

2
58-6.
DEPARTMENT OF THE INTERIOR.

BULLETIN

OF

THE UNITED STATES

GEOLOGICAL AND GEOGRAPHICAL SURVEY

OF

THE TERRITORIES

SECOND SERIES, No. 1.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1875.

DEPARTMENT OF THE INTERIOR.

BULLETIN

OF

THE UNITED STATES

GEOLOGICAL AND GEOGRAPHICAL SURVEY

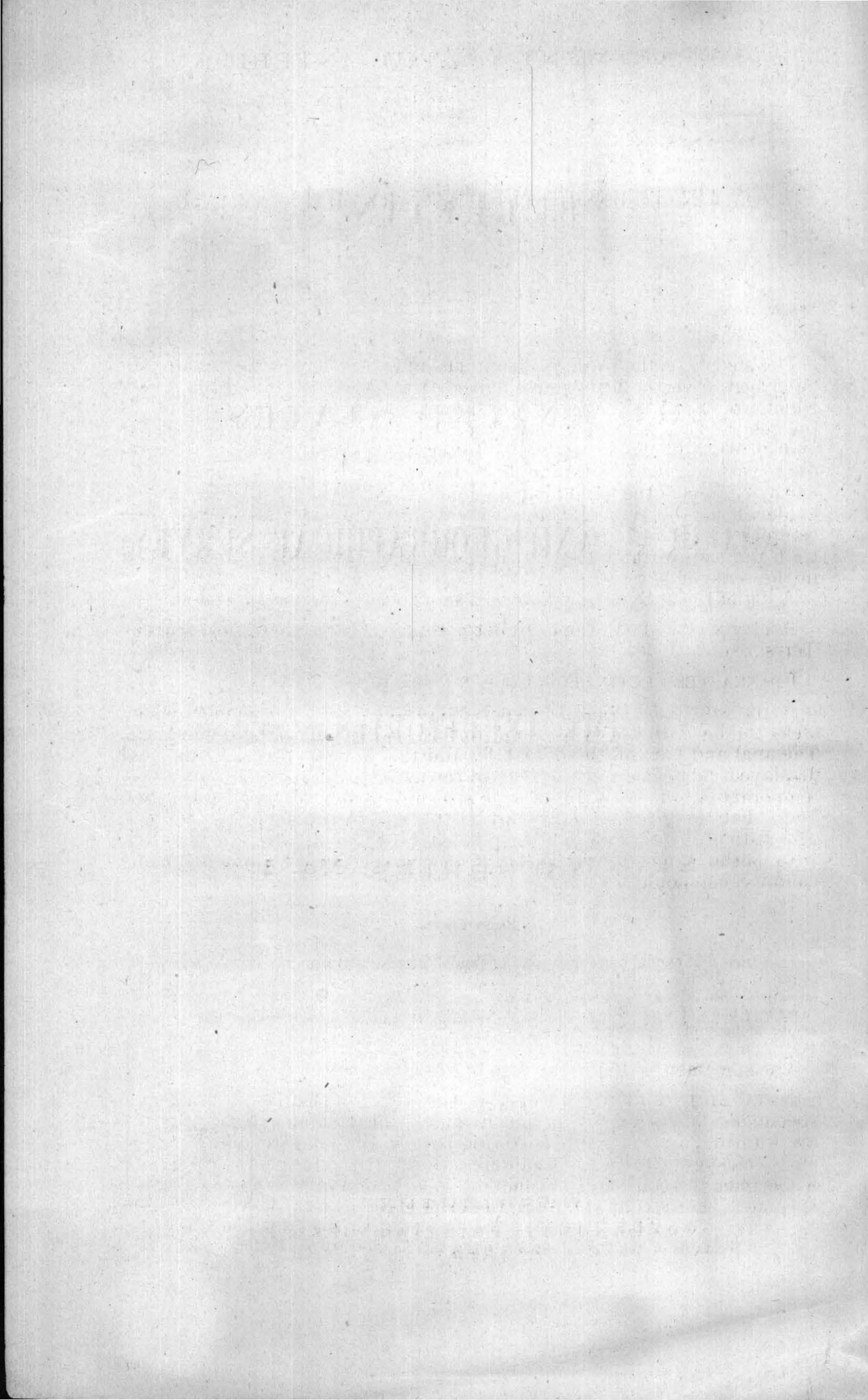
OF

THE TERRITORIES.

SECOND SERIES, No. 1.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1875.



ON THE FISHES OF THE TERTIARY SHALES OF THE SOUTH PARK.

BY E. D. COPE.

The survey of the present season has added to the few species already described, from the beds above named,* two forms of the genus *Amia*, which are described below. The species previously known belong to the genera *Amyzon*, Cope, and *Rhineastes*, Cope, members of the sucker and catfish families, respectively. Both genera are nearly allied to existing forms, and the addition of *Amia* increases the modern facies of the ichthyic fauna of the period in question. The discovery strengthens the evidence for the view that the waters inhabited by these fishes were completely isolated from access of salt or brackish water, thus differing from the beds of the Green River epoch, and occupying a later position in the scale of periods.

A list of the species now known from this formation is appended.

AMYZON COMMUNE, Cope, Bulletin United States Geological Survey Terrs., No. 2, p. 50.

RHINEASTES PECTINATUS, Cope, *loc. cit.*, p. 49.

AMIA SCUTATA, Cope, *sp. nov.*?—Represented by a specimen which lacks the head and body anterior to the middle of the long dorsal fin. The anal and part of the dorsal fin and the heterocercal tail are well displayed. The species differs from the existing *A. calva*, L., and its contemporary *A. reticulata*, in the large size of its scales, of which only seven and a half longitudinal rows are visible above the vertebral column. The radii of the anal fin number nine, and the caudal vertebræ forty-six, with, perhaps, one or two missing from the specimen. The ray-bearing caudal hæmapophyses number twelve.

Measurements.

	M.
Length from first caudal vertebra to end of caudal hæmapophyses	0.210
Depth of body at anal fin.....	.100
Length of base of anal fin.....	.028
Length of body of a vertebra.....	.005
Depth of body of a vertebra009

The specimen is of the full size of the *A. calva*.

AMIA DICTYOCEPHALA, Cope, *sp. nov.*—Established on a number of specimens, but primarily on one in which the caudal and inferior fins are wanting, and only the posterior part of the skull remains. A second consists of the entire cranium; a third, of the tail; and a fourth, of a specimen in good condition, lacking head and tail. The first-mentioned specimen shows that there are ten or twelve rows of scales above the

* Bulletins of the United States Geological Survey: Bulletin No. 2, p. 49.

vertebræ, and that the dorsal fin commences about an inch behind the line of the posterior border of the cranium. It also exhibits the strong sculpture of the surfaces of the latter to consist of narrow inosculating ridges, inclosing larger and smaller pit-areas.

The specimen exhibits this sculpture to be very marked on the opercular, suborbital, parietal, frontal, and sublingual bones, the only ones where it displays the surface. The branchiostegal radii number twelve, the upper large and wide. The subopercular is turned up anteriorly as in *A. calva*, and is thickened on the border of the suture with the interoperculum. The sublingual bone has much the form of that of *A. calva*, but is rather wider and there more abruptly contracted than in a specimen of the latter before me. The orbit is smaller relatively than in *A. calva*.

It is uncertain whether this and the preceding species possessed the dentition of *Amia* or *Pappichthys*, Cope, as the mandibular bone is partially broken away on the inner side. Some of the teeth are of small size and abruptly contracted near the apex, so they may belong to the inner row of the true *Amia*, which is wanting in *Pappichthys*.

The fourth specimen displays the ventral fins and the characteristic femoral supports. The fins originate about an inch behind the line of origin of the dorsal fin in a specimen of 0^m.055 depth of body. The scales exhibit also the dermal margin with truncate posterior outline seen in the existing species; this character is chiefly seen on the abdominal surfaces. There are thirty-five vertebræ between vertical lines drawn from the beginning of the dorsal fin and end of the basis of the anal fin; and thirty-two dorsal radii in the same interval; anal radii, nine; ventrals, six.

Measurements.

	M.
Depth of body to vertebræ (No. 1).....	0.045
Length of four dorsal vertebræ (No. 1).....	.019
Depth of one dorsal vertebra (No. 1).....	.010
Length of head to free border of operculum (No. 2).....	.124
Depth of operculum.....	.032
Length of head on vertex.....	.093
Length from end of muzzle to orbit.....	.032
Length of orbit.....	.012

AMYZON PANDATUM, *sp. nov.*—Form very stout; the body deeper in relation to its length than in the known species of *Amyzon*: greatest depth just in front of dorsal-fin, and two-fifths the length to basis of caudal. Length of head one-third the latter. Spines of premaxillary causing a protuberance above the end of the muzzle, as in many existing *Catostomi*. Mouth slightly inferior; end of muzzle obliquely truncate in profile. Dorsal fin elongate elevated in front; radii mostly short; caudal openly emarginate; anal not very elongate in either direction; ventrals below first rays of the dorsal. Radii, D., III, 31; A., II, 11. Scales, ¹⁰⁻¹²₁₀₋₁₁, with concentric and radiating lines well developed. Vertebræ, 6, 17, 10.

