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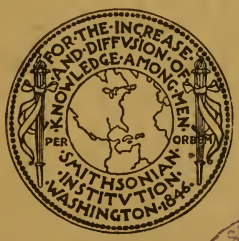
ADDITIONAL INFORMATION ON THE FOLSOM COMPLEX

REPORT ON THE SECOND SEASON'S INVESTIGATIONS AT THE LINDENMEIER SITE IN NORTHERN COLORADO

(With 12 Plates)

BY
FRANK H. H. ROBERTS, JR.
Archeologist, Bureau of American Ethnology



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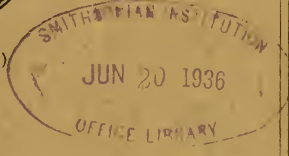

CITY OF WASHINGTON
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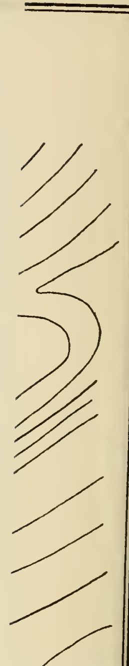


ADDITIONAL INFORMATION ON THE FOLSOM COMPLEX

Report on the Second Season's Investigations at the Lindenmeier Site in Northern Colorado

By FRANK H. H. ROBERTS, JR.
Archeologist, Bureau of American Ethnology

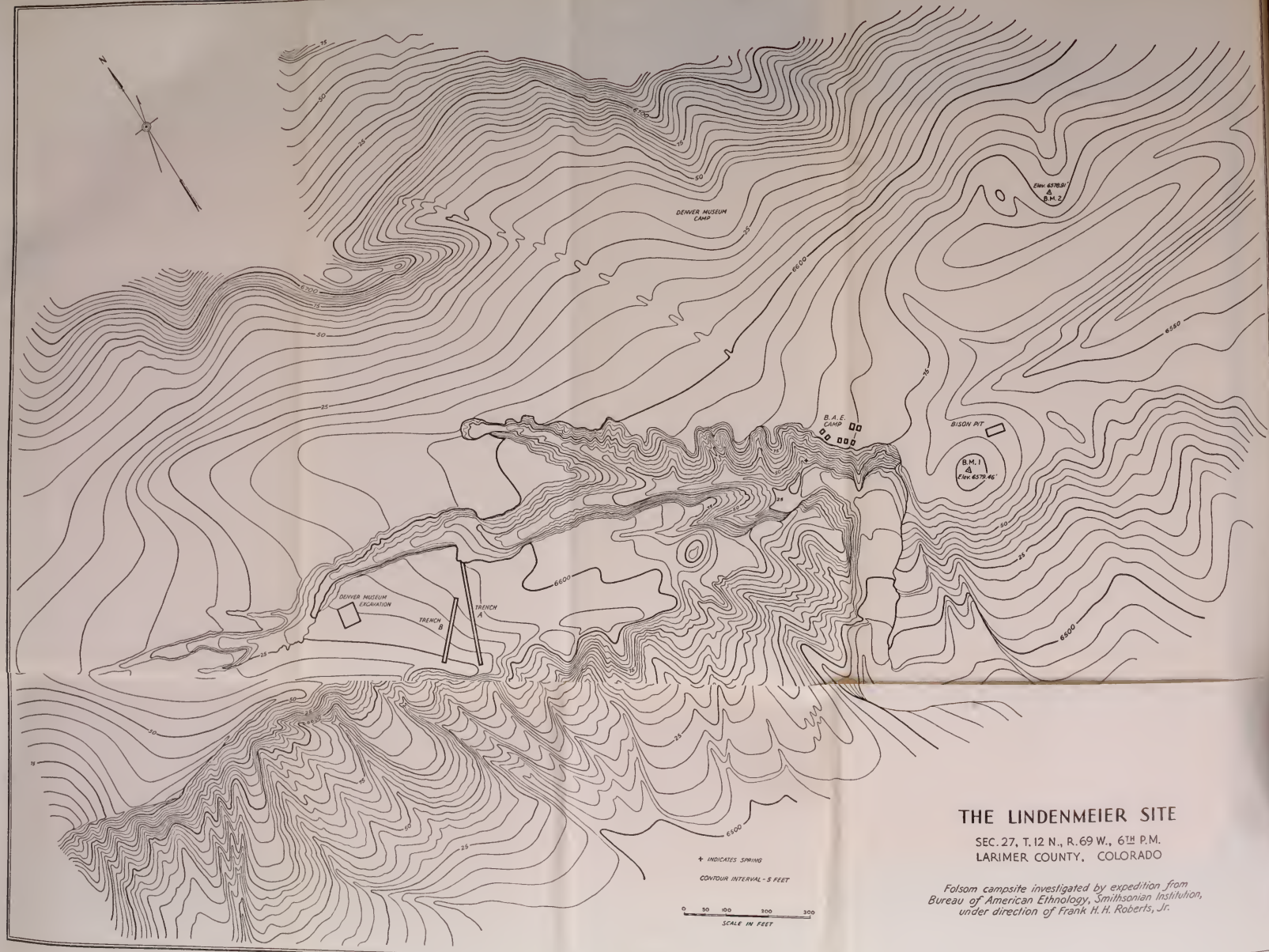
(With 12 Plates)

INTRODUCTION

During the summer of 1935 further investigations were conducted at the Lindenmeier site in northern Colorado. It was at this location that the first definite complex of stone implements attributable to Folsom man was found in situ in the autumn of 1934.[1] From the first of June until early September the writer and a group of associates carried on a series of excavations in an effort to obtain more information on this little-known phase of American archeology. The results were gratifying in some respects but in others fell short of expectations. The digging yielded 750 artifacts, large quantities of chipper's debris—innumerable fragments of stone forming a byproduct of the tool-making industry—and several deposits of bones from animals whose flesh or skins had been used by the one-time dwellers at the site. No human skeletal material was found. This was disappointing, inasmuch as all interested in the subject are anxious to know what the people are like who made the implements. Fragments of charcoal and scattered ashes were plentiful, but no indications of a shelter or habitation were observed. The presence of hammerstones accompanied by chips and flakes was noted at a number of places. These suggested that one or more individuals had been seated there while shaping tools out of rough stone nodules. Pieces of several projectile points, as well as other implements, that had been broken in the making were obtained from one such spot. By fitting the fragments together and restoring the flakes it is possible to gain good evidence concerning the technique used in manufacturing the tools.

Dr. Kirk Bryan, of the division of geology, Harvard University, assisted by Franklin McCann and John T. Hack, spent the month of

[1] Roberts, 1935.



THE LINDENMEIER SITE

SEC. 27, T. 12 N., R. 69 W., 6TH P.M.
LARIMER COUNTY, COLORADO

Folsom campsite investigated by expedition from Bureau of American Ethnology, Smithsonian Institution, under direction of Frank H. H. Roberts, Jr.

July in studying the geology of the district. As a part of their investigations they prepared a map of a portion of the terrain lying to the east of the archeological site. To facilitate their work, a level was run from a United States Geological Survey bench-mark (located on the line between sec. 19, T. 12 N., R. 68 W., and sec. 24, T. 12 N., R. 69 W., sixth principal meridian) and an accurate bench-mark based on mean sea level datum established at the site. E. G. Cassedy, illustrator for the Bureau of American Ethnology, joined the party in August and made a survey of the site proper, and some of the outlying area not mapped by Bryan. Mr. Cassedy has combined his and Bryan's surveys in a map showing the general topographical features of the site and adjacent region.

The announcement of the finds made at the Lindenmeier site in the autumn of 1934 attracted wide-spread attention and aroused a lively interest in the subject. As a result there were many visitors while work was under way. The numerous groups included anthropologists, paleontologists, geologists, geographers, and various scientists whose fields of research are not closely related to the present investigations. Among the anthropologists attracted to the site during the summer of 1935 were: A. V. Kidder and E. H. Morris, of the Carnegie Institution of Washington; E. W. Haury and E. B. Sayles, of Gila Pueblo, Globe, Ariz.; Donald Scott, of the Peabody Museum, Cambridge, Mass.; L. L. Leh, of the Department of Anthropology, University of Colorado; R. L. Zingg, of the University of Colorado Summer School, and his class in anthropology. Dr. E. B. Renaud, of the University of Denver, visited the site a number of times prior to 1935, and W. D. Strong, of the Bureau of American Ethnology, spent 2 days there while the writer was at work in the autumn of 1934. Geologists, paleontologists, and geographers present during the summer were: Paul MacClintock, Princeton University; Frederic B. Loomis, Amherst College; Wm. Van Royen and A. L. Lugn, University of Nebraska; C. Bertrand Schultz, of the Nebraska State Museum.

Members of the party engaged in the actual archeological work during the 1935 season were: W. C. Beatty, Jr., Denver, Colo.; C. T. R. Bohannon, Washington, D. C.; A. L. Coffin, Fort Collins, Colo.; L. C. Eiseley, Lincoln, Nebr.; H. L. Mason, Silver Spring, Md.; Carl F. Miller, Tucson, Ariz.; Roger Mixter, Boston, Mass.; Wayne Powars, Greeley, Colo.; and George L. McLellan, Lodi, Calif.

The Lindenmeier site, as described in the preliminary paper issued in the spring of 1935,[2] is located on an old valley bottom, which, owing

[2] Roberts, 1935.

to the eroding away of the ridges which once bordered it along one side, now constitutes a terrace above an intermittent tributary to a series of streams which ultimately join the South Platte River. The work in 1934 was mainly confined to a deep deposit of midden material exposed in the side of a ravine that cuts across the terrace in the zone of former occupation, but traces of the cultural stratum were also noted at several points along the edge of the terrace. The plan of procedure in 1935 called for the digging of two large trenches between the edge of the terrace and the bank of the ravine (pl. 1, fig. 1). The trenches were started several hundred feet apart at places where bones and stone chips had been found the previous autumn but were directed so that they would converge at the pit where most of the specimens were obtained. This method of digging was adopted for the purpose of exposing a complete cross-section of the fill overlying the old valley bottom and of determining, if possible, where the artifacts found in the deep deposit had originated.

The expedition did some work near the location of the original Coffin finds. The preliminary report on investigations at the site discussed its discovery by Judge C. C. Coffin and his son A. L. Coffin, and the subsequent reporting of its existence to the Smithsonian Institution by Maj. Roy G. Coffin, professor of geology at Colorado State College.[3] The paper also pointed out that the material described in it came from a place a quarter of a mile to the west of that where the first Coffin finds were made. In discussing the latter the writer mentioned the fact that most of the Coffin artifacts had been picked up from the surface, which is the top of a hard, compact, tufaceous layer, an Oligocene deposit, which underlies the entire site. The artifacts had undoubtedly been in top-level material that had been eroded away by wind and water. Because of their weight the implements remained until picked up. Portions of the sand, gravel, and nodule layer which had overlain the compact deposit remained in some places, and the Coffins had found a few objects on the contact line between the two. After an inspection of the location the writer was dubious about the possibilities of getting more information than that already obtained by Judge and Major Coffin but had discussed a tentative plan of procedure with A. L. Coffin. When the deeply buried deposit was discovered in the ravine bank, indications were that it was a more likely place for obtaining specimens from undisturbed layers, and activities were concentrated at that point.

During the winter and early spring following the writer's first excavations, the Coffins visited the site a number of times, and in

[3] Roberts, 1935, pp. 1-3.

scratching around the remaining "islands" of top-layer earth A. L. Coffin and Major Coffin uncovered some bones at the original location. On the strength of this evidence, trenches were dug through a portion of the area where erosive action had not completely uncovered the basic stratum. This was a fortunate procedure because, contrary to the impression of the preceding autumn, there was evidence still in situ. A bone pile comprising the remains of several individual bison was located there. Some of the skeletons were partially articulated and, in common with a majority of the separate bones, were in a good state of preservation. Although a number of the bones had been cut and split, the material as a whole was much more satisfactory from the standpoint of the paleontologist than that obtained in the earlier work. It made less debatable the identification of the species of bison present at the site and corroborated the conclusion reached the previous year from very scrappy evidence.

