs says:

> Thus it seems that Bonneville, Lahontan, Mono, and other waters in the Great Basin were due to the combined effect of decreased evaporation because of low summer temperature and relatively heavy precipitation connected with the climatic changes that ended the expansion of the ice sheets and made these disappear. The pluvial periods coincided with the maximum extension of the land ice and the early stages of ice retreat. A pluvial period and an expansion of the lakes represented each glacial epoch; the last high-water stage corresponded to the last, the Wisconsin glaciation, and to the last glaciation in the mountains of the West. The Last Bonneville, Lahontan, and Mono, consequently, date back about 30,000 to 35,000 years.[30]

It is to be noted that one of the chief arguments for the recency of Romer's camel, outside of the preservation of desiccated tissue, is the fact that it was obtained from a cave which was supposed to be slightly later than Lake Bonneville. Antevs' estimate of the age of Lake Bonneville leaves a considerable latitude of time for this camel, and while its state of preservation is remarkable, we have no means of knowing how long muscle tissue may last under perfectly dry conditions such as obtain in

[29] Jones, 1925, p. 47, 50.

[30] Antevs, 1925, p. 77. This opinion is in general agreement with that of Gilbert, Russell, Meinzer and Hay.

the Southwest. Indeed there is no reason to believe it might not last thousands of years.[31]

To illustrate the variety of opinions existing about the Great Basin, one may also point out that Dr Charles Keyes [32] regards Lakes Bonneville and Lahontan as having no relation whatever with the Wisconsin ice, completely antedating, in fact, the glacial period.

The problem of the use of climatic change in the Southwest as a time measurement grows more acute when we come to consider caves in the southern portion of the area, i.e., Conkling's, Shelter cave and others, for here climatic change may not have been so great, and the pluvial period not so well marked.[33]

On the basis of finds elsewhere[34] there is every reason to believe that the sloth was one of the last of the Pleistocene animals to vanish, and the fact that his remains have been found associated with camel and horse in what appear to be late Pleistocene deposits in the Southwest certainly suggests that they survived much later than Hay had supposed. It is possible that they existed during the pluvial period, or shortly following, but that they continued on into the Recent is another question and at present an unanswerable one.

This divergence from the main topic of this paper has not been undertaken with any idea of being exhaustive, or of upholding one theory against another. It has merely seemed fitting to point out a few of the problems which face us in determining the question of survival, and to indicate that we are far from attaining a definite solution. It may not be amiss, however, to suggest that every late straw in the wind points to man's presence here during the pluvial period which began as the glaciers started to recede, Jenks' latest find at glacial Lake Agassiz doing much to clinch the matter.[35]

IV

The use of invertebrates as an aid in determining the approximate geological age of a site has received little attention in the domain of archaeology. Indeed it has been thought that the molluscan fauna of the Pleistocene and Recent were too nearly identical to serve as any but the most doubtful indicators of antiquity. This view has been held in the past by

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[31] Harrington, 1933, p. 168; Hay, 1928; Stock, 1931, p. 32; Lull, 1930, p. 347.

[32] Keyes, 1918.

[33] Antevs, 1925, pp. 71, 72.

[34] Hay, 1912, p. 9.

[35] Jenks, 1934.

Shimek[36] and Baker.[37] The passage of time has, however, resulted in an increased knowledge of the Pleistocene invertebrates and a modification of this earlier opinion. Baker himself, writing in 1931, commented that "during the last ten years . . . a large amount of Pleistocene material from authenticated stratigraphic deposits has been critically examined with the result that several forms appear to be specifically or varietally distinct from those of their relatives living today."[38]

Under the circumstances it seemed wise to make every effort to obtain as full a record of the invertebrate life of the deposit as possible. In this we were eminently successful, and the collected data, along with the vertebrate material, sheds additional light on the deposit. Later, additional collections were made, and in the latter case four levels were distinguished and the material from each kept separate. All identifications are by Frank C. Baker of the University of Illinois, an acknowledged authority in this field.[39]

Of sixteen species identified the first year, two from the bone deposit level were extinct, and according to Baker[40] are not represented in the recent fauna. These are *Succinea ovalis pleistocenica* and *Succinea grosvenori gelida*. The following year an augmented collection of invertebrate material added *Fossaria parva tazewelliana* to the list of extinct forms. Of this form Baker says:

> Typical *tazewelliana* is very distinct from *parva* (the living species) but there are, in most collections, some specimens approaching *parva* and in some cases these variations would be classed as *parva* but for the presence of the *tazewelliana* form. The number of *parva*-like forms increases in later deposits and the Early Wisconsin collections show a mixture of the two forms. The specimens in all but one Late Wisconsin collection are referrable to *parva*. No *tazewelliana*-like form has been observed in the Recent fauna.[41]

Parva has so far not appeared in the deposit, and the fact that *tazewelliana* is well nigh lacking in Late Wisconsin collections must, we think, give added weight to its appearance in the bone deposit.

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[36] Shimek, 1913, p. 506.

[37] Baker, 1920, pp. 360, 369.

[38] Baker, 1931a, p. 270.

[39] Those desiring a complete list of the invertebrate fauna from this deposit are referred to a forthcoming paper in the Nebraska Museum bulletin series, which will give this information in detail.

[40] *In litteris.*

[41] Baker, 1931a, p. 290.

Succinea grosvenori gelida is known from Yarmouth to Early Wisconsin time[42] and none have so far been recorded from Late Wisconsin deposits. *Succinea ovalis pleistocenica* is also unrecorded from any deposits later than Early Wisconsin.[43]

Of the other species which extend into the Recent there seem to be none which do not occur in the Pleistocene as well. Since by far the larger percentage of Pleistocene invertebrates are represented unchanged in recent times, the paucity of extinct material does not in itself cast doubt on the age of the find nor necessarily imply a case of survival. In fact the appearance of these forms taken in conjunction with the evidence derived from faunal change and the occurrence of fossil bison seems, if one cannot put it in stronger terms, at least suggestive of considerable antiquity.

A study of the four sections kept separate in the faunal collection revealed a definite progression from an abundance of fresh water forms in the bone horizon to an entirely land fauna in the upper layers. This is suggestive of a gradual climatic change tending toward greater aridity and, in addition, aids in ruling out any theory of a recent re-deposition of material. An indiscriminate re-deposition in recent times would not have resulted in such an orderly and progressive change from water to land forms in the invertebrate fauna.

It is not the intention of the authors to place undue weight upon the value of the invertebrate evidence tending to suggest antiquity, but to offer it for what it is worth in conjunction with the other evidence; namely, the undisturbed character of the deposit and the presence of fossil bison. It is worth passing attention, also, that the species represented are, even though mostly living, of old types with a long Pleistocene history. Recent forms, such as *Fossaria parva* appear to be absent. Both Mr Baker and Dr Lugn would perhaps assume a greater antiquity for the deposit on the basis of their specialties then the present writers, for obvious archaeological reasons, would care, at present, to venture. The all too fragmentary character of our knowledge concerning the geology of unglaciated western Nebraska is a stumbling block not soon to be removed. Under the circumstances to pronounce that the site seems definitely Pleistocene and at least Late Wisconsin[44] may be branded as bold in the eyes of many authorities. The writers are well aware that they are venturing into a discussion which

[42] Baker, 1931a, p. 285; Baker, 1931b, p. 152.

[43] Baker, 1931a, p. 284.

[44] Or very early Wabash. The terms are relative, of course, and vary according to the area concerned and the time estimates of different authorities. What the writers are trying to suggest is a dating in the neighborhood of 12,000 to 15,000 years ago.

has evoked storms of controversy and has taxed the abilities of critical and careful men. They are also aware that to conclude this problem the most varied research will be needed. Nevertheless, when it is remembered that the number of deeply buried and genuinely authenticated finds of this nature appear to be yearly growing, it would seem that to propose a late Pleistocene dating for this site is not too radical. Though many puzzling facts remain to be interpreted and future work in this area will undoubtedly permit the drawing of less tentative conclusions, the writers feel confident that such a dating will not prove to be far wrong, and, if modified, is much more likely to be extended downward than upward. In any event, if the present writers succeed in again arousing the bickering interest, often extending to billingsgate, which, in the past, has lent so much color to anthropological activities in this field, they will consider that the history of the Scottsbluff quarry has been well worth recording.

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NEBRASKA STATE MUSEUM
LINCOLN, NEBRASKA
UNIVERSITY OF PENNSYLVANIA
PHILADELPHIA, PA.