Measurements.

	M.
Total length.....	0.112
Length to basis of caudal.....	.093
Length to basis of anal (axial).....	.071
Length to basis of ventral (axial).....	.041
Depth of caudal peduncle.....	.015
Depth of anterior anal rays.....	.022
Depth at occipital crest.....	.030

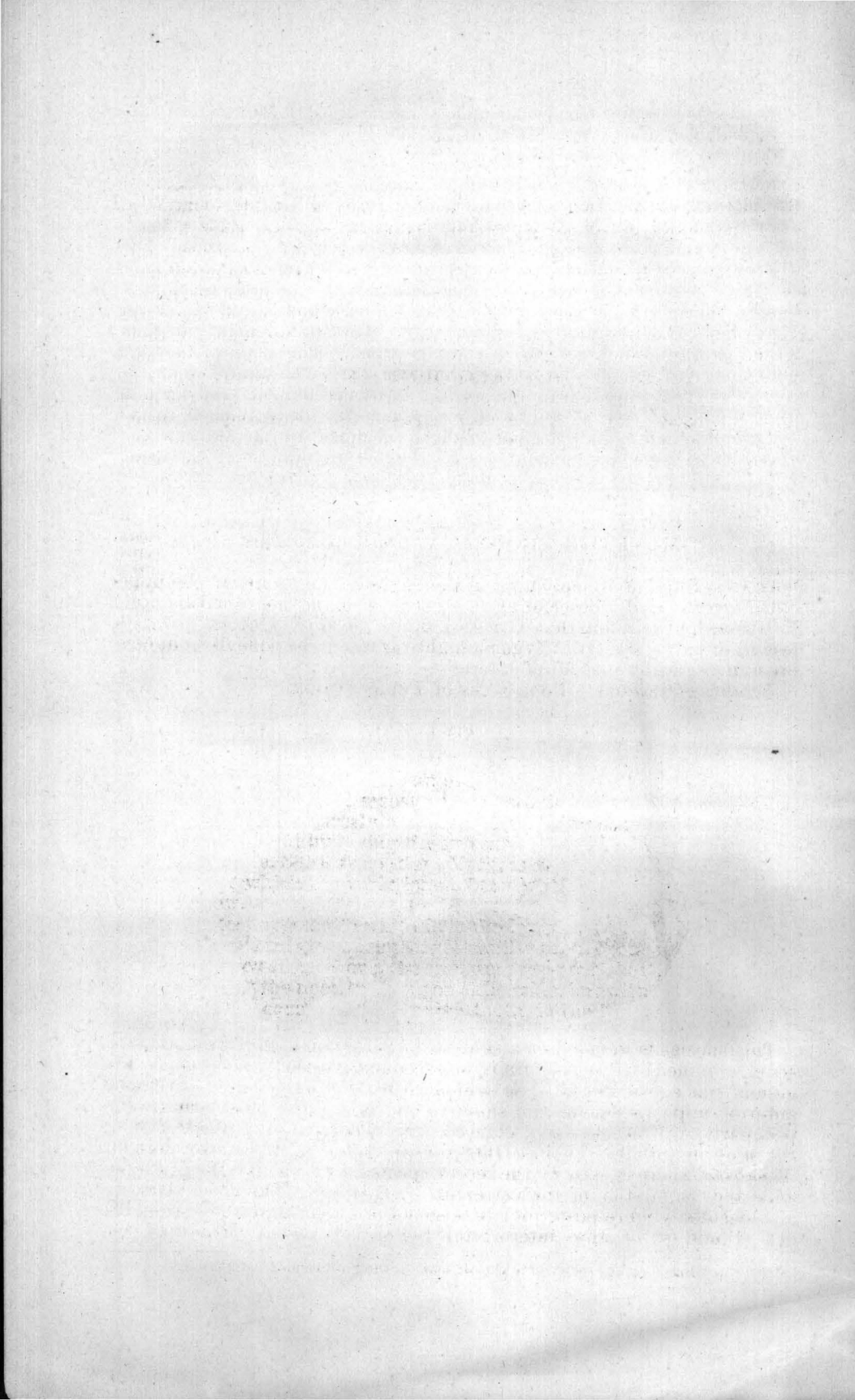
In another rather larger specimen, which agrees with that above described, the lateral line is well preserved.

From the South Park, Colorado.

AMYZON FUSIFORME, *sp. nov.*—Represented by a very small fish, which exhibits fully ossified bones, but may be immature. It exhibits characters quite distinctive, although the caudal peduncle, anal fin, and opposite parts of dorsal are wanting. The head is very perfectly preserved, and is of a regularly short-conic form, with equal lips. The attenuated muzzle shows none of the obtuseness characteristic of the other *Amyzons*. Another peculiarity is seen in the ventral fins, which stand below the eighth instead of the first articulated ray. They are evidently in their normal position, and the ribs are undisturbed. The pectorals extend more than half-way to the ventrals. There are seven neural spines in front of the first interneural, and sixteen between the latter and the first interhæmal. In this, as in the other species, the postclavicle is rather elongate and acute, and the parapophysial element of the anterior vertebral mass extends as far down as the line of the middle of the orbit.

Measurements.

	M
Length of head	0.0095
Length to line of ventrals0180
Length to line of anal0239
Depth at first dorsal ray0105
Depth at occiput0070



ON THE CRANIAL AND DENTAL CHARACTERS OF MEPHITINÆ, WITH DESCRIPTION OF MEPHITIS FRONTATA, N. SP. FOSS.*

BY DR. ELLIOTT COUES, U. S. A.

DENTAL FORMULÆ.

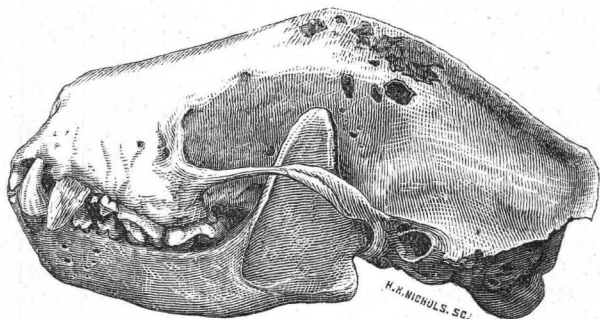
$$\begin{array}{l} \text{I. } \frac{3-3}{3-3}; \text{ C. } \frac{1-1}{1-1}; \text{ P. } \frac{3-3}{3-3}; \text{ M. } \frac{1-1=16}{2-2 \quad 18}=34: \left\{ \begin{array}{l} \text{Mephitis,} \\ \text{Spilogale.} \end{array} \right. \\ \text{I. } \frac{3-3}{3-3}; \text{ C. } \frac{1-1}{1-1}; \text{ P. } \frac{3-3}{3-3} \text{ or } \frac{2-2}{3-3}; \text{ M. } \frac{1-1}{2-2} = \frac{6}{18} \text{ or } \frac{14}{18} = 34 \text{ or } 32: \text{ Conepatus.} \end{array}$$

MEPHITIS FRONTATA, Coues, n. sp. foss.

DIAG.—Skull extremely high in the middle; the profile of the upper outline very rapidly descending in a nearly straight line from this point to the occiput and muzzle. Greatest depth of skull without jaw little less than half its length. Zygoma highly arched; the bone in front compressed vertically instead of laterally.

Locality of remains.—Bone-caves of Pennsylvania.

Fig. 1.



This species is founded on a skull, No. 2232 of the Smithsonian Museum, obtained by Professor Baird in the bone-caves of Pennsylvania. The animal was a true *Mephitis*, as evidenced by the functionally-developed anterior upper premolar and shape of the jaw. The most remarkable peculiarity will be seen at a glance in the accompanying illustration of the skull in profile. Though the frontal region is tumid throughout *Mephitina*, there is seen in the recent species nothing like the protuberance and angulation of the vertex of *M. frontata*. The prominence is also decidedly more posterior; it is something over and above the general tumidity of the interorbital region of recent *Mephitis*; the

* Based on the material in the Museum of the Smithsonian Institution.

shape is rather as a *Gulo*; but even the profile of the latter is here exaggerated. The prominence appears to be mainly due to enlargement of the frontal sinuses, as may be seen in this specimen, on which the outer tablet of the skull is abraded in places, exposing the interior. With this general elevation is associated a notably higher arch of the zygoma; but the bone itself is slenderer than in recent species at its anterior portion, where it is curiously narrowed vertically instead of being laminar throughout. None of these characters obtain in any of the numerous recent skulls examined, notwithstanding the great variability of the latter.