Besides animal bones, a number of invertebrates were obtained at the site. Identification of the mollusks contributes further to the knowledge of general conditions at the time of occupation. Fragments of charcoal were saved in the hope that the wood could be identified and contribute still more evidence on the physiographic environment. This material is being studied by Dr. Ralph W. Chaney, of the University of California, but no report on it has been received. Samples of the soil in which the remains were found were tested for possible fossil pollens in a further effort to broaden the picture. This work was done by Margaret Kaeiser, of the University of Oklahoma, under the direction of Dr. Paul B. Sears, head of the department of botany at that institution. Unfortunately, there was no evidence of pollen in the dirt. Dr. Paul S. Conger, custodian of diatoms, United States National Museum, examined earth samples for fossil diatoms, microscopic unicellular algae that inhabit fresh and salt water, but found none. He noted fragments of sponge spicules, although they were too disintegrated for identification.

In addition to the work done by the Smithsonian Institution's field party, investigations were conducted at the Lindenmeier site by the Colorado Museum of Natural History, Denver. Their excavations extended from June 14 to September 1. Jack Cotter, Harley Goettsche, and Robert J. Lanberg comprised the Denver expedition. J. D. Figgins, at that time director of the Denver Museum and now with the Bernheim Foundation near Louisville, Ky., visited the site a number of times while his men were at work there. Mr. Figgins and Mr. Cotter made available to the present writer, for study, all the material

obtained from their excavations, and Mr. Cotter also furnished a copy of the manuscript that he submitted as a report on the work.

The Denver Museum party dug a series of 15 test pits. These were spaced at intervals extending from the area of the original Coffin finds to some distance beyond the main Smithsonian trenches. The pits gave a good sampling of the character of the deposits across the portion of the site lying between the terrace edge and the ravine bank on a line approximately at right angles to the trenches. One of the test holes west of the large trenches penetrated the artifact-bearing stratum at what appeared to be a likely spot. With this as a starting point an area 30 feet by 30 feet was laid off and completely excavated. This large pit (map 1) yielded most of the specimens obtained by the Denver group.

THE MAIN TRENCHES

As previously stated, the major part of the 1935 work consisted in driving two large trenches from the edge of the terrace toward the deep pit where the 1934 activities were centered. The trenches were dug in 10-foot sections. Their bottoms followed the top of the light-colored substratum just below the old soil level which was the surface of the ground at the time when the site was inhabited by the makers of the tools found there. Detailed drawings were made of the faces and side walls in each section, and these give a minute record of events involved in the growth of the valley fill. All of the material obtained from each section was so designated, and in addition the positions of specimens in the section were carefully noted. Only one trench was carried through to completion (pl. 1, fig. 2). The other was stopped when it became apparent that the evidence from it would largely duplicate that from the first. The completed trench was 270 feet (82.296 m) long, 10 feet (3.048 m) wide, and sloped from a depth of 3 feet (.914 m) at the edge of the terrace to 17 feet (5.182 m) in the bank of the ravine. When the work had been completed, the section drawings of the sides of the trenches were combined into one long diagram for each wall (fig. 1). A number of interesting factors are brought out by these diagrams.

The numbers extending across the top of the drawing (fig. 1) indicate the pegs which marked off the courses of the trenches. They were set every 10 feet (3.048 m). References to specific sections in the ensuing discussion will be by number. For example, section 1 consists of that portion lying between pegs 1 and 2, section 2 between 2 and 3, and so on. Neither trench had a complete zero section. As there had already been some digging at the terrace edge, when the presence of

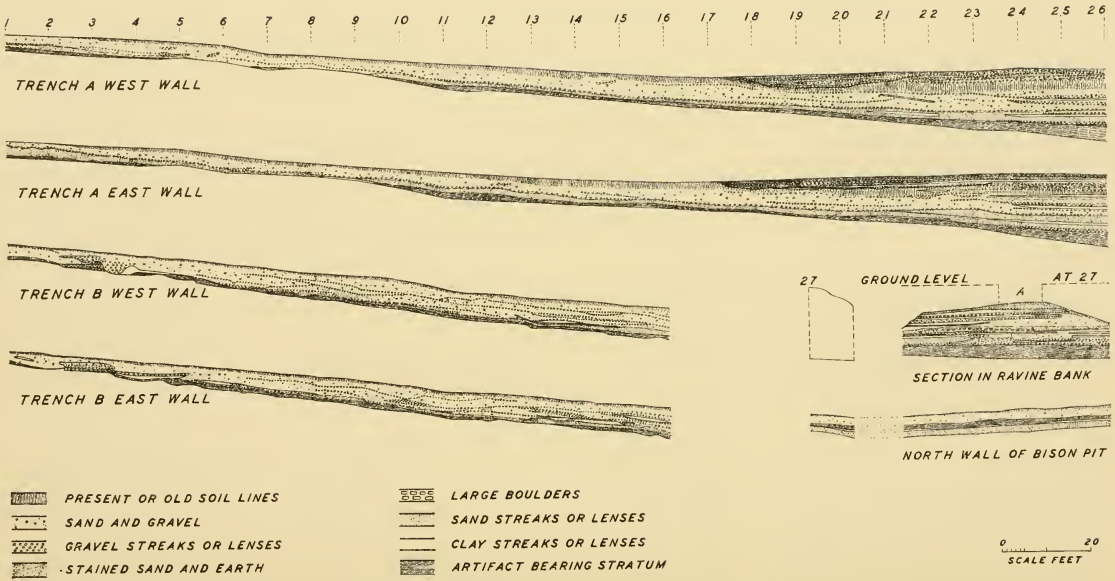


FIG. 1.—Cross-sections of trench walls, face of deep pit in ravine bank, and sides of bison pit.

bones and artifacts was noted the previous year, the initial pegs were set a short distance from the old excavations. Loose dirt was cleared from the pits and the walls were straightened to correspond to the lines of the proposed trenches. The remaining earth was worked out up to the number 1 pegs. This made possible the starting of each trench with a clear-cut number 1 face. Objects found in the zero sections were so recorded, but the careful drawing of section sides and faces was started with peg 1. At the lower end of trench A there is no drawing of the detail of the fill between pegs 26 and 28. This is due to the fact that the material in those sections was worked back on a 48-foot (14.630 m) face from the deep pit in the ravine bank, and the walls of the big pit did not correlate properly with those of the narrower trench in making a composite diagram. There was little change, however, in the last 20 feet (6.096 m). The main difference was in the deepening of the dark earth stratum in which the archeological objects are found.

The method followed in digging was that of stripping off the deposits layer by layer, from top to bottom, in a single section. The upper strata were removed by the use of pick and shovel. Careful check at various places about the site had demonstrated that the higher levels were so nearly sterile, from the standpoint of artifacts, that it was not necessary to subject them to the same careful kind of excavation as that employed in the specimen-bearing stratum. The latter, which rested upon the top of the hard Oligocene clay, was dug with small tools, bent awls, hand trowels, etc., and all the earth sifted through screens (pl. 2, fig. 1). The slow, meticulous method of digging had several advantages. There was little danger of breakage, it made possible a careful check of the provenience of each specimen (pl. 2, fig. 2), and it facilitated following the top of the clay bed. A different method was adopted for the last five sections in trench A. This was necessitated both by the increase in the amount of overburden and by the shortening of the time available for the work. In these sections the upper layers were removed by the use of a team, plow, and scraper. The lower levels, however, were subjected to the same careful hand technique used throughout most of the work. The chief drawback to the use of the plow and scraper was in the fact that it prevented the drawing of diagrams of each section face. Some information was no doubt lost because of this condition, but inasmuch as the side walls were diagramed, most of the essential evidence on changing conditions in the valley filling process was obtained from the sections.

In drawing and recording the deposits in each section, all of the animal burrows were noted. Even though many of them had long

been abandoned and were completely filled with compact material, they were easily seen. Wherever they occurred in the side walls or faces of the sections, they were included in the diagram. They have not been indicated in figure 1 because they are not deemed essential to the discussion of the valley fill. One interesting fact came out of the check on the animal burrows, however. It has been a common practice on the part of many to discount all finds made in comparatively deep deposits by attributing their location to the work of animals. They explain that the specimens were either carried down by such creatures or fell into holes made by them. Out of a total of 983 burrows, only 1 contained an implement. When it is borne in mind that 750 implements were recovered, the extremely small percentage for such an occurrence becomes apparent. Furthermore, indications were that the animal concerned had been attempting to remove the stone from the burrow and that it had been unable to do so. Those who have excavated in the Southwest, where sites riddled by prairie dogs are a common feature, have frequently noted that the animals will bring objects to the surface but that it is extremely rare to find specimens carried down into the lower reaches of the burrows. The figures from the Lindenmeier site certainly show that the "animal burrow argument" against the authenticity of finds in low levels has been considerably overemphasized.

Trench A, the completed one, did not exhibit as many complicated features in its upper or shallower sections as did trench B. Nevertheless, there were several worthy of comment. The dark, artifact-bearing stratum disappeared toward the end of section 4 and did not appear again until the work had penetrated into section 9. The soil covering over the tufaceous base had been removed by some agency, presumably wind, prior to the deposition of the upper layers. Despite evidences of a small stream channel cutting across sections 6 and 7, the erosion does not seem to be attributable to water action. The top of the clay bed gave more the appearance of a wind-scoured surface. As a matter of fact the bottom of the trench followed across the summit of a ridge in sections 5 to 9. This ridge had run at an angle to the line of the present valley and is quite apparent in the bank of the ravine down stream from the pit where trench A cut into the gully. Test holes were sunk in the floor of the trench in these sections to make certain that the black stratum did not go below the clay and that the latter was actually the top of a ridge and not a lens laid down subsequent to the deposition of the specimen-bearing layer. The few artifacts and stone chips found in this part of the trench were lying directly on top of the basic stratum. As a further check on the situation

a smaller trench was dug through the area east of sections 3 to 5. This work revealed that the artifact-bearing layer there was on a slope dropping away from the ridge.

The black layer appeared again in section 9 and continued unbroken, though varying in thickness from section to section, through to the ravine. At first it was thought that the greater depth of the cultural layer in sections 10 to 13 was due to the washing down of material from the area above. Evidence of water action was not apparent, however. There undoubtedly was some drift from the higher ground but not in sizeable quantities, and the increase in thickness may possibly be explained by the fact that the black stratum overlay a slight declivity in the top of the old clay bed in sections 11 and 12.

The lower sections in trench A demonstrate clearly the factors involved in the filling of the old valley and the raising of the surface level from that occupied by the makers of the implements to the present top of the ground. There are numerous layers of water-deposited material and evidences of the shifting of intermittent stream beds. Various soil lines indicate intervals when conditions were static and vegetation flourished unhampered by material carried down from the higher slopes. In the upper levels of sections 17 to 22 an old stream bed is clearly shown. It was cut, the water course shifted, and the channel filled before the present ravine became a feature of the terrain. Despite the fact that conditions in the West are such that cutting and filling may take place at a rapid rate, considerable time is probably represented by the accumulation in the valley bottom.

A few interesting things may be noted regarding the occurrence of specimens. The most prolific sections in the yield of implements were 12 to 16, the greatest number coming from 16. The largest amount of chipper's debris centered in 13, 14, and 15. In section 15 one series of flakes totalling 111 was found in a 4-inch (10.16 cm) radius, with 78 of the chips in a single pile. Nearby were some hammerstones, and several broken implements occurred in the material from the section. All the fragments from these implements were obtained, and it was possible to restore them. In the lot was a Folsom point represented by two pieces found 4 feet (1.219 m) apart. Section 14 yielded the only definitely worked piece of bone, a thin disk with a series of lines cut around the edge. The percentage of implements by sections is as follows: 1, 3.6 percent; 2, 5.3; 3, 2.5; 4, 1.1; 5, 1.1; 6, 0; 7, 0.4; 8, 0.4; 9, 1.8; 10, 3.6; 11, 3.6; 12, 7.8; 13, 10.6; 14, 7.5; 15, 8.5; 16, 14.5; 17, 3.6; 18, 3.1; 19, 3.6; 20, 0.4; 21, 1.1; 22, 0.4; 23, 2.1; 24, 2.1; 25, 6.7; 26, 4.6. The material from the deep pit in the ravine bank is not included in these figures because the work done there was

not on a comparable basis. However, the yield per square foot in trench A was greater. The proportions average 1 specimen to 0.9 square foot for trench A, and 1 specimen to 6.5 square feet for the pit.

Cut and split animal bones occurred in sections 1, 10, 11, 12, and 16. Those in 10, 11, and 12 did not constitute a continuous deposit through the three sections. In 10 the bones extended across the trench from the middle of the section to within a few inches of the face of number 11. In the latter they were along the west wall in the half towards the face of 12. Those present in the bottom of 12 started 1 foot (30.48 cm) beyond the face of the section and continued for 6 feet (1.828 m) along the east wall. The lens extended into the trench 2 feet (60.96 cm) from the east wall. The bones from the first sections were very fragmentary and in a poor state of preservation. Those in 10 were in better condition and indicated that they came from several young bison. The implements and chips of stone in the section were intermingled with the bones. In section 11 were numerous small fragments, most of which show the effects of burning or at least are partially charred, and a number of bison foot bones which had been split. Several large stones, hammers and choppers, accompanied the bones. The material in 12 consisted of exceedingly scrappy fragments, presumably bison but too shattered for identification. Section 16 contained a few scattered pieces which appear to be from the leg bones of a bison.

The bottom of trench B had a more gradual slope than did the bottom of A, owing to the fact that the ridge which crossed A in its sections 5 to 9 was not present in B. Trench B ranged in depth from 3 feet (.914 m) at the upper end to 7 feet 6½ inches (2.298 m) at the face of section 16, where work was stopped. Sections 1 to 7 (fig. 1), trench B, gave distinct evidences of the channel of a small stream that formerly meandered down the slopes across that portion of the terrain. The flow was probably intermittent, water being present only after heavy rains or when the snows of winter were melting, and consisted of the run-off from the higher ground above the site. The runlet had changed its course and size several times. Originally it had swung in a slight curve from west to east through section 2 to section 1. Owing to subsequent filling and widening, it moved down the slope to section 3, where its course turned to such an extent that it followed the direction of the trench through sections 4, 5, and 6. In section 7 it swung off toward the west again and passed beyond the bounds of the trench. Considerable quantities of clay were deposited in the channel, and after it had become appreciably shallower the water again began to cut, although it formed a much smaller bed along the

course of the older one. These features do not show as well in the diagrams of the trench walls as they do in the drawings of the section faces, which are not reproduced in this report, but study of sections 2 and 3, figure 1, will show their beginnings as they appeared in the walls. The significance of this old stream is that its original channel was cut after the deposition of the soil layer which contains man-made objects and that it removed this dark stratum as it progressed. Furthermore, the channel and its history as briefly sketched provide evidence that there was a higher and more extensive ridge above the site than that of the present day. Now there is not sufficient run-off, even after the heaviest rains, to form such a course. Numerous sand and gravel lenses scattered along the length of the trench demonstrated the occurrence of subsequent washes which carried material down from the higher slopes. With the exception of sections 13-15 there were no clear-cut channels, however. Those sections showed that a wide, shallow stream had crossed that point after considerable material had been deposited above the old occupation level.

In trench B the largest showing of specimens was in sections 7 through 10, although 1 through 5 had a consistent yield. The percentage dropped in 6 and then swung upward to the peak which was reached in 9. It then dropped off to section 12 which contained no implements, although some chips and flakes were found there. From this point to the end of the trench there was a gradual increase in returns, but the yield was not as good as in the earlier sections. In section 5 the black layer on either side of the channel contained a number of large nodules and flakes. None were found in the channel, however. On the west side of the trench at the lower end of section 12, just below peg 13, was a shallow, saucer-shaped depression in the top of the old clay bed. The concavity held a quantity of charcoal and suggested that it might have been a shallow fire pit, although the underlying clay showed no signs of the effects of heat. It is possible that a small fire burning for a short time in such a pit would not cause sufficient discoloration to remain over a long period of years or that such reddening as did take place was subsequently leached out. There were some small fragments of burned bones in the charcoal and around the borders of the basin. The lens of charcoal extended into section 12 a distance of 2 feet 6 inches (76.20 cm). It did not appear in section 13. It projected into the trench for 2 feet (60.96 cm) in section 12. The percentages of implements for the various sections in trench B are as follows: 0, 1.7 percent; 1, 7.9; 2, 6.2; 3, 5.2; 4, 7.1; 5, 6.2; 6, 1.7; 7, 7.9; 8, 15.8; 9, 17.5; 10, 9.7; 11, 4.4; 12, 0; 13, 0.9; 14, 2.6; 15, 5.2.

Bone fragments were not as plentiful in trench B as in trench A; also, the pieces found were as a rule smaller and more fragmentary. Material of this type came from sections 1, 7, 8, 9, 12, 14, and 15. Sections 7 and 12 contained numerous burned and partially charred pieces. An interesting correlation is suggested by the occurrence of the many burned fragments in trench A, section 11, and trench B, section 12. These two sections were located along the same contour line, and their bottoms, the old occupation level, had only a slight slope so that the original surface would have provided a comparatively flat area, a place suitable for camping purposes. The presence of charcoal in the concavity in the old surface in section B-12, the burned bones in both B-12 and A-11 together with the large stones and choppers in the latter—as noted in the discussion of trench A—constitute good evidence that the makers of the Folsom points had actually tarried for a time along that portion of the slope. If the trenches did not cross a portion of the real campsite, they at least bordered upon it. This is further substantiated by the fact that subsequent sections in A were those from which the most specimens came.

In discussing the big pit in the ravine bank in the preliminary report, mention was made of evidence indicating that small ponds or marshy places had been scattered over the old valley bottom.[4] It was suggested that the deep level seemingly constituted the peripheral vestiges of one such spot, the main portion of which was washed away when the present ravine, possibly an older one also, was formed. Information gleaned from the lower sections of trench A corroborates that conclusion as well as the suggestion that the archeological objects obtained there represent midden material that was deposited along the edges of a shallow pond or slough. Some of the specimens no doubt drifted down from the higher levels and others may have been tossed out to sink through the mire to the top of the clay stratum where they are found today. They were not dropped on an occupation level, as were those from sections 12-16, because from section 23 through to the ravine the black stratum gave every indication of an underwater deposit of the kind generally associated with bogs.

The valley fill, as revealed in cross-section by the trenches, shows that the old level of occupation consisted of a soil layer, several inches in thickness, resting on a tufaceous substratum, a Tertiary deposit dating from the Oligocene. The soil layer probably was produced by the natural decay and break-up of the top of the Oligocene bed and subsequent growth of vegetation over the area. There was no evidence

[4] Roberts, 1935, pp. 11, 14.

of deposition by water. No information was obtained to indicate what agency was responsible for the original scouring of the valley and removal of material down to the Oligocene stratum or when such action took place. After the abandonment of the location by its human inhabitants, material from the higher levels was washed down across the site. The first layer to be deposited consisted of stained sand and earth, presumably occupation level material from the upper slopes. This in turn was covered by sand, gravel, and boulders swept down into the valley from its bordering hills. Then the alternating periods of erosion and building up set in as demonstrated in the lower sections of the trenches. As previously stated, all of this change could not have been extremely rapid here because ridges which contributed to some of the valley fill have since completely disappeared, being weathered away in the opposite direction. Furthermore, there are good indications that the central portion of the valley, which lies to the north of the ravine and the archeological site (map 1), now consists of secondary fill. The material which raised the old bottom to the level represented by that above the deep pit was subsequently washed away and the area again built up with sand, gravel, and rocks carried down from the ridges to the west and north of the site. That the original fill, represented by the deposit above the deep pit and the artifact bearing stratum in the area crossed by the trenches, was not disturbed may be attributed to the fact that it was far enough up the opposite slope to escape forces at work on the floor of the valley. This feature is one, however, which belongs more properly in Dr. Bryan's discussion of the geology of the site and will not be considered further at this point. The geologic report will appear in a later publication on the work at the site.

THE BISON PIT

The excavation where the bison bones were uncovered measured 20 feet (6.096 m) by 47 feet (14.326 m) (map 1). Owing to erosion by wind and water, as mentioned in an earlier paragraph, the deposit was not as deep as in the area where the trenches were dug. The bones ranged in depth from 10½ inches (26.67 cm) at the upper side of the pit to 3 feet (.914 m) below the surface along the lower side. The position of the strata here differed slightly from that observed in the main trenches. The object-bearing layer did not consistently follow the clay substratum. It rested upon a bed of stained sand and earth which in turn lay directly on the clay. A wholly satisfactory explanation for this condition was not obtained from the digging. The best suggestion which can be offered at this time is that the particular

animals were killed before a definite dark soil layer had been built up. Some of the bones extended down into the stained stratum. Exposure of a larger section in this area is probably essential to an understanding of the various factors responsible for the situation. The deposit above the bones was similar to that in the upper layers of the trenches, namely, sand, gravel, and some boulders, with a thin soil line at the present surface.

At least nine individual bison are represented in the collection from this location. Many of the bones, including several legs, were still articulated when uncovered (pl. 3, fig. 1). The remains of one creature were found with a forequarter, most of the ribs from one side, and the vertebral column still intact. The skull, in a somewhat damaged condition, was nearby. Portions of other skulls were obtained, but they are all too fragmentary to be of material assistance in the identification of the species. The most striking find consisted of a vertebra with the tip end of a projectile point in place in the foramen for the spinal cord (pl. 3, fig. 2). This bone was in position in the center of a group of articulated vertebrae, and when it was removed from the ground and was being cleaned by L. C. Eiseley, graduate student from the University of Pennsylvania, the point was discovered. Hafted on either an arrow or spear shaft, it had apparently been driven into the animal and then broken off at the end of the longitudinal groove. The wound may not have been directly responsible for the creature's death, but it would have crippled it to such an extent that a killing blow could easily have been administered. This was not the only implement from the pit, however, as 33 additional specimens of the stone chipper's work were found in association with the bones. These objects consist of points, portions of points, various types of scrapers, blades, flakeknives, and gravers. Two flakes with chipped cutting edges accompanied the bison skull, and several fragmentary points were lying between components of articulated segments in such a way as to suggest that they had been in the flesh of the animals.