The animal was the size of the common species. The skull in general bulk is intermediate between various specimens of *M. mephitica*.

The excellent figure, engraved by Nichols, of Washington, from an photograph on wood by Smillie, renders further description unnecessary.

MEPHITIS MEPHITICA, Bd. ex Shaw.

(*M. americana* or *chinga*, of authors.)

The cranium of no animal with which I am acquainted varies more than that of the skunk, and few exhibit such remarkable differences, independently of age and sex. Some specimens are more than a fourth larger than others, and twice as heavy; and there is a corresponding range of variation in contour. Compared with an ordinary ratio of osteological variability, the discrepancies are almost on a par with those exhibited by the coloration of the animal when set over against the more constant markings of most animals. In the series of twenty or thirty skulls examined, I find that the western ones, and especially those from the Pacific coast, representing *occidentalis* of Baird, are, as a rule, larger and heavier than others, more widened and flattened behind, with stronger and more flaring sagittal and especially occipital crests. But these extremes shade insensibly into an ordinary pattern, and I can draw no dividing line. Tables of measurements would show these variations, though they would scarcely render that realizing sense of the discrepancies that is found by laying the two extremes side by side. An average cranium, No. 3816, from New York, is selected for description, in the course of which the variations of the whole series will be brought under review.

The greatest zygomatic width is to the length as 1 to 1.55, or slightly less than two-thirds such length. A similar proportion is generally preserved. Viewed from above, the cranium presents a short, tumid, rostral portion, high at the nose, tapering on either side, but with a protuberance indicating the course of the canine tooth in the bone, subtruncate in front, with large subcircular nasal aperture, in this view much foreshortened. The rostrum is about a third of the whole length, if measured from extreme front to anterior root of zygoma; the zygoma, and then the rest of the skull, being, respectively, another third. In other skulls, the rostrum is shorter than this, and less vaulted. The general convexity of the rostrum continues on to the forehead, in the broad, smooth, interorbital space. Supraorbital processes are very slight, being only indicated in a little bulging at the front, where the anterior forks of the sagittal crest come to the brim of the orbit. There is thus scarcely any definition of the orbit from the general temporal fossa. The point of greatest constriction of the skull is considerably behind

the supraorbital process, just about half-way from end of rostrum to occiput, and opposite the apex of the mandibular coronoid, when the jaw is closed. It is a gradual pinching-together of the sides of the cranium for some distance, rather than an abrupt constriction at a particular point. It is sometimes unsymmetrical, one side being more emarginate than the other; is sometimes scarcely narrower than the interorbital space, sometimes about three-fourths as much. Back of this point, the skull widens rapidly to the hinder root of the zygoma and mastoid; the latter being the broadest point of the skull proper, separated from the former by an emargination, in which lies the opening of the meatus auditorius not visible from above. From each mastoid, the skull narrows in an approximately straight line backward and upward for a distance, and then ends with a straight-across contour, more or less emarginate on the median line. This whole posterior boundary, representing the lambdoidal crest, is extremely variable, not only according to age, but fortuitously. In some skulls—those with the broadest back part and most flaring occipital crest—there is a deep emargination in the middle line of the skull, boldly salient angles on either side of this, and a concave outline thence to the mastoid. This occipital flange hides all the parts beneath it. For the rest, the top of the skull shows a sagittal crest, (only in very young skulls a raised tablet,) well marked in all but young examples, forking anteriorly (at or a little in advance of the point of greatest constriction) to send a curved leg outward to either supraorbital process. Aside from this crest and the occipital one, the general cranial surface is vaulted. The zygomatic arches, viewed above, show the point of widest divergence near their posterior roots, whence they gradually and regularly converge forward with slight curve.

Viewed in profile, the skull shows its highest point at the interorbital space, whence it slopes gradually with a general slight convexity to the muzzle and occipital protuberance. This highest point is generally a little, sometimes decidedly, in advance of the middle of the skull. The frontal profile may acquire a slight concavity, and the opposite one may be slightly sinuous, owing to irregularity of the sagittal crest. The muzzle is cut squarely off, with an obliquity of perhaps 30 degrees from the perpendicular. The zygoma shows but a slight upward arch, and no beveling or special curve to define the portion of the orbit which it represents. It is laminar, narrowing midway, stoutest near posterior root. The anteorbital foramen* is a short perforation of a thin upper plate of its anterior root; behind, the glenoid fossa presents rather forward than downward. The prominent orifice of the meatus presents laterally between the root of the zygoma and the mastoid, which latter is a protuberant but blunt process immediately behind the meatus. Behind this, there is an emargination, terminated by the prominent downward-projecting paroccipital; back of this, the semicircular outline, foreshortened, of the occipital condyle appears.

The back of the skull is a subtriangular face, flat and perpendicular in general superficies, bounded above by the overhanging sagittal crest; either lateral corner being the prominent paroccipital, between which appear the faces of the oblique condyles, the upper border of the foramen being transverse with a slight curve.

The skull from below shows a broad, flat, palatal surface for about two-fifths of its total length. The palate ends about opposite, or a little

*As a curious but not very infrequent anomaly, this foramen is sometimes divided into several separate canals, through which branches of the facial nerve pass out apart from each other. I have observed the same thing in *Conepatus*.

back of, the posterior molars. This terminal shelf, representing the emargination between the pterygoids, is always broad and quite transverse; but the edge varies greatly in detail. It is commonly transverse, with a small median, backwardly-projecting point, producing a double emargination. It may be simply a broad curve, or it may present a median nick. The latter case is oftenest observed in specimens from the West, and constituted a chief character upon which *M. occidentalis* rested; but, with a larger series than Professor Baird examined, it is shown to be wholly fortuitous. The general shape of the palate is triangular; including the teeth, its greatest width behind is about as much as its length; anteriorly, it presents broad but short incisive foramina, scarcely reaching opposite the molars. The depth of the pterygoid emargination is considerably less than the length of the palate. The pterygoids are simply laminar, with strongly hamulate ends. They are usually parallel, but sometimes converge a little posteriorly, making the inclosed space club-shaped. The general surface of the base of the skull behind is quite flat, owing to slight inflation of the bullæ. These are decidedly convex only at one place, interiorly, elsewhere flat, and outwardly produced to form a tubular meatus. Traces of separation from surrounding parts long persist; at least, in front. About the bullæ are seen the following foramina: one in advance, just inside the glenoid fossa; two at the anterior extremity of the bulla; three along its inner border; one more exterior, near the mastoid; one far posterior, in the occipital. The basi-sphenoid suture, early obliterated, is straightly transverse in advance of the middle of the bullæ. The general basilar area is flat, narrowing forward, unmarked, or with merely a slight median ridge. The border of the foramen magnum represents a deep emargination of the posterior border of this area, with the condylar protuberance on either side.

All the bones of the skull finally co-ossify, excepting, of course, the mandible, and most are joined at a comparatively early age. The periotic and internasal sutures persist the longest; the latter after the nasals are consolidated with the maxillaries, and the former after the basi-spheno-occipital suture is obliterated. When found separate, the nasals are seen to be regularly concave along their exterior border, truncate anteriorly, with a produced antero-lateral corner, and received by a pointed process in a recess of the frontal. The intermaxillary bone forms less than half of the general naso-maxillary suture. The maxillary extends within a short distance of the supraorbital protuberance. The malar is rather small, and fuses early with the rest of the zygomatic arch. The occipital bone is rather late to co-ossify; the supra-occipital is then seen to represent most of the lambdoidal crest, reaching, on either hand, from the median line half-way to the mastoid process; thence crossing this crest to the paroccipital, whence the suture runs on the floor of the skull along the border of the periotic by the foramen lacerum posterius to the basi-sphenoid; thence straight across the median line.

The lower jaw in *Mephitis* is never locked, as far as known, in the glenoid by the clasping of the condyle in the embrace of the fossa, as is the rule, in adult life, in *Meles* and in *Taxidea*, and as sometimes occurs in the Otters, (*Lutrina*.) The ramus of the mandible is stout, and nearly straight along the tooth-bearing portion; the symphysis is thick, short, abruptly ascending obliquely forward. Between the ramus proper and the angle of the jaw, the lower border is decidedly emarginate, and the angle itself is scarcely or not at all exflected (*cf. Conepatus*). The angle itself is obtuse, and there is a decided neck in the outline thence to the

condyle. The condyle is horizontal, transverse, very narrow, and acute internally; on the outer half, its articular surface looks upward; on the inner half, backward. The coronoid process rises straight and high, nearly uniformly tapering to the apex, a perpendicular from which falls decidedly in advance of the condyle (*cf. Conepatus*). The general muscular impression on its outer face is well marked. It is pointed below, and reaches forward on the ramus to a point underneath the last lower molar (*cf. Conepatus*).