The assemblage in the bison pit recalled in some aspects features observed at the quarry where the original Folsom finds were made.[5] Evidence at the latter place indicated the culmination of a hunt and the killing of animals around a water hole or marshy spot. After as much of the flesh as could be carried away had been removed from the carcasses, they were left to sink in the mire. Through the course of time natural agencies drained the swampy ground and covered the site with earth washed down from higher levels in the vicinity. No

[5] Cook, 1927; Figgins, 1927.

traces of an occupation level or camp were found at Folsom—only the signs of the kill. In this respect it was like the bison pit. Since most of the material scattered over the Lindenmeier site is so scrappy in its nature, the discovery of partially articulated skeletons and numerous whole bones was fortunate. Just why the dismemberment of these animals had not been carried to completion can only be postulated. They may have been killed shortly before the group moved from the site and only such portions taken as could be disposed of immediately. The camp possibly was oversupplied with meat and as a consequence only the hides and choice cuts were removed. Then again, they may represent a winter kill when pelts were the chief objective, the winter coat being superior for robes or blankets.[6]

There is no evidence to show the manner of hunting or methods of butchering. It must be borne in mind, however, that the period here represented long antedates the era of the horse in North American Indian cultures and that the chase had to be conducted on foot, the practice in vogue among later peoples when encountered by the first Spanish explorers in the Southwest.[7] This custom probably called for greater cunning and skill, if not actual bravery, than did the method of hunting after the horse became a prominent accessory in the Plains cultural pattern. It was necessary for the hunter to get close enough to the bison to use his stone-tipped weapons with success. By analogy, on the basis of later customs, it may be suggested that Folsom man erected brush-shelters or blinds close to the ponds and watering places frequented by the bison and bagged the creatures from ambush. Vicente de Saldivar Mendoca observed such a practice when he visited the buffalo plains in 1598 as sargento mayor of the Oñate expedition.[8] It is also possible that the hunters camouflaged themselves in a manner similar to that reported at a much later date by Catlin. He described the way in which Indians covered themselves with wolf skins and crawled on hands and knees to within a short distance of the desired game and then killed it.[9] Wolves were numerous and commonly followed the herds of buffalo, the latter paying little attention to their presence.[10] Bones from the wolf were found here, so that hunting in that fashion was not beyond the range of possibility.

Butchering an animal the size of those represented by the material from the bison pit would not be an easy task. It seems obvious that

[6] Catlin, 1841, vol. 1, pp. 253-254.
[7] Espinosa, 1933, p. 157.
[8] Bolton, 1916, p. 230.
[9] Catlin, 1841, vol. 1, p. 254.
[10] Winship, 1896, p. 528.

the skinning and cutting up of the meat must have been done where the slaughter took place, in this instance at no great distance from the camp. The situation at the time of occupancy would have been favorable to the brush-blind type of hunting. A slough or marshy spot had existed in the old valley floor not far from the point where the bones were found—this was demonstrated in one of the Denver Museum test pits. A screen placed on the slope above would have made an ideal place to await the coming of the bison. The nature of the soil layer indicated that there was fairly heavy vegetation around the water hole, probably coarse grass and reeds, which would protect the meat from dirt and sand during the process of skinning and cutting up an animal killed at this place. The handling of the carcass no doubt presented a problem of some difficulty, as there were no mechanical means for transporting it or to facilitate turning and lifting. Such work had to be done by manpower alone. The only tools available for the dismembering operation were those of stone or perhaps bone.

The nearest approximation to the description of such an undertaking is probably that by Castañeda. The latter was the chronicler for the Coronado expedition, which penetrated into the buffalo area in 1540. Members of that party had an opportunity to observe the Indians under conditions comparable to those of earlier centuries. In his account of the skinning of the bison Castañeda said: "They cut the hide open at the back and pull it off at the joints, using a flint as large as a finger, tied in a little stick, with as much ease as if working with a good iron tool." [11]

Other documents, one attributed to a friar accompanying the Coronado party,[12] one by Luxán,[13] and Fray Juan Augustin Morfi's History of Texas,[14] give good accounts of the use to which various parts of the animal were put. The skins were employed in the making of tents, clothes, footgear, and rope. The sinews were used to make thread for sewing their clothes and tents, and for wrapping shafts. The stomachs served as pitchers and vessels, the intestines as containers of fat and of marrow. Awls were made from the bones. The horns were cut into spoons, cups, and ornaments. The hoofs were converted into glue to aid in fastening projectile points in shafts. The brains were used in tanning and softening the hides. In view of all this, it is little wonder that the bulk of the bone material from the site consists of scraps and splinters. Even in the bison pit, which

[11] Winship, 1896, p. 528.
[12] Winship, 1896, p. 570.
[13] Hammond and Rey, 1929, pp. 120-121.
[14] Castañeda, 1935, p. 67.

contrasted sharply with other portions of the site, many of the bones were cut and split, and several of the skulls had been battered and chopped into small pieces.

The bones from the bison pit were submitted to Dr. C. L. Gazin, assistant curator of paleontology, United States National Museum, who kindly furnished the following notes:

The Fort Collins material represents an extinct species of bison and should probably be referred to *Bison taylori*. The horns of the skull are very incomplete, but from the size of the proximal portions of the horns, the breadth of the cranium, and the length of the rostrum it is clearly not a living type.

Comparisons are handicapped by lack of comparable fossil material in our collections outside of Alaska and Minnesota. It has been necessary to rely largely on published illustrations and descriptions of the numerous bison which have been designated as distinct species. It is obvious that too many names have been applied to North American bison and some of the older types are hardly adequate for clear diagnosis. Several of the known species are eliminated in comparisons, however. The Fort Collins material apparently could be referred with equal readiness to *Bison occidentalis*, *Bison taylori*, or *Bison oliverhayi*, among those which remain, and there seems to be some doubt as to the validity of one or more of these.[15]

The skull resembles, and approximates in size, a skull from Kansas identified by Lucas as *Bison occidentalis*, which was the first reference to this Alaskan species of material from the United States proper. This determination by Lucas probably furnished the basis for continued recognition of the species in the middle western region. The Fort Collins skull is intermediate between the types of *Bison taylori* and *Bison oliverhayi* from Folsom, N. Mex., in breadth of the cranium at the postorbital constriction, but the entire length of the skull is as great as, or perhaps somewhat greater than, that of *Bison taylori*. Unfortunately, the incompleteness of the horns obviates detailed comparisons of these structures; however, the greatest diameter of the basal portion of either horn about equals that in *Bison taylori*. Characters of the teeth which have been used to distinguish species of bison are of doubtful value and do not help in the present case.

The proportions of most of the limb elements are slightly less than the measurements given by Hay and Cook for *Bison taylori*, although a few of the foot bones are larger in their respective measurements. The various limb bones and vertebrae, other than indicating an animal of distinctly large size, are of little or no diagnostic value in determining the species.[16]

ARTIFACTS

The specimens collected from the excavations consist of points, scrapers, gravers, chisel-gravers, choppers, large blades, flakeknives,

[15] The scrap bones secured in the autumn of 1934 were identified by J. D. Figgins as being from both *Bison taylori* and *Bison oliverhayi*. See Roberts, 1935, p. 31.

[16] For a discussion of *Bison taylori* and *Bison oliverhayi* see Hay and Cook, 1930, Figgins, 1933.

hammerstones and rubbing stones, and worked bones. Pieces of hematite show the effects of having been rubbed for pigment. There are numerous flakes, too nondescript in character to be called implements, which exhibit signs of workmanship. The collection also contains a large number of channel flakes, the long spalls removed in the fluting of the projectile points. Varieties of stone represented in the implements are jasper, chert, chalcedony, moss-agate, quartzite, petrified wood, geyserite, limonite, granite, quartz, and sandstone. Most of the chipped tools, the cutting and penetrating implements, were made from the chalcedony, chert, jasper, moss-agate group, the "flint" of the amateur collectors. This type of material is well adapted for use in tools and wherever available constituted the preferred stone of the implement fashioners. The harder quartzite and petrified wood were employed but, in addition to being more difficult to work, did not produce as good finished products. On the other hand, they were better for hammers and mauls, and numerous examples show that they, as well as the quartz and granite boulders, were used for that purpose. Sandstone is suitable only for rubbing, polishing, and sharpening bone tools and was so employed at this site.

The percentages of specimens found at the various places where excavations were made is as follows: Trench A, 37.6 percent; trench B, 15.2; the big pit in the ravine bank, 17.5; the bison pit, 4.4; the small trench east of sections 3-5, trench A, 10.7; miscellaneous, scattered surface finds and specimens scratched out in prospecting along terrace edge and ravine bank, 14.5.

POINTS

There is an interesting range in the size and variety of points (pl. 4). This group constitutes 11.3 percent of the specimens in the collection. The predominant type of point is the characteristically fluted Folsom in its two forms, the long and slender one with tapering tip, and the short, broad style with the maximum breadth of blade occurring close to the tip end.[17] Although most of the specimens are fragmentary examples, there is sufficient material to show that the two forms were about equal in number. The short, stubby examples, designated form A in the preliminary paper, range in size from one with a length of 22.5 mm, breadth of 14 mm, and thickness of 3.5 mm, to one with a length of 70 mm, breadth of 35 mm, and thickness of 6 mm. The long, slender specimens, the B form, have a range between one with a length of 23.5 mm, breadth of 13 mm, and thickness

[17] Roberts, 1935, pp. 15-16, fig. 2.

of 2 mm, and one with a length of 60 mm, breadth of 23 mm and thickness of 4 mm.

The preponderance of broken specimens found at most sites has been pointed out by numerous writers. In the 1935 series from the Lindenmeier site the situation remains unchanged, as 87 percent of the points are only fragmentary examples. In general this condition may be attributed to the brittleness caused by the fluting. The removal of the longitudinal flakes from each face so thinned the points that they became extremely fragile. At the present site, however, two other factors must be considered, namely, that many points were broken in the making, and that the collection contains specimens which were never completed. The purpose of the grooves is not known, although a number of explanations have been made to account for them. It has been suggested that the fluting was to facilitate hafting, the split end of the shaft fitting more snugly into the grooves than it would if the point had a convex basal surface. Other interpretations are that it was to improve the penetrating qualities, to permit the head to break off in the animal, to allow the head to slip out of the foreshaft, to promote bleeding, and to reduce the weight. No doubt a number of such ideas influenced the development of this typical feature. The most important, however, in the opinion of the present writer pertain to the quality of penetration and the hafting.

The method of shaping and chipping Folsom points was discussed at some length in the previous report and need not be described in detail in this paper.[18] It will suffice to say that the evidence from the recent work substantiates that of the preceding season and corroborates conclusions drawn from it. These conclusions were that the points were first shaped, then the channel flake was removed by indirect percussion applied to a nubbin or small "seat" left in the center of the concavity when the base was chipped. Finally, the edges were retouched. The 1935 material adds one significant factor, however, which was suggested by the earlier specimens, but the evidence was not conclusive enough to warrant its mention in the preliminary report. This factor is that the tip was left in a roughly rounded state, not pointed, until after the channel flake was removed. Its shaping constituted a part of the secondary chipping by which the edges were refined. Several specimens in the new series definitely show this to have been the practice. Two examples, both broken into several pieces in the process of manufacture and tossed aside uncompleted, clearly demonstrate the feature.

[18] Roberts, 1935, pp. 18-21.

The broken material from the 1935 work contains more tip ends than that of 1934, although the butt ends still comprise a large percentage of the series. Most of the tip ends came from the bison pit, and the inference is that they had been embedded in the flesh of the animals whose bones were found there. In discussing the prevalence of butt ends in the previous finds it was suggested that the circumstance could be attributed to the replacing of damaged points. Many must have snapped off in the killing of game. This is illustrated by the tips in the bison pit and by the one in the vertebra. Undamaged shafts were no doubt retrieved and carried back to camp to be fitted with new points. The fragment of the old one remaining in the shaft would be the butt end, and in the remounting process it would be tossed aside to remain in the debris of accumulation. Such an explanation, of course, refers only to fragments which show that they formed part of a completed point; it would not apply to butts from those broken in the making. The basal portions were not always discarded, however, as examples in the collection show that it was not an uncommon practice to take a butt which had lost its tip and rechip it so that it again had a point capable of penetration. Specimens in this group are extremely stubby and flat-pointed.