As remarked under the head of *Conepatus*, the dental formula of the three genera of *Mephitinae* does not, in point of fact, differ. The difference is *nil* as between *Mephitis* and *Spilogale*; in *Conepatus*, a supposed lesser number of teeth is only true in the very small size of the abortive, deciduous, or, at any rate, not functionally developed anterior upper premolar. In *Mephitis*, also, the tooth may be very small, or even abortive, on one or both sides of the jaw; it is, however, normally present and readily recognizable.

Selecting an average skull, of middle age, with fully-developed, yet little-worn, dentition, (for in very old skulls the teeth are so ground down as not to furnish fair characters,) we observe the following points:

The back upper molar is the largest of the grinders, about as long as broad, quadrate, with rounded inner corners, and entirely tuberculous. It is completely divided across lengthwise by a sulcus, on the outer side of which is a narrow portion, much higher than the broad inner portion, and separated from it not only by the groove across the face of the tooth, but by a nick in the hinder border. This elevated outer moiety is oblique on its face from the general level of the dentition; it runs to a point at its fore and hind end, and has a central, slightly-excavated field, with irregular-raised boundary. The flatter inner moiety of the tooth is chiefly occupied by a large antero-internal tubercle, separated by a curved sulcus from a posterior raised margin. The next tooth—back premolar—differs altogether from the same flesh-tooth in the *Mustelinae*. It is relatively smaller, and has not a prominent isolated antero-internal fang. On the contrary, it is triangular in general outline, the inner corner of the triangle representing the fang of the *Mustelinae* just named; this is cuspidate, but this whole inner moiety is low and "tuberculous" in comparison with the elevated and truly sectorial character of the rest of the tooth; for, viewed in profile from the outside, the tooth seems wholly sectorial, with two cusps, an anterior, produced acute one, and a posterior, shorter and obtuse, separated from the other by an acute re-entrance. Taken together, these two external cusps make the trenchant edge of the tooth. The next premolar is immediately and very markedly reduced in size; it is a small, simple, two-rooted, conical, acute cusp, with a slight posterior "heel" and well-marked cingulum on the inner side. The next—anterior—premolar is exactly like the foregoing, but very much smaller still, and single-rooted; it sometimes aborts. In very old skulls, the foregoing descriptions can hardly be verified. The back molar wears down to a perfectly smooth face, with raised inner and outer borders; the flesh-tooth loses its edge and inner cusp, and becomes almost tuberculous throughout; the other premolars become mere stumps. The canines offer no points for remark. Of the upper incisors, the lateral pair is much larger than the rest, though not longer. I fail to appreciate any tangible difference in this respect between *Conepatus* and *Mephitis*. The tips of the teeth all fall in the same line; they are even and regular; the ends are obscurely lobate. These teeth start from the sockets quite obliquely, but soon turn perpendicularly downward, with an appreciable elbow.

In the lower jaw, the back molar, as usual, is small, simple, circular, single-rooted, with a central depression and irregularly-raised margin. The next molar is much the largest of the series, and very notably different from the same tooth in *Mustelineæ*. It is fairly sectorial throughout; for the back portion, though lower than the rest, is decidedly of the same character as the other part. This tooth consists of five cusps: a posterior pair, side by side, inner and outer, of equal size and similar shape; a middle pair, side by side, the outer of which is larger and sharper than the inner; and a single anterior cusp. The latter forms, with the exterior middle cusp, the main trenchant edge of the tooth. The interior middle cusp is a higher development of the "heel," more or less prominent on the inner face of the main cusp of the musteline tooth. The posterior pair of cusps is the low tuberculous part of the tooth in *Mustelineæ*. The first premolar from behind is a simple conical cusp, two-rooted, with evident heels, both before and behind, and a well-marked cingulum. The next tooth is similar, but smaller, with less of a girdle, and scarcely an anterior heel. The anterior premolar is like the last, but smaller still, and single-rooted. I have not seen its abortion. In very old skulls, the two molars become ground almost perfectly flat, and the premolars become stubby cones. The lower canines are shorter, relatively stouter, and more curved than the upper ones; there is usually quite an elbow at the point of greatest curve. The inferior incisors are more nearly of a size than is usual in *Mustelineæ*, and more regular, *i. e.*, none are crowded out of the general plane; but this is a matter of degree only. The outer pair is larger than the rest; viewed from the front, they widen from base to tip, and the apex is emarginate. The next pair sets a little back from the general plane; for, though their faces are generally quite flush with the others, yet their greater thickness causes them to protrude behind. All the under incisors are approximately of one length. The cutting-edge of the outer pair is oblique; of the others, horizontal. The cutting-edge of the outer pair is nicked, as already said; and the front faces of the rest are marked by a sulcus ending in a slight bilobation of their cutting-edges.

SPILOGALE PUTORIUS, Coues ex Linn.*

Mephitis zorrilla, bicolor or *interrupta* of late authors.

Numerous specimens before me, labeled "*bicolor*" and "*zorilla*," exhibit surprising variation in size and shape, without, however, warranting presumption that they are not all of the same species. Independently of the usual differences according to age, there is a remarkable range of variation in the width and depression of the skull behind and development of the occipital crest. An average specimen is selected for description, in which the range of variation will be also noted. Comparative expressions used have reference to the skull of *Mephitis mephitica*.

The skull is smaller than that of *M. mephitica*; excepting one abnormally large example, all are much less in every dimension than the smallest (adult) skulls of *M. mephitica* which I have seen. Viewed from above, the muzzle appears more tapering, if not also relatively shorter; the angle of obliquity of truncation of the nasal orifice is much the same. Supraorbital processes are small, but well defined, as acute eminences, prolonged from well-defined ridges of bone divaricating from the sagittal crest. This crest is a single and acute ridge in adult

* *Viverra putorius*, L., Syst. Nat., i, 10th ed., 1758, p. 44. (Based on Catesby.)

skulls; in young ones, it is a tablet of bone, the sides of which separate almost at once from the occipital protuberance. There is little, if any, postorbital constriction of the skulls; the least width there being little, if any, less than the interorbital width. The lateral divergence of the zygomata is much as in the last species. Behind, the skull is notably widened and flattened, almost as in *Taxidea* the intermastoid diameter being relatively much greater than it is in either *Conepatus* or *Mephitis*; in fact, it is not very much less than the interzygomatic width, in some cases, at least. The occipital crest is strongly developed, and its outline is characteristic in the great convexity of contour on each side and deep median emargination; in other genera the median emargination is always slight, sometimes *nil*; and the lateral outline from the mastoid to the point where the supraoccipital bones leave the general occipital crest is about straight—if anything, concave.

A notable peculiarity appears in the profile-view of the skull. The dorsal outline in *Mephitis mephitica* is strongly convex, with a high point about the middle, and this is carried to an extreme in *M. frontata*; in the present case, the same outline is nearly straight from the ends of the nasals to near the occipital protuberance; in fact, the skull is as flat on top as an Otter's, and flatter than a Badger's. The zygomata are strongly arched upward, with a regular curve throughout, instead of being highest behind; the prominence of the bulla ossea on the floor of the skull is sufficient to bring this part fairly into view from the side, as is scarcely the case in *M. mephitica*; this feature is also due, in part, to an abbreviation of the mastoid process, which is hardly at all produced downward.

On the floor of the skull, the principal feature is the width behind, which, being simply co-ordinate with the general lateral dilatation already noticed, requires no further comment. The paroccipitals are very small—in fact, mere ribs of bone, hardly able to bear the term "process." There is also a point in connection with the bullæ auditoriæ. These are not only more bullous at the usual point of greatest inflation, but behind this, the part that reaches between the lateral elements of the occipital bone and the lateral portion of the lambdoidal crest has also a general smooth convexity instead of an irregular concavity. The bony palate ends in the same relative position as in *M. mephitica*, and shows the same variation in the character of the edge of this shelf.

The mandible, though, of course, proportionally smaller than in *M. mephitica*, is identical in shape, contrasting equally well with the peculiarities of *Conepatus*, elsewhere mentioned.

The smaller size aside, there is scarcely anything in the dentition of this species calling for comment in comparison with *Mephitis*. The anterior premolar is well developed, and, as far as I can see, the dentition is, in other respects, nearly identical with that of *Mephitis*; the upper sectorial tooth, (posterior premolar,) however, has the cusp of its inner moiety rather a pointed process of the border itself than a conical cusp, surmounting this inner part.

It should be noted that in one specimen, as an abnormality, the anterior upper premolar has aborted entirely on the right side, though present on the left; while the lower jaw of the same specimen shows an abortive posterior premolar on the left side. But, in general, in *Mephitina*, abortion or other irregularities of dentition are less frequent than in the *Mustelina*, where the smaller teeth are more crowded.

CONEPATUS MAPURITO, Coues ex Gm.*

Mephitis (*Thiosmus*) *mesoleucus*, LICHT., and most late authors.