There are a number of points in the collection which are not of the characteristic Folsom form. One type in the variant group consists of small points made from fortuitous flakes, often from portions of channel flakes. None of these has the fluting; as a matter of fact, they are too thin to permit the removal of a side spall. They definitely belong in the implement complex, however, and their outlines closely follow the general Folsom pattern. The other type of point is represented by fragments only, but the pieces are so distinct in their nature that they must be considered as representative of a form found in the West which is frequently linked with the Folsom. This is the so-called Yuma. The fragments are from the true Yuma, not from any of the multitudinous subtype varieties. The typical Yuma point, in the conception of the writer, is one which is long and slender. The edges extend approximately parallel from the base—in some cases there is an almost imperceptible narrowing toward the butt—for about two-thirds of the length and then taper to a sharp point (fig. 2). It is oval in cross-section (fig. 2, *b*). The base may be straight across, slightly concave, or deeply concave. Sporadic examples have a small shoulder on one or both sides near the base, thus forming a slight tang (fig. 2, *f*). In the shaping process the main flakes were removed so that the facets extend completely across the face of the blade, usually at a slight angle directed toward the tip. The edges were then

refined by a retouch in which minute flakes were removed, a process comparable to the secondary chipping in the Folsom group.

A large variety of blades and points have been grouped under the name Yuma, and at the present time there is considerable confusion as to what constitutes such a point. In fact it seems that the tendency is to call anything Yuma that is not a true Folsom or a barbed and tanged arrowhead of the recent Plains type. Dr. E. B. Renaud, of the University of Denver, was the first to describe the form and gave it the name Yuma. His discussion and classification, including his several subtypes, may be found in his various publications.[19] Dr. E. B. Howard considers the Folsom-Yuma problem at some length in his "Evidence of Early Man in North America,"[20] and J. D. Figgins has written a number of articles on the subject.[21] As the situation

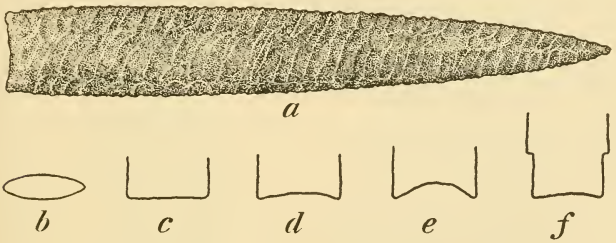


FIG. 2.—Yuma point, *a;* Cross-section, *b;* and base types, *c-f.* (Actual size.)

stands today, it seems essential to reach an agreement on what is meant by Yuma and that its use be restricted to something more specific than its present catch-all connotation.

The importance of the fragments from Yuma type points found at the Lindenmeier site lies in the evidence bearing on their position in the sequence. One came from the latest old stream channel in section B-3. Its position distinctly indicated a later deposition than the black stratum containing the Folsom points. The other specimen came from the black layer. This was in A-23, where indications were that the layer was the bottom of a swamp or bog deposit. The exact position of this example was not obtained, as the point was found in the screen and not in situ. Indications were that it had been in the black fairly high above the contact. Since this cannot be established with certainty, it will be considered as being on a level with the Folsom

[19] Renaud, 1931, 1932, 1934.
[20] Howard, 1935.
[21] Figgins, 1934, 1935.

material. Portions from two other points, not typically the true Yuma type as described in this paper but of a form usually called Yuma, were also obtained. One was above the black layer in section B-8. The other was above the black in the area just east of A-4. The situation may then be summarized as follows: Out of four specimens attributed to the Yuma group, one was in a position that may be regarded as evidence for contemporaneity with the Folsom, and three were later.

The Denver Museum party obtained, in its large pit, four specimens which in a broad sense of the word might be called Yuma. Two of these were from the contact line between the black and the basic substratum. The others were from a higher level in the black. The situation in the deposit where these were found was similar to that in trench A from section 23 through to the deep pit. As a consequence there is the possibility of somewhat later material sinking to a lower level. The only conclusion which can be drawn from the evidence as it now stands is that there was at best only a late contemporaneity between Yuma and Folsom at the Lindenmeier site with a later survival of the Yuma. Subsequent work may throw more light on the subject and change the picture, but at present the Yuma must be considered comparatively late in this immediate district. Furthermore, they are only a minor factor, as only .05 percent of the points from the site can be classified as Yuma, and some of these are of such a nature that their inclusion is highly debatable.

SCRAPERS

Implements of this type comprise 32.8 percent of the collection from the 1935 excavations (pls. 5, 6, 7, 8). The tools fall into several major groups. These are the side scrapers, "snub-nosed" scrapers, end scrapers, "thumbnail" scrapers, and scraper edges. The latter consist of pieces from broken implements too indefinite in character to warrant inclusion in one of the other classes. The term "thumbnail" is occasionally used as a synonym for "snub-nosed." In this discussion they are regarded as different types.

The side scraper series represents 56 percent of the group. There is considerable variation in the type of flakes used in their manufacture, their degree of finish, and in their general quality. Some of the implements are light in weight and almost as thin as a sheet of heavy paper. Others are thick and cumbersome. Certain examples are little more than rough flakes with a worked edge along one side only; in some cases merely a portion of the edge shows chipping. Tools in this

group frequently retain part of the siliceous crust of the nodule from which the flake was struck. In contrast are those which display careful workmanship not only of the edges but of the faces as well. The scraping edges, regardless of the quality of the tools, are straight, convex, or concave. Good examples of the concave form are illustrated in figure 3. Several of the implements combine both straight and convex, concave and convex, or all three types of edges. It is possible to separate the side scrapers into a large number of subforms, but for the purposes of this paper the general grouping just described is sufficient.

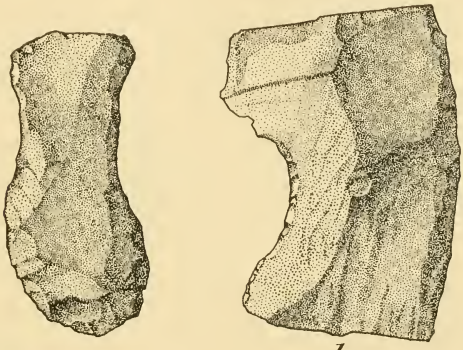


FIG. 3.—Side scrapers with concave cutting edges. (Actual size.)

The "snub-nosed" scrapers are an interesting series and are perhaps the most consistent in type of all the tools in this general category (pl. 8). They comprise 26.6 percent of the scrapers. Despite the fact that there are a number of subforms, the implements, whether large or small, made from good stone or poor, show no marked deviations from the main pattern. All are characterized by one thick, rounded, convex, carefully chipped end. The treatment of the other end, the edges, and the lateral faces varies. Some are untouched, on others the sides were chipped, others show the use of the flaking tool on the lateral faces. Rarely was the bottom of the tool, the ventral surface or side which came off the core, altered in any way. The size range in this group is rather pronounced. They vary in length from 21 to 50 mm, in breadth at the cutting edge from 18.5 to 40 mm, and in thickness from 4.5 to 12 mm.

The end scrapers are more variable and nondescript in form than the types just described. They constitute only 2.4 percent of the series, which might be taken as an indication that they were not as widely used as the other forms. Such was not necessarily the case, however, as numerous implements included in the side scraper class because their predominant features pertain to that form also have an end scraper. So far as shape is concerned, this tool adheres to no particular pattern. Any random flake seems to have sufficed for such an implement. Its main feature is a scraping edge at one or both ends of the flake. The sides and lateral surfaces generally remain untouched. The ends differ from those of the "snub-nosed" group in that they are not thick and bulky, but are more chisellike in form. They are either straight across, slightly convex, or have a sweeping curve not unlike present-day blunt-end table knives. The size range varies between an example with a length of 35 mm, a breadth of 18 mm, and a thickness of 5 mm, and one with a length of 48 mm, a breadth of 23 mm, and a thickness of 4 mm.

The "thumbnail" scrapers are not numerous in the collection. Only 1.6 percent of the scrapers are listed under this classification. They constitute a definite type, however. The name is derived from the close resemblance between their shape and that of the ordinary thumbnail. They are thin, roughly rectangular in outline with a convex scraping edge. Fragments from channel flakes seem to have been favored as material from which to make these implements. The size range is not great. Examples in the collection are from 14 to 15 mm in width, 15 to 17 mm in length, and 2 to 3 mm in thickness.

The broken series or scraper edges comprise 13.4 percent of the scraper group. Most of the specimens are probably portions of side scrapers, but as previously mentioned they are not sufficiently clearcut in form to warrant more definite classification.

A curious implement, the only one of its kind thus far found at the site, is one which can be termed a core scraper (fig. 4). It was made from a small core, not from a flake as were the majority of the tools. The long, slender facets where chips were removed in the shaping process show that the maker was possessed of great skill. Whether the object was the product of a bit of experimental work or belongs to a definite, although minor, type is a question which can be answered only by additional digging. If no other examples are found in a comparable series of specimens, it unquestionably should be considered unique. Core scrapers have been found in parts of Alaska and in some sections of Siberia. This implement is not correlative to the types from those places, however, and it may be that in the last

analysis it should be regarded as an aberrant form of end scraper or "snub-nosed" scraper.

One type of scraper—the turtleback [22]—found during the 1934 excavations is not represented in the collection obtained in 1935. The failure to obtain additional examples indicates that it must have been a very minor form.

No suggestions as to possible uses for the various types of scrapers have been made in foregoing paragraphs. There is no definite knowledge on the subject, but to judge from the later Indians, such tools must have been absolutely essential in the domestic life of their makers. That they constituted an important part of the implement group is shown by the fact that almost a third of the specimens belong in this category. They no doubt functioned in the dressing of skins, the removing of flesh from bones, for cutting bones, and for the

FIG. 4.—Nodule scraper. (Actual size.)

smoothing of spear and arrow shafts. The "snub-nosed" scrapers would be particularly well adapted to the scraping of marrow from split long bones. The convex scrapers, such as figure 3, *b*, are just the type of tool needed in the shaping of wooden shafts.

GRAVERS AND CHISEL-GRAVERS

The tools in these two groups are similar in many respects (pl. 9). Although they are definitely related and the terms used to designate them overlap to some extent, there is a distinction between the specimens in these groups. The gravers constitute 5.6 percent of the collection. They are of particular interest because they suggest that the makers of the Folsom points were also adept at some form of the engraver's art. As yet there is only meager evidence of the character of this type of delineation, but the 1935 investigations established the fact that markings were made on bone and soft stone. Fragments from two objects of polished bone, burned in a fire, exhibit finely cut lines which appear to have been components of some kind of decoration. A bone disk with a series of short grooves bordering the edges

[22] Roberts, 1935, p. 24.

on both faces (pl. 9, *e*), suggests the use of an implement such as one of the so-called gravers. A fragment from a similarly marked bone was found by the Denver party, and a portion of a correspondingly shaped and cut object made from soapstone—found by Maj. R. G. Coffin—shows that materials other than bone were subjected to ornamentation of a type which could be executed only by use of such a tool.

Another possible function for the graver type of point has occurred to the writer, namely, its use in tattooing. This custom prevailed to a greater or less extent throughout the country among the later Indians and may have been one of the traits of Folsom man. The small, very sharp tips would readily puncture the skin for the application of pigment. Unfortunately, the "canvas" on which such designs are drawn is highly perishable, and there is little likelihood of finding direct evidence that tattooing was done.

Most of the gravers consist of chance flakes modified only by the presence of short, needlelike points on one side or end. Any piece of stone, provided it was thin enough, was suitable. Sometimes a channel flake (pl. 9, *a*), was employed, and occasionally a fragment from a broken scraper. On the whole, however, nondescript scraps from chipper's debris were all that the maker required. The small sharp points were not fortuitous: they were definitely chipped. They differ from the usual drill in that one face of the point is flat, and the other is beveled along the edges and has a slight bevel at the tip of the point. Drills are chipped on all sides. The gravers may have from one to five points on a single flake. The implements in this group range in size between one with a length of 19 mm, breadth of 13 mm, and thickness of 3 mm, and another with a length of 55 mm, breadth of 33 mm, and thickness of 6 mm. The actual graver points do not vary greatly in size. They consistently range between 1.5 and 2 mm in length and 1 and 1.5 mm in width at the base.