In the following description, reference is had to the same parts of *M. mephitica*, to which all expressions of comparison apply. The account is based mainly upon No. $\frac{1881}{790}$ Mus. Smiths. Inst., from Texas, but several other specimens are examined at the same time.

Viewed from above, the muzzle is notably tapering—decidedly more so than in *M. mephitica*, though the calibre at the base of the zygomata is even greater. The nasal aperture is much less foreshortened in this view. Supraorbital processes are barely, or not at all, recognizable; the prongs of the sagittal crest are faintly indicated or entirely inappreciable. The point of greatest constriction of the skull (about midway between muzzle and occiput) is well marked and abrupt; the skull immediately swelling behind it, forming a decided projection into the temporal fossa, hardly or not seen in *M. mephitica*. The cranial dome is rather higher and fuller. The zygomatic arches are comparatively shorter, more divergent, and more regularly curved. In profile, the differences are more striking. The highest part of the skull is back over the cranial dome, not at the interorbital space; the slope is but slight thence to the occipital protuberance, but is long and regular from the same spot to the incisor teeth; for so great is the obliquity of the nasal orifice that the end of the muzzle comes into this general curve, instead of rising, with slight obliquity, from the teeth to then bend abruptly backward at an angle. None of the specimens, unluckily, are young enough to show the nasal sutures; but I have no doubt that these bones, if not also the neighboring part of the maxillaries and intermaxillaries, will be found to afford good characters. The anteorbital foramen (as in other species, sometimes subdivided into several separate canals) is farther forward and higher up, piercing a thicker zygomatic root, and consequently being rather a tube than a hole. The zygomatic bones are slenderer and less laminar than in *Mephitis*. The arch, as a whole, is shorter and more anterior; in skulls of the same length laid together, the back roots of the arch in *Conepatus* fall in advance of the other when the muzzles are together. Viewed from behind, the occipital surface is much higher and narrower: thus the distance from the bottom of the foramen magnum to the occipital protuberance is greater than the interparoccipital width; in *Mephitis*, it is, if anything, less. Beneath, the palate is seen to end some distance back of a line drawn across behind the molars; the pterygoids and contained interspace are correspondingly shorter than in *Mephitis*, in which the palate ends more nearly opposite the back molars. The edge of the palatal shelf is simply transverse in some specimens, while in others it shows a little median process backward, and we may presume that in other cases it is nicked, for all this variation is now well known to occur in both *Mephitis* and *Spilogale*.

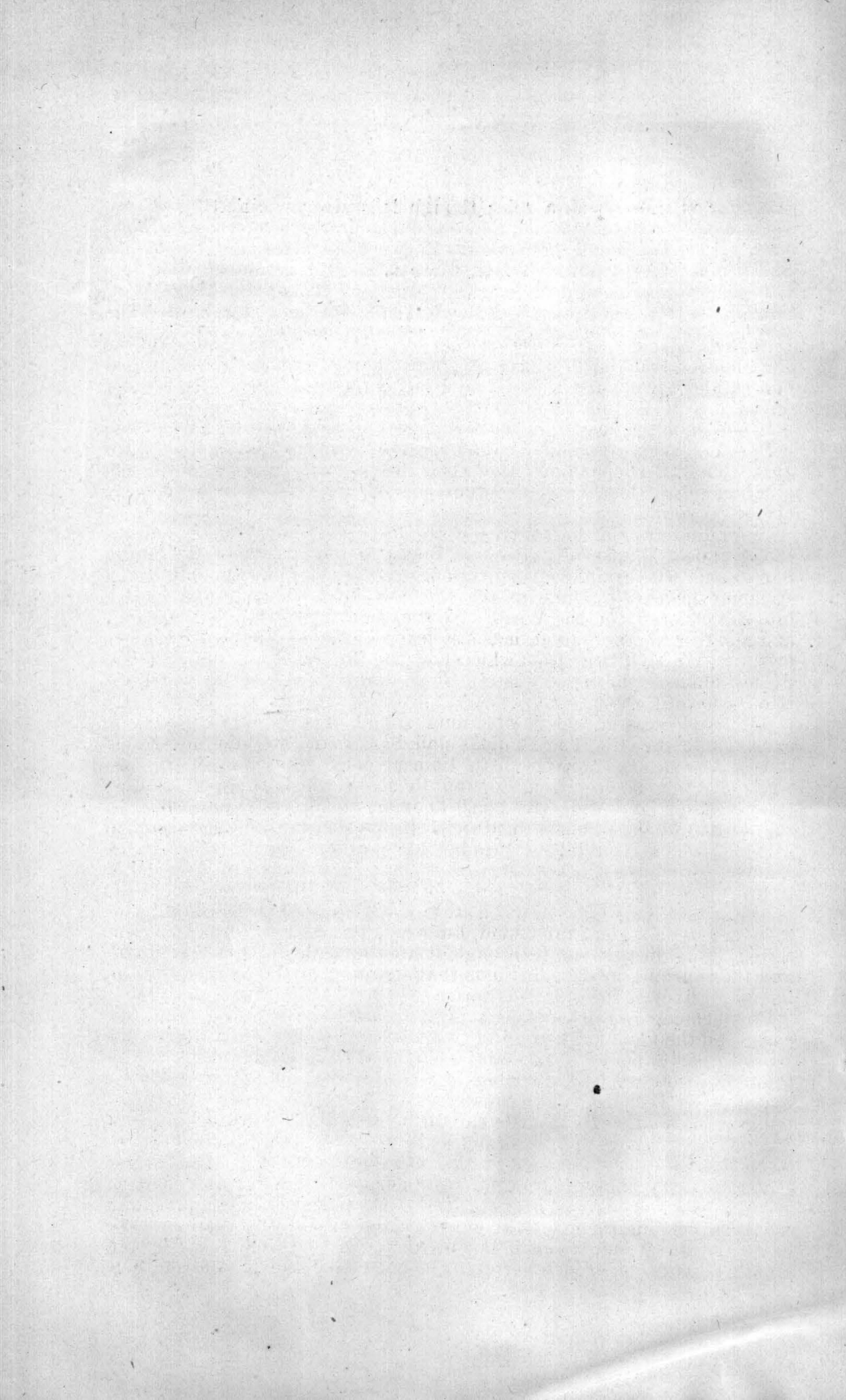
The lower jaw gives excellent characters. The angle of the mandible is strongly exflected and the emargination between this and the condyle is slight. The coronoid process rises with considerable backward obliquity, with a very convex anterior border, and concave posterior one, carrying the apex of the bone backward to a point nearly or directly over the condyle.

* *Viverra n apurito*, GM., Syst. Nat., i, 1788, p. 88.

A peculiarity of the dentition of *Conepatus* has been unduly exaggerated by some authors who assign a different dental formula, ($pm. \frac{2-2}{3-3}$)

as against $pm. \frac{3-3}{3-3}$ in *Mephitis*.) But the supposed wanting anterior premolar is present as a rule; though it is always minute, probably never functionally developed, and deciduous or abortive on one or both sides. I see this small tooth plainly in two skulls before me, but do not find it in a third; in which last, there is instead an unusul diastema between the canine and the nearest premolar. This point disposed of, nothing in the dentition of *Conepatus* calls for special remark. The detailed account given under the head of *Mephitis mephitica* is here equally applicable.

Vertebrae, C., 7; D., 16; L., 5; S., 3; Cd., 18. (Gerrard.)



ANCIENT RUINS IN SOUTHWESTERN COLORADO.

BY W. H. JACKSON.

In the extreme southwestern corner of Colorado Territory, west of the one hundred and eighth degree of longitude, are groups of old ruined houses and towns, displaying a civilization and intelligence far beyond that of any of the present inhabitants of this or adjacent Territory.

It will be my endeavor, in the few pages following, to describe these with as much minuteness and circumspection as a very hasty trip enabled me to observe; depending more upon the pictorial illustrations accompanying this article for clear exposition of the subject than upon my choice of words.

Extending around the sources of the Rio Grande del Norte is one of the grandest uplifts of the whole Rocky Mountain chain, the Sierra San Juan. The drainage from its southern face supplies the half-dozen streams which go to make up the Rio San Juan, flowing westwardly into the Colorado of the West. To the southwest, standing isolated and alone, is another great mass of trachytic mountain-peaks, known as the Sierra La Plata, from which flow the Rio La Plata and the Rio de los Mancos, the most western of any importance of the northern tributaries of the San Juan.

Although ruins in considerable number and importance were said to exist along the Rio Las Animas and San Juan; we did not think it best to spare any of the little time at our disposal for their investigation. Our object being to find those in which the picturesque predominated and were the least known, we directed our course to the westward, having obtained reliable information of the existence of some which would come up to our anticipations. The Rio de los Mancos, (from what circumstance so named I have not been able to learn,) rising in two principal forks among the western foot-hills of the Sierra La Plata, flows southwesterly through fertile and beautiful valleys to a great table-land, known as the "Mesa Verde," and entering, flows directly south through it, to the valley of the San Juan, and then turning west again joins that stream near the crossing of the boundary-lines of the four Territories.