The chisel-gravers are more definitely shaped than the gravers. They are not as numerous, the type forming only 1 percent of the total collection, but they nevertheless are a distinct tool (pl. 9, *k, l, m*). They also were made from flakes. In contrast to the gravers, the points are broader and more elongated. There is a pronounced bevel on the tip, and the end of the latter is a straight edge, convex on rare examples, rather than a sharp point. These implements exhibit better workmanship than that on the simple gravers. The chipping is not confined to the points but as a rule extends along the edges, sometimes even around the base. The chisel-gravers range from 25 to 37 mm in length, from 13 to 27 mm in breadth, and from 3 to 8 mm in thickness.

The points range between 3 and 10 mm in length, from 4 to 7 mm in width at the base, and from 2 to 3 mm in width at the cutting end.

Both gravers and chisel-gravers are found in combination with other tools. There is a definite group of "snub-nosed" scrapers exhibiting the feature, and not a few side scrapers have one or the other type of point on a side or an end. Such specimens suggest that the small points may have served a utilitarian as well as an artistic purpose, although it is hard to postulate what such a function might have been. Most of them are too small to have served as awls or perforators.

CHOPPERS

Implements of this type are not numerous in the collection, comprising only 0.5 percent, but they form a definite class. They could be considered as variations of the tools generally called hand axes or rough celts (fig. 5, *a* and *b*). To avoid complications in the matter of correlation and chronological implications not necessarily justified, neither of those more common names will be used in referring to such objects. The choppers were made from true cores or from pseudo cores. The latter were originally flakes of more than average size which produced an object exhibiting in all respects the characteristics of a core implement despite the fact that the stone from which it was formed was not a complete nodule. The general shape of the tools suggests the adze or celt of the later Indians. The workmanship was not as good as that on the chipped celts of more recent times. The makers were apparently satisfied with the minimum expenditure of effort needed to make a usable tool. The main outlines were roughed out by the removal of large flakes, and the finer chipping was reserved for one chisellike end. The bases are rough. As there is no trace of rubbing or polish on the stones to indicate that they were hafted, they may have been held in the hand. If so, the butt ends were probably wrapped in a piece of bison skin or similar substance to prevent slipping and to protect the user's palm.

The specimen marked *a*, figure 5, has an overall length of 71 mm. It is 43 mm wide at the base end and 27 mm wide at the cutting edge. The thickness at the base is 28 mm and at the bit 5 mm. Chopper *b*, fig. 5, has a total length of 74 m. It is 39 mm broad at the base and 24 mm wide at the cutting edge. The base is 22 mm thick and the cutting end 3 mm.

Numerous unworked stones which were so shaped by nature as to make efficient choppers were found on the site. That many of these were used in splitting and hacking bones was suggested by the fact

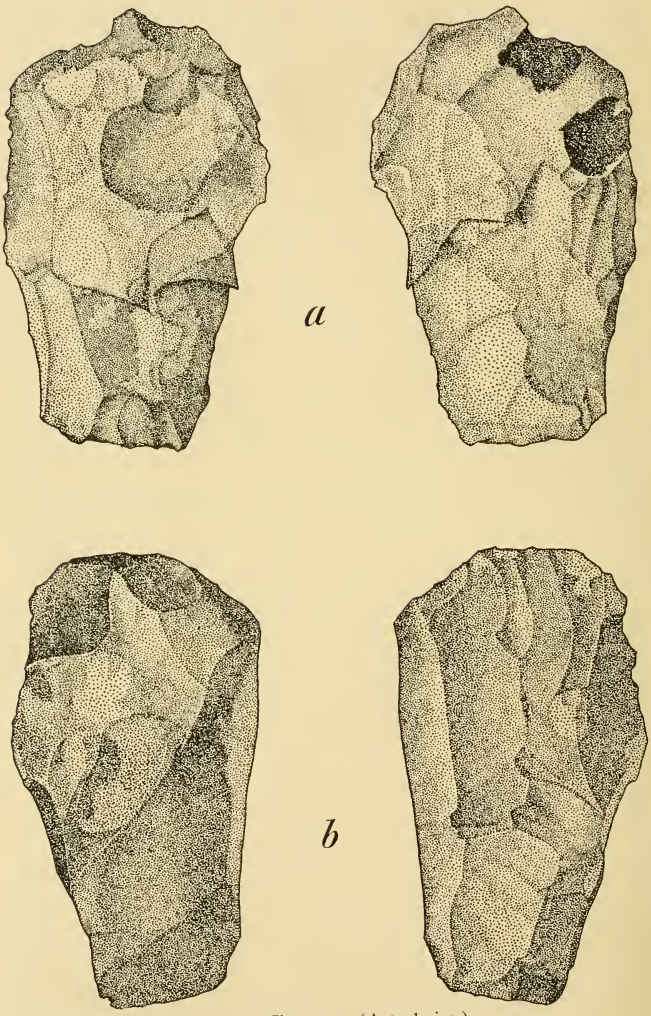


FIG. 5.—Choppers. (Actual size.)

that they were found in association with such objects. Several of these natural choppers also have slightly battered edges, showing that they had been employed as tools.

KNIVES

The specimens which may be grouped under the classification of knives consist of implements made from large, ribbonlike fragments of stone modified only by chipping along the edges; flakes which were more carefully shaped and bear a general resemblance to modern knife blades; and skillfully chipped stones which exhibit typical Folsom features in their fluted faces and secondary retouch along the edges. Tools in this group comprise 3 percent of the collection.

The ordinary flakeknives (pl. 10, *a-f,* and pl. 11, *a-c*) are crude implements, yet would be quite efficient in use. On some of them the chipping is large and irregular, on others (pl. 11, *a,* for example) it is as minute and precise as could be desired. Both convex and concave edges are present in the series. Some of the tools have two types on a single side, others on opposite sides. There is nothing to indicate that any of these cutting edges were hafted in handles, but it is quite possible that some of them were. The flakes range from 37 to 79 mm in length and from 10 to 45 mm in breadth. The thickness varies from 2 to 11 mm.

The group which shows more definite shaping (pl. 11, *d-f*) comprises specimens which exhibit some of the finest chipping noted in the collection. Not all of them were subjected to the same degree of workmanship, but the class as a whole is much superior in finish to the rough flakeknives. It seems probable that most of the blades in this group were hafted. All have an unfinished end, and on a few there is a slight gloss or luster such as a handle might produce. Measurements in this group range between 45 and 80 mm in length, 20 and 28 mm in breadth, and 3 and 8 mm in thickness.

The carefully chipped blades with fluted faces (pl. 10, *g* and *h*) comprise only 18 percent of the knives. So far as craftsmanship is concerned they are comparable in every way to the projectile points. The same technique was employed in their manufacture. Their ends, however, are rounded and blunt. In some cases they were smoothed. The cutting edges tend to be parallel rather than tapering or bulging as in the case of the points, yet such a knife could be converted into a typical point by the mere expedient of chipping the blunt end to a penetrating tip. These knives were undoubtedly mounted in a handle. Blades in this group range from 51 to 70 mm in length, 23 to 31 mm in width, and 4 to 6 mm in thickness.

Knives were also made from channel flakes, or perhaps it might better be said that channel flakes were used as knives. The razor-keen edge of these byproducts would be ideal for cutting purposes. Study of such flakes suggests that they were first employed as struck-off from the face of the point. Then as the edge became nicked and dulled in use it was touched up with the flaking tool.

LARGE BLADES

The tools and fragments from such implements classed under the heading of large blades are leaf-shaped objects which combine both the qualities of a knife and a scraper. This group constitutes 6.3 percent of the series. These specimens are suggestive of the so-called blanks of later periods. The latter were the intermediate stage between the original nodule and the finished tool. They were roughed out in the quarry and then carried home to be completed as time permitted. The blades from the Lindenmeier site are actual implements, however, despite their similarity to the blanks. On many of them there is a careful secondary retouch along the edges. Others show minute chipping of the type which results from use. They would have functioned well in the skinning and cutting up of an animal and also in the scraping of a hide. Some of them exhibit a slight rubbing or gloss at the base which suggests the use of handles, while others do not. Even in an unhafted state they would be quite serviceable.

The blades range in size from 55 to 90 mm in length, 35 to 40 mm in width, and 7 to 9 mm in thickness. The majority fall between 75 and 80 mm in length, which might therefore be termed the standard length.

MISCELLANEOUS OBJECTS

Several varieties of specimens are grouped under this heading because they constitute only a minor part of the collection. In some cases there is only a single example of the class. Other objects are not actual tools or implements, yet are an integral part of the general complex. Included in this listing are the worked bones, channel flakes, hammerstones and rubbing stones, and pieces of hematite.

Only a few bones show signs of use or of having been shaped for some definite purpose. Many have cuts and marks made at the time when the flesh was stripped from them or when they were split for their marrow, but this is not considered indicative of workmanship preparing them for some special function. One difficulty in judging the bone material lies in the fact that most of it has been decalcified,

and an accompaniment of this phenomenon seems to be the sloughing of the outer surface. The surface is frequently essential in the identification of a fragment of bone as a tool. A number of chance scraps in the collection could have served as implements, but because the outer surface is gone, the polish acquired through use is missing, and for that reason it can not be stated with assurance that they were tools. Each of these specimens has a tapering, blunt-pointed end like that on punches and awls. Their sides have been rubbed and the base end is rounded, but because signs of usage are absent they cannot be designated as such tools. There is no question but that the people used bone implements, because the collection contains small fragments, preserved by having been charred in a fire, that exhibit the smooth and highly polished surfaces characteristic of awls. The pieces are too small, however, to give any clue as to the size and general shape of the specimens. Two pieces cut from the shaft of a long bone, each with one sharp, well-defined edge, would be serviceable as knives or fleshers. As green bone they would have functioned efficiently either in skinning or in scraping the fat and hair from a hide. The edges of both are slightly discolored and show a trace of polish. Another object suggests that it was the end of a paddlelike scoop. It also was cut from the shaft of a long bone.

The bone disk with ticked edges (pl. 9, *c*) has already been mentioned. This object was probably a marker or gaming die. It cannot be considered as an ornament in the strict sense of the word, as there is no perforation for suspension and no indication that it was attached to any other substance. It seems to have been fashioned from a piece of scapula or shoulder blade. Both faces are smooth, except for the series of cut lines bordering the circumference. This specimen and approximately half of one similar to it obtained by the Denver Museum party are the best examples of worked bone found at the Lindenmeier site. The disk measures 34 by 28 mm, and is 2 mm thick.

The channel flakes form an interesting series because they demonstrate so impressively the consummate skill of the men who struck them off from the sides of the points. The flakes are smooth on one side, the one that formed the groove in the face of the point, and flaked on the other. Some are paper-thin; others are as much as 2 mm thick. One good example from a white chalcedony point is 45 mm long, 13 mm wide, and 1 mm thick. It is unquestionably the complete spall from the channel. One piece of channel flake fits into the groove on one of the butt ends recovered from the site. This is the only example of the flake and the point thus far obtained. Many of the channel flakes were discarded when removed, but others, as men-

tioned in the discussions of the gravers and knives, were employed in some utilitarian fashion before being tossed aside. Every type of material observed in the points or fragments of points is represented in the channel flakes.

The hammerstones are as a rule merely nodules with battered ends. Any chance stone which could be held in the hand and used for striking seemed to answer the purpose, although in a few cases (pl. 12, *i*, for example) the stone was roughly shaped to an oval form. The majority were like *k*, plate 12, however. These objects were probably employed in knocking flakes off large nodules, for cracking bones, and other purposes where a striking implement would be required. Harder types of stone were used for this purpose, and the specimens in the collection are of granite, quartz, and petrified wood. The hammerstones range between 12 and 16 ounces in weight.

The pieces of sandstone in the collection show that they were used as rubbing stones. Many of them have distinctly flattened sides and ends (pl. 12, *a, b, d*). Some of them suggest the small hand stone used by the later Indians in grinding grain, nuts, and other materials, but no mortars or nether milling stones have been found, and it therefore seems that they must have had some other function. As most of the fragments of this type are stained with red pigment, it is possible that they were used to work color into a skin or some other substance. One of the stones (pl. 12, *c*) has a shallow concavity in one side and may have been a paint bowl. A similar specimen was found in the 1934 work. Neither indicates that it was a mortar in which pigment was ground. Both must have served merely as mixing bowls or palettes. One piece has a number of grooves or scratches in one side. These indicate that it was employed as a sharpening stone for touching up the ends of bone awls.

Many pieces of hematite were obtained from various places in the excavations. Some are very small, but others are sizeable nodules. The surfaces on all of them are smooth and striated from rubbing. One piece was shaped until it approximates a trapezoidal form. An attempt was obviously made to perforate it, as it was drilled on two sides, but the hole was not completed. The owner probably intended to suspend it on a thong either as a pendant or to prevent loss. Hematite was widely used by the later Indians both for the making of ornamental objects and as a source of paint. To judge from the numerous fragments in the present collection, Folsom man also found it a necessary component in his material culture complex.

IDENTIFICATION OF BONES AND MOLLUSKS

A number of animals, in addition to the bison, are represented by the bones found at the Lindenmeier site. As mentioned in the discussion of the bison pit, Dr. Gazin has identified the remains of that animal as a form of *Bison taylori,* one of the extinct species. The other bones were submitted to Dr. Remington Kellogg, assistant curator, division of mammals, United States National Museum, who made the following identifications:

Fox, *Vulpes velox.*
Wolf, *Canis nubilus.*
Rabbit, *Lepus townsendii campanius.*
Pronghorn (Rocky Mountain antelope), *Antilocapra americana.*

The fox, wolf, and rabbit were represented in the material obtained in 1934, but the antelope was a 1935 addition. The bison is the only extinct animal in the group. There has been no change in the others from the time of the Pleistocene; hence they throw no light on the problem of the age of the site.

The invertebrate material was submitted to Dr. Horace G. Richards, research associate, New Jersey State Museum. The specimens and his identifications were checked by Dr. H. A. Pilsbry, of the Academy of Natural Sciences of Philadelphia. Dr. Richards found nine species represented in the mollusks. They are:

Gastrocopta armifera Say.
Gastrocopta ashmuni Sterki.
Pupilla muscarum (Linne).
Pupoides inornatus Vanatta.
Pupilla sonorana Sterki.
Vertigo sp.
Valonia gracilicostata Reinh.
Succinea avara Say.
Zonitoides arborea Say.

Seven of these species live in the region today. Two of them are considerably north of their present northern limits. *Gastrocopta ashmuni* Sterki has its present northern limits at Grand Canyon, Ariz., and southern and central New Mexico. The other, *Pupilla sonorana* Sterki, has a present northern limit of Mora County, N. Mex. According to Dr. Richards, this northern occurrence of the two species may indicate a warmer climate at the time of the deposition of the fossils.[23]

[23] Letter from Dr. Richards to the writer, Dec. 14, 1935.

SUMMARY AND DISCUSSION

The 1935 investigations at the Lindenmeier site consisted of the digging of two large trenches through the area where objects attributable to Folsom man are found, of further excavations in the deep pit in the ravine bank where most of the specimens obtained during the preliminary investigations were dug, and of uncovering the remains of a group of bison at the location where Judge C. C. Coffin, A. L. Coffin, and Maj. Roy G. Coffin made their original discoveries. The collection obtained from the work contains some 750 specimens, large quantities of chipper's debris, and numerous bones from animals killed by the former occupants of the region. The artifacts comprise a series of tools and implements of which 11.3 percent are points, 32.8 scrapers, 5.6 gravers, 1.0 chisel-gravers, 0.5 choppers, 3.0 knives, 6.3 large blades, 0.8 hammerstones, 1.6 pieces of hematite which have been rubbed or shaped, 13.6 channel flakes from the longitudinal grooves in the faces of the typically fluted points, 4.0 sandstone rubbers, 0.5 pieces of bone showing evidences of workmanship, and 19 percent flakes showing signs of work but too nondescript in character to permit classification as types of implements. The artifacts as a group show that the lithic component in the local cultural pattern was primarily a flake industry, slightly less than 1.5 percent of the implements being of the core type.

The size range in the points in the collection raises a pertinent question, namely. On what type of weapon were they used? The general conception, based on knowledge of the Southwest and the Mexican area, has been that the bow and arrow was a late development in the New World and that older cultures employed a spear and spear thrower. Archeologists occupied with the Folsom problem have assumed that the fluted points, because of their size, were used in a shaft hurled from a spear thrower. Many of the smaller examples in the present group could easily have functioned as arrowheads and suggest that the early bison hunters may on occasion have used the bow. Definite conclusions should not be attempted solely on the evidence of stone points, but attention should be called to the fact that all of them are not necessarily of a size requiring a spear shaft.

Interesting evidence on one of the "burning issues" in the archeology of the western plains area, the Folsom-Yuma problem, was obtained from the investigations. Stratigraphic material demonstrated that as far as the Lindenmeier site is concerned there was only a very late contemporaneity between Folsom and Yuma points, the Yuma appearing toward the end of the Folsom occupation and surviving

longer. Furthermore, Yuma points constitute so small a factor that it is questionable whether they should be considered as belonging to the complex.

Five species of animals are represented in the bones from the site. Only one, the bison, is an extinct form. Nine species of mollusks were found and while none of these is extinct, two are considerably north of their present range. Their presence at the Lindenmeier site is considered an indication that the climate was somewhat warmer and moister when Folsom man was there than it is now.

The large trenches revealed in cross-section the deposits overlying the old level of occupation and demonstrated that what now constitutes a terrace was at one time an old valley bottom. The ridge that bordered its southern side has been eroded away since the area was abandoned by its aboriginal occupants. The nature of the valley fill, as exposed in the trench walls, suggests that the changes which culminated in the present state of the site could not have been extremely rapid ones. Considerable time must have elapsed since the layer containing the man-made objects was laid down. Evidence in the trenches also indicated that the makers of the tools and the Folsom points stopped for a time along the slope above the old valley bottom. If the trenches did not cross a portion of the real campsite, they at least bordered on it. This was shown by the finding of cut and burned bones, charcoal and wood ashes, hammerstones and chipper's debris, and implements broken in the making. All were so situated that their locations could not be attributed to drift or to the washing down of material from higher levels. The broken implements, when the fragments are fitted together and the original flake is restored, give good evidence of the technique used in the manufacture of tools.

The trenches did not produce data that are of aid in determining the age of the site. Despite their establishing the fact that the soil layer in which the objects are found was produced by the natural decay and break-up of the top of the Oligocene bed underlying the area, they gave no clue either to the agency that originally eroded away the overburden, thus laying bare the Tertiary stratum and forming the old valley, or to the time when the action took place. Conditions at the Clovis lake beds are somewhat better from the standpoint of dating, and Dr. Ernst Antevs has reached the conclusion, from extensive studies of the area, that the Folsom artifacts found there represent an antiquity of from 12,000 to 13,000 years.[24] Since the Clovis material indicates that it comprises the relics of a people whose material

[24] Antevs, 1935, p. 311.

culture was similar to that of the group occupying the Lindenmeier site, it may be suggested that the latter was approximately the same age. This should not be regarded as an established fact; it is merely a postulation based on analogy. Subsequent work may show the two sites to have been as widely separated in time as they are in space. There is still an opportunity to obtain a geologic date for the Lindenmeier site through a study of the terrace system of the South Platte River and the relation of its terraces to the glaciation in the Rocky Mountains to the west. The Lindenmeier terrace can be correlated with those of the South Platte, but as yet there has been no determination of the ages of the latter. An attempt to solve this particular problem will constitute a part of the program for future work in the region.

No human remains have been found, and so far as his physical characteristics are concerned, Folsom man is still a *persona incognita.* There is no evidence as to what type of shelter he may have used. On the other hand it seems obvious that he was a typical hunter depending entirely upon the bison for his maintenance and sustenance. He no doubt supplemented his preponderant meat diet with wild seeds and "greens" but did not cultivate his own vegetal food. He probably did not settle long in one place but traveled wherever the bison moved, in order to support himself. For that reason it is not likely that his dwelling consisted of anything more substantial than a tent made from the skins of that animal. Traces of the places where he pitched his shelter will be extremely hard to find at this late date. A hard packed floor and hearth, perhaps some post molds, is the most that can be expected. He probably tarried as long at the Lindenmeier camp as he did at any of his settlements, possibly longer than at most of them when its advantages are recalled. Hence the chances of locating a lodge site or even of uncovering his own remains are not altogether beyond the bounds of likelihood.

The old valley bottom with its numerous meadows, marshes, and bogs undoubtedly attracted bison because of the reeds and sedge grasses for feed and the mire in which to wallow. It is not likely that large herds frequented the district—rather that small groups drifted in from the plains to the east. The presence of the animals would draw Folsom man into the area, but in addition there were the assets of raw material for use in making implements, a good supply of water, firewood, and a pleasant camping spot. Here he could stalk his game, cut and dry the meat not wanted for immediate consumption, tan the skins, make his tents and such clothing as his needs required, fashion

his tools from the available stone, and prepare his equipment for the inevitable trek when the bison shifted to other pastures.

Present indications are that the Lindenmeier site was not occupied continuously by a large group of people. It probably was an annual summer and fall camping grounds visited regularly over a period of years by smaller parties. That the intervals between occupations were not protracted is shown by the homogeneous nature of the layer in which the artifacts are found.

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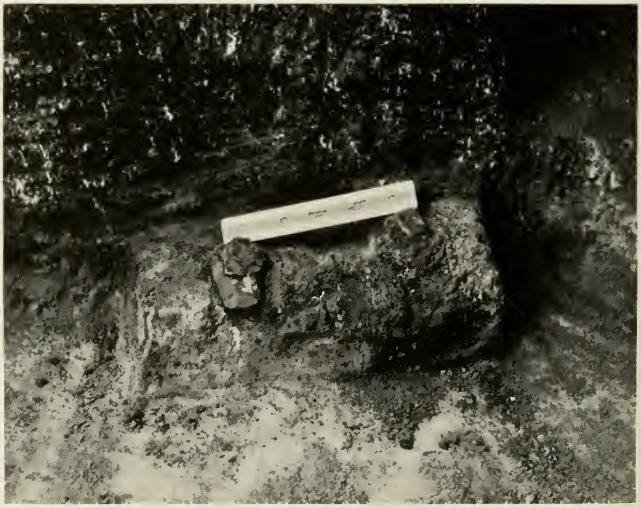
1. General View of Site Showing Ravine and Trenches Across Terrace

2. Lower End of Trench A

Man standing on top of clay substratum.