Commencing our observations in the park-like valley between the *mesa* and the mountains, we find that the low benches which border the stream upon either side bear faint vestiges of having, at some far-away time, been covered with dwellings, grouped in communities apparently, but now so indistinct as to present to the eye little more than unintelligible mounds. By a little careful investigation, however, lines of foundations of great squares of blocks of single buildings and of circular inclosures can be made out; the latter generally with a depressed center, showing an excavation for some purpose. The greater portion of these mounds were now overgrown with artemisia, piñon-pine, and cedar, concealing them almost entirely from casual observation. We found the surest indication of the proximity of these old ruins by the great quantities of broken pottery, which covered the ground in their

neighborhood; the same curiously indented, painted, and glazed ware found throughout New Mexico and Arizona. It was all broken into very small pieces; none that we could find being larger than a silver dollar. We had no opportunity to make any excavations about these old mounds; but such little scratching around as we could do developed nothing new below the surface, that which covered the ground having been broken and scattered since the demolition of the homes of the makers. Nowhere among these open-plains habitations could we discover any vestiges of stone-work, either in building material or implements. It is very evident that the houses were all of adobe; the mound-like character of the remains justifying that belief.

The "Mesa Verde" extends north and south about twenty, and east and west about forty miles. It is of a grayish-yellow Cretaceous sandstone, with a very nearly horizontal bedding, so that the escarpment is about equal upon all sides, ranging from 600 to 1,000 feet in height. The capping or upper strata are generally firmly and solidly bedded, and retain a perpendicular face of from 200 to 500 feet. It is generally, however, a succession of benches, one above the other, and connected by the steep slopes of the talus. Side-cañons penetrate the *mesa*, and ramify it in every direction, always presenting a perpendicular face, so that it is only at very rare intervals that the top can be reached; but, once up there, we find excellent grazing, good springs, and thick groves of cedar, and the piñon-pine. From the bottom of the cañon up, the slopes of the escarpment were thickly covered with groves of cedar and piñon, gnarled and dwarfed, but sucking up a vigorous livelihood from the cracks and crevices of the barren declivities. Below, the cotton-wood and willow grew luxuriantly beside the streams, while dense growths of a reedy grass towered above our heads as we rode through it. Throughout its entire length, the cañon preserves an average width of about 200 yards, sometimes much wider and again narrower. The stream, meandering from side to side, and frequently interrupted by beaver-dams, cuts a deep channel in the friable earth, which characterizes all the valley-lands of this region. The banks upon either one side or the other are perpendicular, so that it was an extremely troublesome matter to cross. Added to the difficulties of getting in and out of the stream was the thick-matted jungle of undergrowth, tall, reedy grass, willows, and thorny bushes, all interlaced and entwined by tough and wiry grapevines. The current is sluggish, and the water tinged with a milky translucency, gathered from the soil. The bottom is gravelly, but is covered to a depth of two or three feet with a very soft and miry mud. In every turn were deep pools gouged out, so that the stream seemed to be a succession of them; riffles or bars of sandy gravel intervening, through which the water oozed rather than flowed.

Entering the cañon at its upper end, we strike into the old Indian trail, which comes over from the head of the Rio Dolores, and, passing down this cañon a short distance, turns off to the left and goes over to the head of the San Juan. About a hundred Indians had just passed over it with their horses and goats, so that it was in most excellent traveling order, although winding in and out, and over and among great blocks of sandstone and other *débris* from above; the encroaching stream, too, frequently forced our narrow pathway high up on the slopes of the projecting spurs, the treacherous character of the banks of the stream forbidding the crossing and recrossing usual in such cases. Grouped along in clusters, and singly, were indications of former habitations, very nearly obliterated, and consisting mostly, in the first

four or five miles, of the same mound-like forms noticed above, and accompanied always by the scattered, broken pottery. Among them we found one building of squared and carefully-laid sandstone; one face only exposed, of three or four courses, above the mass of *débris*, which covered everything. This building lay within a few yards of the banks of the stream; was apparently about 10 feet by 8, the usual size, as near as we could determine, of nearly all the separate rooms or houses in the larger blocks, none larger, and many not more than 5 feet square. The stones exposed were each about 7 by 12 inches square and 4 inches thick; those in their original position retaining correct angles, but, when thrown down, were worn away and rounded by attrition to shapeless bowlders. Being so exposed to the elements, the cementing material which bound the masonry together was entirely worn away upon the surface; but, upon pulling away a few courses, it was found binding the rocks together quite firmly. I do not think, however, that it was anything more than an adobe mortar.

As we progressed down the cañon, the same general characteristics held good; the great majority of the ruins consisting of heaps of *débris*, a central mass considerably higher and more massive than the surrounding lines of subdivided squares. Small buildings, not more than 8 feet square, were often found standing alone apparently; no trace of any other being detected in their immediate neighborhood.

We now commenced to note another peculiar feature. Upon our right, the long slopes of protruding strata and *débris* formed promontories, extending out into the cañon. Upon these, and not more than 50 feet above the stream, we found vestiges of former occupation; the foundations in every case being circular, with a deep depression in the center. They generally occurred in pairs, two side by side, and ranging from 10 to 20 feet in diameter. No masonry of any kind was visible, but thickly strewn all about any quantity of broken pottery. Above were indications of habitations in the face of the cliff, but not enough to warrant further search.

At those places where the trail ran high up, and near the more precipitous portion of the bluff, we found remnants of stone walls, inclosing spaces of from 5 to 12 feet in length, in the cave-like crevices running along the seams. They were pretty well demolished, the stones undressed and imbedded in mud mortar. In many places, little niches or crevices in rock had been walled up into cupboard-like inclosures of about the size of a bushel-basket. We searched them eagerly, but they had all been despoiled before us. Nothing of any greater importance was found up to the time we made camp at nightfall. All that we had seen during the day was of exceeding interest, but came far short of our expectations.

Our camp for the night was among the stunted piñons and cedars immediately at the foot of the escarpment of the *mesa*; its steep slopes and perpendicular faces rising nearly 1,000 feet above us. Quantities of broken pottery were strewn from above down, across the trail, to the edge of the stream; and, as ruins of some sort generally followed, close attention was paid to the surroundings; but, with the exception of a small square inclosure of rough slabs of stone, set in the earth endwise, and indicating, possibly, a grave, nothing was found to reward our search. Just as the sun was sinking behind the western walls of the cañon, one of the party descried far up the cliff what appeared to be a house, with a square wall, and apertures indicating two stories, but so far up that only the very sharpest eyes could define anything satisfactorily. We had no field-glass with the party, and to this fact is

probably due the reason we had not seen others during the day in this same line; for I doubt not that ruins exist throughout the entire length of the cañon, far above and out of the way of ordinary observation. Cedars and pines also grow thickly along the ledges upon which they are built, hiding completely anything behind them. All that we did find were built of the same materials as the cliffs themselves, with but few, and then only the smallest, apertures toward the cañon; the surface being dressed very smooth, and showing no lines of masonry, it was only upon the very closest inspection that the house could be separated from the cliff.

The discovery of this one, so far above anything heretofore seen, inspired us immediately with the ambition to scale the height and explore it, although night was drawing on fast, and darkness would probably overtake us among the precipices, with a chance of being detained there all night. All hands started up, but only two persevered to the end. The first 500 feet of ascent were over a long, steep slope of *débris*, overgrown with cedar; then came alternate perpendiculars and slopes; in one place a clear exposure of about 25 feet of very fine-looking bituminous coal. Immediately below the house was a nearly perpendicular ascent of 100 feet. That puzzled us for a while, and then we were only able to surmount it by finding cracks and crevices into which fingers and toes could be inserted. From the little ledges occasionally found, and by stepping upon each other's shoulders, and grasping tufts of *yucca*, one would draw himself up to another shelf, and then, by letting down a stick of cedar, a hand, or foot, would assist the other. Soon we reached a slope, smooth and steep, in which there had been cut a series of steps, now weathered away into a series of undulating hummocks, by which it was easy to ascend, and without them, almost an impossibility. Another short, steep slope, and we were under the ledge upon which was our house, (Fig. 12, Plate III.) It was getting quite dark, so we delayed no longer than to assure ourselves that it was all we hoped for, and to prospect a way up when we should return the next morning with the photographic outfit and note-books.

Bright and early, as soon as breakfast was dispatched, we commenced the ascent. Mexico, our little pack-mule, with the apparatus upon her back, by sharp tacks and lively scrambling over the rocks, was able to reach the foot of the precipice of which I have spoken above. Up this we hauled the boxes containing the camera and chemicals by the long ropes taken from the pack-saddle. One man was shoved up ahead, over the worst place, with the rope, and, tying it to a tree, the others easily ascended.

The house stood upon a narrow ledge, which formed the floor, and was overhung by the rocks of the cliff. The depth of this ledge was about 10 feet by about 20 in length, and the vertical space between ledge and overhanging rock some fifteen feet. The house occupied the left-hand half as we face it; the rest being reserved as a sort of esplanade, a small portion of the wall remaining, which cut it off from the narrow ledge running beyond. The edges of the ledge upon which the house stood were rounded off, so that its outside walls had to be built upon an incline of about forty-five degrees; the esplanade, too, had been extended by three abutments, built out flush with the walls of the house, upon the steeply-inclined slope, and giving support probably to a floor and balustrade.

The house itself, perched up in its little crevice like a swallow's nest, consisted of two stories, with a total height of about 12 feet, leaving a space of two or three feet between the top of the walls and the over-

hanging rock. We could not determine satisfactorily whether any other roof had ever existed or whether the walls ran up higher and joined the rock, but we incline to the first supposition. The ground-plan showed a front room about 6 by 9 feet in dimensions, and back of it two smaller ones, the face of the rock forming their back walls. These were each about 5 by 7 feet square. The left hand of the two back rooms projected beyond the front room in an L. The cedar beams, which had divided the house into two floors, were gone, with the exception of a few splintered pieces and ends remaining in the wall, just enough to show what they were made of. We had some little doubt as to whether the back rooms were divided in the same way, nothing remaining to prove the fact, excepting holes in the walls, at the same height as the beams in the other portion. In the lower front room were two apertures, one serving as a door, and opening out upon the esplanade, about 20 by 30 inches in size, the lower sill 24 inches from the floor, and the other a small outlook, about 12 inches square, up near the ceiling, and looking over the whole cañon beneath. In the upper story, a window corresponded in size, shape, and position to the larger one below, both commanding an extended view down the cañon. The upper lintel of this window was of small, straight sticks of cedar, of about the size of one's finger, laid close together, the small stones of the masonry resting upon them. Directly opposite this window was a similar one, as shown in the figure, but opening into a large reservoir, or cistern, the upper walls of which came nearly to the top of the window. It was semicircular, inclosing the angle formed by the wall against the rock, with an approximate capacity of about two and a half hogsheads. From the window, and extending down to the bottom of the reservoir, was a series of cedar pegs, about a foot apart, enabling the occupants to easily reach the bottom. The entire construction of this little human eyrie displayed wonderful perseverance, ingenuity, and some taste. Perpendiculars were well regarded, and the angles carefully squared. The stones of the outer rooms or front were all squared and smoothly faced, but were not laid in regular courses, as they are not uniform in size, ranging from 15 inches in length and 8 in thickness down to very small ones. About the corners and the windows, considerable care and judgment were evident in the overlapping of the joints, so that all was held firmly together. The only sign of weakness was in the bulging outward of the front wall, produced by the giving way or removal of the floor-beams. The back portions were built of rough stone, firmly cemented together. The mortar was compact and hard, a grayish-white, resembling lime mortar, but cracking all over, like some of the adobe mortars. All the interstices between the larger stones were carefully chinked in with small chips of the same material. The partitions were of the same character as the smooth wall outside, both presenting somewhat the appearance of having been rubbed down smooth after they were laid. The apertures, from one room to another, were small, corresponding in size and position to those outside. Most peculiar, however, was the dressing of the walls of the upper and lower front rooms. Both were plastered with a thin layer of some firm cement of about an eighth of an inch in thickness, and colored a deep maroon-red, with a dingy white band 8 inches in breadth, running around floor, sides, and ceiling. In some places, it had peeled away, exposing a smoothly-dressed surface of rock. No signs of ornamentation, other than the band alluded to, were visible. The floor, which was covered to a depth of 2 or 3 inches with dust, dirt, and the excrement of small animals, had

been evened up with a cement resembling that in the walls. The back rooms were half-filled with rocky *débris* from roof and cliff.

While busied with my negatives, the others had prospected the ledge in opposite directions, coming upon ample evidence of its having been quite thickly peopled. Ruins of half a dozen lesser houses were found near by, but all in such exposed situations as to be quite dilapidated. Some had been crushed by the overhanging wall falling upon them, and others had lost their foot-hold and tumbled down the precipice. One little house in particular, at the extremity of this ledge, about fifty rods below the one described above, was especially unique in the daring of its site, filling the mind with amazement at the temerity of the builders and the extremity to which they must have been pushed. Careful views of this having been secured so as to show as well as possible its almost complete inaccessibility, we felt impelled to hurry on to new developments. Apparatus was carefully lowered to the patiently-waiting mule, and adjusted to the pack-saddle, then, mounting our own animals, pushed on down the cañon. Below it opened out into quite a valley, side-cañons opening in from either hand, adding much to the space. Every quarter-mile, at the most, we came upon evidences of former habitations, similar to those already described; the greater majority occurring in the level bottoms and on the low spurs of the escarpment.

Two or three miles below the house in Fig. 12, we discovered a wall standing in the thick brush upon the opposite side of the river. Considerable difficulty was experienced in crossing; in some places having to cut our way through the entangling vines with our belt-knives, and then, when the stream was reached, had to follow it some distance before an opportunity occurred to emerge.

The wall, or walls rather, before us were a portion of an old tower, (see Fig. 1, Plate I,) in the midst of a group of more dimly marked ruins or foundations, extending some twenty rods in each direction from it. As seen in the figure referred to, the tower consisted of two lines of walls, the space between them divided into apartments, and a single circular room in the center. The outside diameter of all was 25 feet, that of the inner circle 12 feet, and as the walls were respectively 18 and 12 inches in thickness, left a space of 4 feet for the small rooms. This outer circle was evidently divided into six equal apartments, but only the divisions marked in the diagram could be distinguished. In the place where they should have occurred, the walls were so broken down and covered with *débris* as to render all details indistinguishable. Where the walls were standing, they showed small window-like doors opening into the inner circle. The highest portion of the inner wall was not more than 8 feet, and of the outer about 15. From the amount of *débris*, I should not judge it to have been much higher—not more than 20 feet at the most. The space between the walls was filled with *débris*. Outside there was very little, except where the wall was totally ruined, and inside the inner circle was more; but, as that had probably been an underground apartment, or excavation, and was still a little below the ordinary level, it was not easy to judge how much had gone into it.

The stones of which this tower was constructed were irregular in size and shape, but with the outer face dressed to a uniform surface, and of the same average size as those already described. The mortar and "chinking" had been worn out entirely from the more exposed portions, giving the wall the appearance of having been dry-laid; but upon pull-

ing away some of the stones to a little depth, they were found to have been well cemented.

Passing on down the cañon, not stopping now to notice the more ordinary forms of ruins, we passed the mouths of numerous side-cañons, down which came great freshets during the rainy season, gouging out deep arroyos, and strewing the surface with the collected *débris* of piñon and cedar, sage-brush and cacti. About the mouth of Coal Cañon, particularly, the whole surface of the "wash" was covered with lumps of fine-looking bituminous coal, as though a thousand coal-carts had traveled that way with their tail-boards out.

We camped at sunset at what our guide called the Rattlesnake Bend, within a half-dozen miles of the outlet of the cañon. We had not discovered any more of the high cliff-houses during the day; but, I doubt not that, if we had had a good field-glass with us, many more might have been found along the crevices near the summit of the escarpment. To have verified our suppositions by a personal inspection would have involved a great deal of labor, and more time than we could have spared from our very scanty store. As it stood, we contented ourselves with securing *types*. In the vicinity of this camp, the cañon changed much in appearance; instead of the long slope of talus capped by a perpendicular ledge, we have here a perpendicular ledge, first of 200 or 300 feet, and then a long receding bench, back to the higher *mesa* beyond.

Close to our camp was one of the little towers that we now came to look upon as common, about 10 feet in diameter, and remaining some 8 feet in height; the inside half-filled with the *débris* from the walls. Half a mile below, in the vertical face of rock, and at a height of from 50 to 100 feet from the trail, were a number of little nest-like habitations. Fig. 5, Plate I, illustrates their general characteristics. The communication with the outside world was from above, to a small window-like door, not shown in the sketch. Two small apertures furnish a lookout over the valley. The walls were as firm and solid as the rocks beneath which they were built. The stones were more regular in size than any noticed, but smaller. The chinking-in of small chips of stone was noticeably neat and perfect on the inside. This was not a commodious dwelling; 15 feet would span its length, and 6 its height, while in depth it was not more than 5 feet. Near by, upon a low ledge, and readily accessible from below, was a string of five or six houses, evidently communicating, mere kennels compared with some others, made by walling up the deep cave-like crevices in the sandstone. The same hands built them that lived in the better houses; the masonry being very similar, especially the inside chinking, which was perfect, and gave the walls a very neat appearance. Fig. 8 of Plate II is an example of the tenacity of their mortar; the view being of one of the line of little houses just spoken of. In this case, a portion of the ledge upon which the house stood has become separated from the cliff, carrying a portion of one of the buildings with it; and although torn away from the remaining wall, and thrown over at a considerable angle, yet it remains perfectly firm and unshaken.