1. SIFTING EARTH FROM SECTION AT LOWER END OF TRENCH A

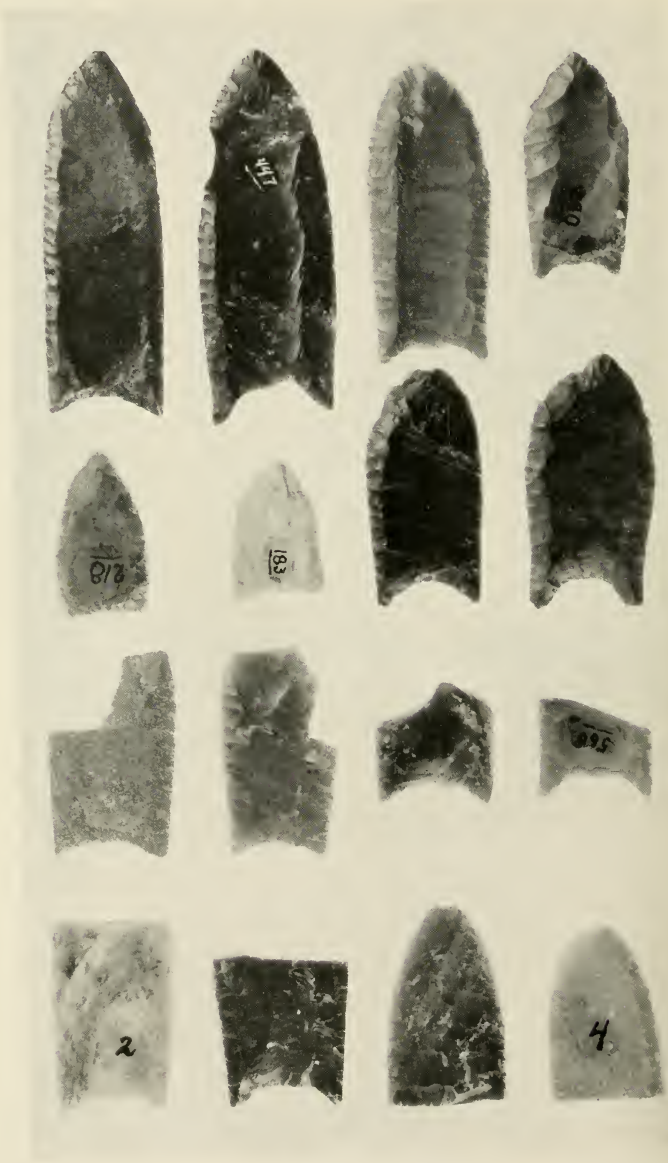


2. ARTIFACTS IN SITU

Chopper at left, portion of Folsom point at right.

1. Uncovering Articulated Bison Leg in Bison Pit

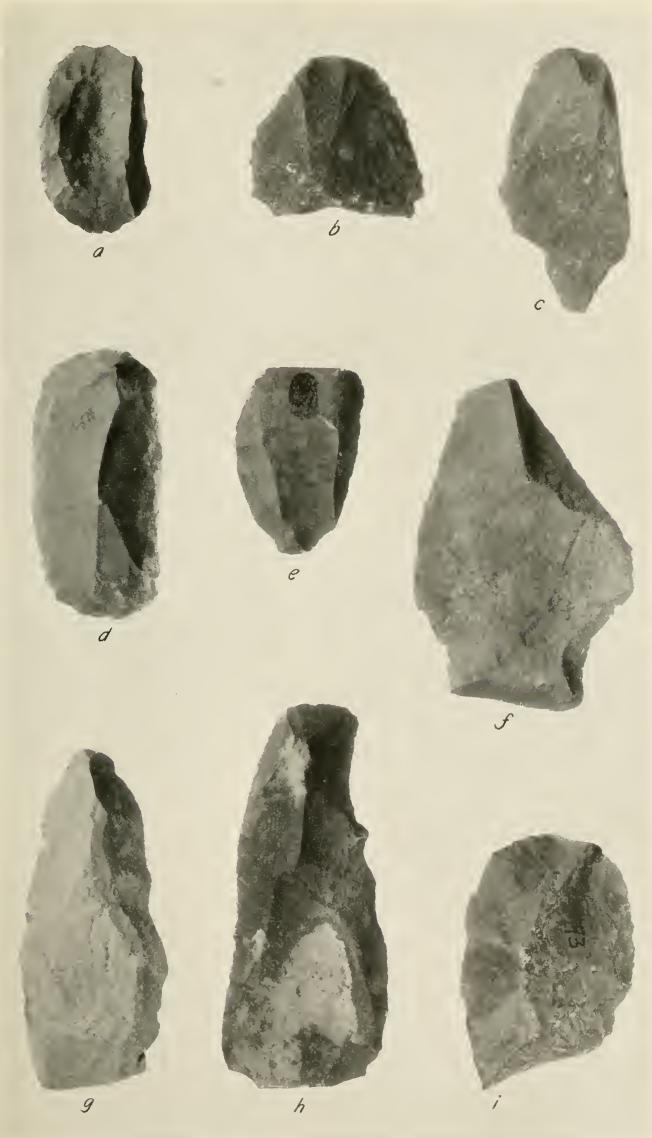
2. Vertebra With Point in Vertebral Foramen



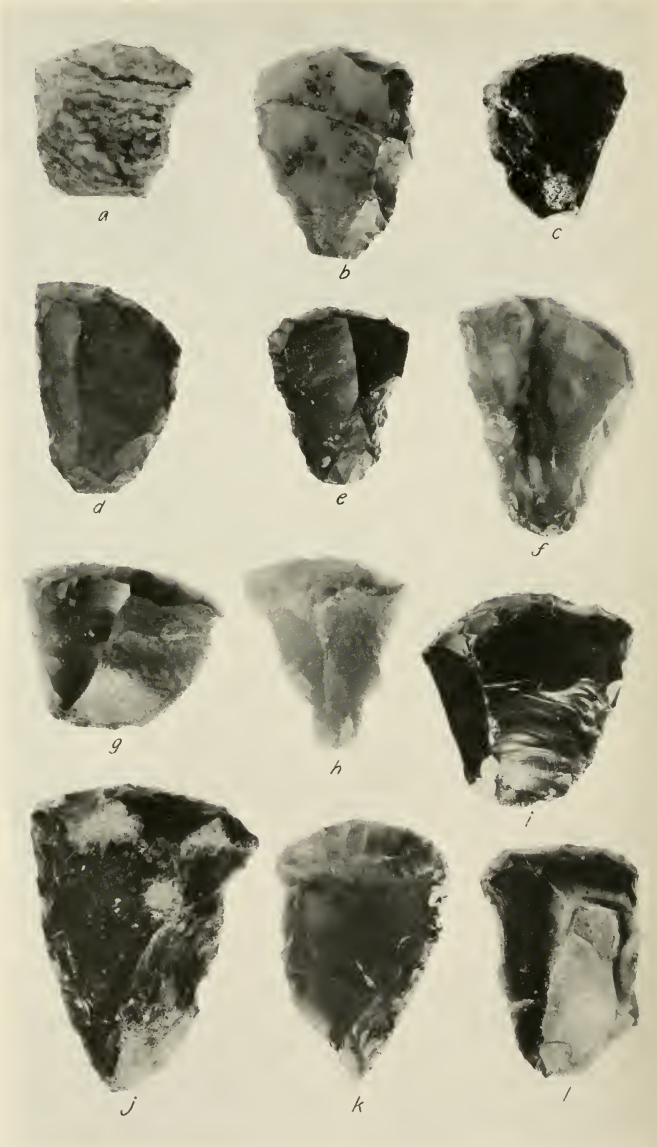
FOLSOM POINTS
Actual size.

SIDE SCRAPERS
Actual size

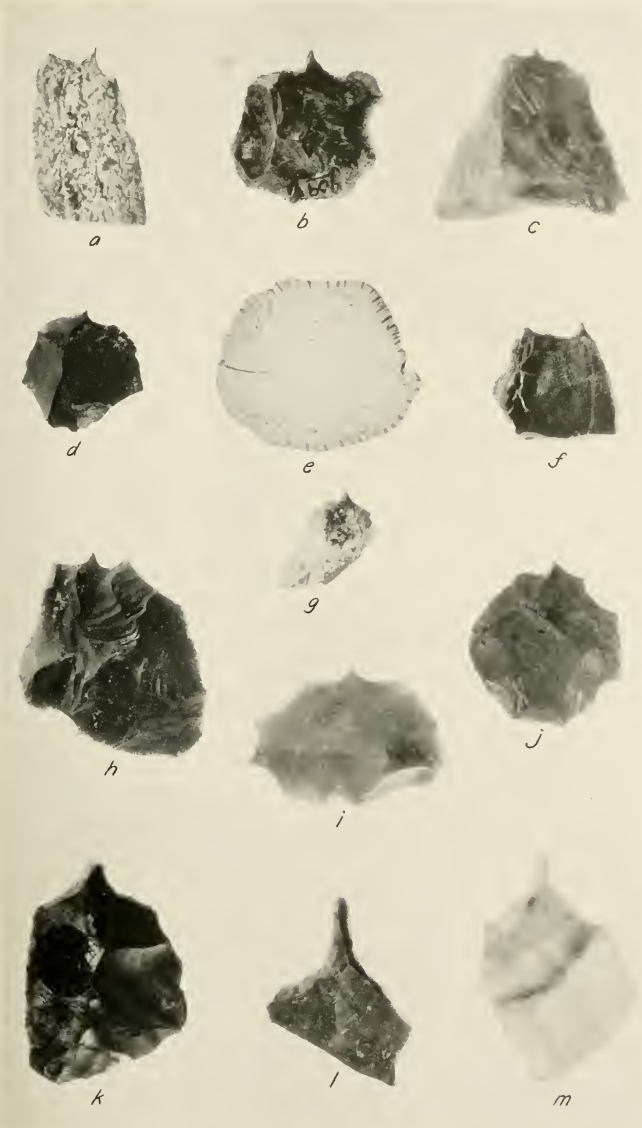
SIDE SCRAPERS
Actual size.



LARGE QUARTZITE SCRAPERS
One-half size.



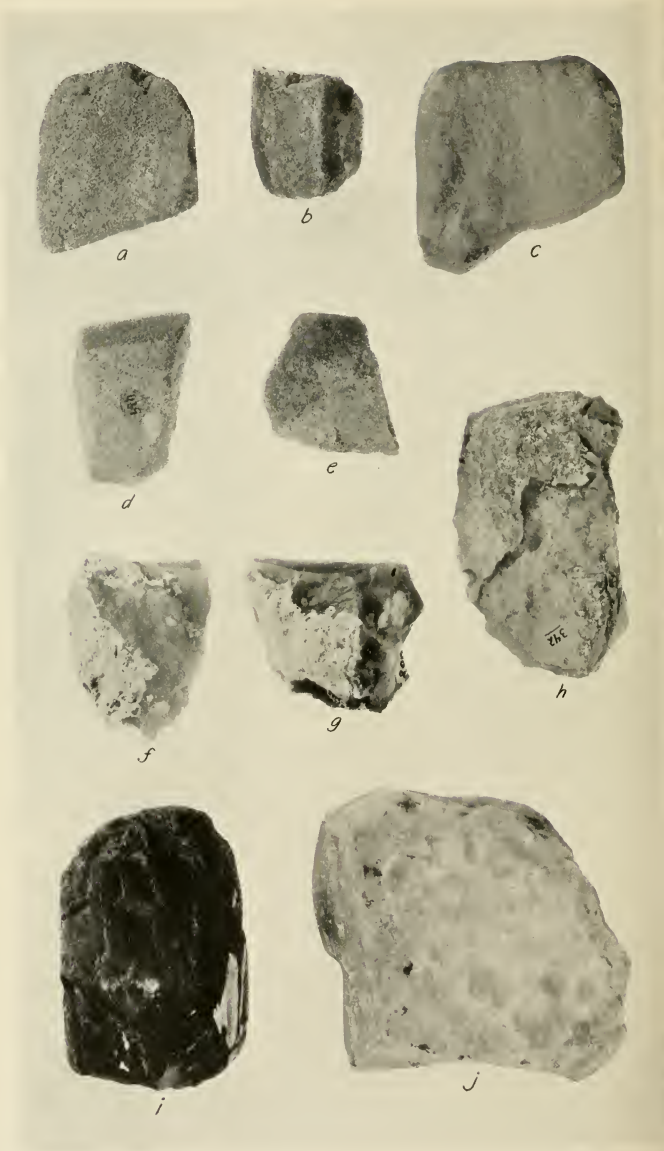
"SNUB-NOSED" SCRAPERS
Actual size.



GRAVERS, CHISEL-GRAVERS, BONE DISK
Actual size.

FLAKEKNIVES
Actual size.

FLAKEKNIVES
Actual size.



RUBBING STONES. *A–E*; SCRAP NODULES. *F–H*; HAMMERSTONES. *I–J*
One-half size.