Scratched into the face of the cliff which contained these houses were various inscriptions, one of which I have depicted in Fig. 6 of Plate I. As they are not cut in very deeply, and in some places mere scratches, I doubt very much whether they are contemporaneous with the houses themselves.

Two or three miles farther, and the cañon changed in feature again; the highest level of the *mesa* coming forward and towering over the valley with a thousand feet of altitude; the bottom-lands widening out to a half and three-quarters of a mile in breadth. Cottonwood and

willow fringed the meandering stream in pleasant groves, while the dead level of the valley was heavily carpeted with a dense growth of artemisia and cacti. Everything was dry, dusty, and barren; the stream itself losing in volume, and becoming more turbid. Fig. 13 of Plate III represents in outline the characteristics of the cañon, or valley rather, at this point.

In the high bluff, on the right hand in the sketch, were some of the most curious and unique little habitations yet seen. While jogging along under this bluff, fully 1,000 feet in height, and admiring its bold outlines and brilliant coloring, one of our party, sharper-eyed than the rest, descried, away up near the top, perfect little houses, sandwiched in among the crevices of the horizontal strata of the rock of which the bluff was composed. While busy with my photographs, two of the party started up to scale the height, and inspect this lofty abode. By penetrating a side-cañon some little ways, a more gradual slope was found, that carried them to the summit of the bluff. Now, the trouble was to get *down* to the house, and this was accomplished only by crawling along a ledge of about 20 inches in width, and not tall enough for more than a creeping position. In momentary peril of life, for the least mistake would precipitate him down the whole of this dizzy height, our adventurous seeker after knowledge crept along the ledge until the broader platform was reached, upon which the most perfect of the houses alluded to stood. The ledge ended with the house, which was built out flush with its outer edge. This structure resembled in general features the cliff-houses already spoken of. The masonry was as firm and solid as when first constructed; the inside was finished with exceptional care. In width, it was about 5 feet in front, the side-wall running back in a semicircular sweep, in length 15, and in height 7 feet. The only aperture was both door and windows, and about 20 by 30 inches in diameter. In Fig. 7 of Plate II, I have traced a design of this aerial habitation as it appeared from below; its uniqueness consisting in position on the face of the bluff. To the casual observer, it would not be noticed once in fifty times in passing, so similar to the rocks between which it was plastered did it appear from our position on the trail. A short distance to the right, and one ledge above, was another building of somewhat ruder construction, but with corner square, and walls truncated.

Referring again to Plate III and Fig. 13, the position of these houses, and also of the one in Fig. 12, can be seen in the dark heavy lines near the summit, just above the most precipitous portion of the bluff, generally at a height of from 600 to 800 feet above the level of the cañon. The talus sometimes runs up to within 200 feet of them, very seldom nearer and most frequently lower.

This was the last cliff-house we noticed in this cañon. From the first to the last, all that were upon an elevation, however light, were on the western side of the cañon, with either doors or windows facing east, overlooking the opposite bluffs. We could not find even the faintest vestige of ruins or houses upon the eastern side. Those built low down on the level land did not hold to the same rule, being scattered indiscriminately upon either bank of the stream.

Proceeding down the broad open cañon over the now very easy trail, we espied upon the opposite side of the stream a tower of apparently greater dimensions than the ones noticed above. The crossing was execrable; but, forcing a way through the tangled undergrowth to the stream, a way was found out of it to the ruin some forty rods back; (see Figs. 2 and 3.) The tower only remained; this was circular, 12

feet in diameter, and now about 20 in height, the wall being about 16 inches in thickness. Facing the valley northward was a window-like aperture, about 18 by 24 inches in size; the lower lintel some 7 or 8 feet above the base. The stones of which it was constructed were uniform in size and angle. Being so entirely exposed to atmospheric influences, the mortar had worn away entirely from between the outer layers. Inside, the *débris* was heaped up nearly to the window. By referring to Fig. 3, it will be seen that a rectangular structure, divided into two apartments, each about 15 feet square, joined the tower. Only one corner of three or four courses of masonry remained, shown by the shaded lines; the rest being indicated by mound-like lines of loose *débris*, in which but few stones remained, from which fact, and also that the center of each square was considerably depressed below the surrounding surface, I should judge that it had been an underground structure, its roof not reaching the window midway in the tower. It would be extremely interesting to excavate upon these old foundations; for I doubt not that many interesting relics, and possibly some clue to their manner of life, might be found. Our time, however, was too limited to admit of the experiment, much as we desired the information it might furnish.

In the same neighborhood stood a corner and a portion of a doorway of a house, (see Fig. 4,) showing considerable care and skill in its construction, and, what we had not noticed before, the doorway facing east was a little over 6 feet in height, tall enough to enable a person to stand up in it.

With these, we finished our observations of the ruins in the Cañon de los Mancos. We were now at its mouth, the *mesa* ending as abruptly as it began; the river, turning well westward and following approximately the course of the San Juan, joined it near the southwestern corner of the Territory, at the foot of Ute Mountain.

Striking off to the right from the stream, and following close under the bold escarpment of the *mesa*, we could still discern, as we bore away, group after group of standing walls and mounds, extending down the valley into the broad open plain of the San Juan. It was with many regrets that we turned our backs upon these relics of a forgotten race. Our trail now lay over the peculiar marly earths lying under the sandstones of the table-land, soft, friable, and dusty, without vegetation, our mule's feet sinking into it to the fetlocks at each step. At our right, portions of the *mesa* had become separated, and weathered into peculiar pinnaced turrets. One particularly stood out detached some fifty rods; the trail passing between it and the *mesa*, forming an old and well-known landmark on the old Spanish trail from Santa Fé to Salt Lake. A little farther on, and to the right, was another mass, bearing a curious resemblance to a matron standing with a child beside her, the alternating bands of red and white strata marking off the figure into its different proportions and into flounces and trimmings.

Away to the south and west, over the broad plains of the San Juan, where roamed the great flocks of sheep and goats belonging to the Navajos, the Callabassas Mountains reared themselves into distinct view, while, between them and the river, a great *cristone* thrust itself up out of the earth to a height of at least 2,000 feet, as veritable a needle as was ever christened such.

Striking into this old trail, we bore around to the western side of the *mesa*, and, near nightfall, arrived at what are known locally as "Aztec Springs." This, for there is one only, lies out upon the northeastern

flanks of the Ute Mountain, and close upon the divide between the waters of the Mancos and the Dolores. It was our intention to have camped here and worked up the surroundings at our leisure; but, very much to the surprise of our guide, the spring was perfectly dry, not even the least moisture remaining to tempt us to dig for it, for others before us had dug to the depth of three or four feet with no reward for their labor. At its best, it could have been but a very insignificant source of supply; the surplus oozing away through a few yards of wiry grass into the dry sand. The basin of the spring lay in quite a depression, that had evidently been excavated for the purpose. A well may have existed; for it cannot be reasonably supposed that the very large settlements which at one time existed in the neighborhood were supplied from it in anywhere near its present condition. The nearest running water was 12 or 13 miles away, and none of the surroundings indicated that this spring ever had any very considerable volume of water. Immediately adjoining the spring, on the right, as we face it from below, is the ruin of a great massive structure of some kind, about 100 feet square in exterior dimensions; a portion only of the wall upon the northern face remaining in its original position. The *débris* of the ruin now forms a great mound of crumbling rock, from 12 to 20 feet in height, overgrown with artimisia, but showing clearly, however, its rectangular structure, adjusted approximately to the four points of the compass. Inside this square was a circle, about 60 feet in diameter, deeply depressed in the center, and walled. The space between the square and the circle appeared, upon a hasty examination, to have been filled in solidly with a sort of rubble-masonry. Cross-walls were noticed in two places; but whether they were to strengthen the walls or had divided apartments could only be conjectured. That portion of the outer wall remaining standing was some 40 feet in length and 15 in height. The stones were dressed to a uniform size and finish. Upon the same level as this ruin, and extending back, I should think, half a mile, were grouped line after line of foundations and mounds, the great mass of which was of stone, but not one remaining upon another. All the subdivisions were plainly marked, so that one might, with a little care, count every room or building in the settlement. Below the above group, some two hundred yards distant, and communicating by indistinct lines of *débris*, was another great wall, inclosing a space of about 200 feet square. Only a small portion was well enough preserved to enable us to judge, with any accuracy, as to its character and dimensions; the greater portion consisting of large ridges flattened down so much as to measure some 30 or more feet across the base, and 5 or 6 feet in height. This better preserved portion was some 50 feet in length, 7 or 8 feet in height, and 20 feet thick, the two exterior surfaces of well-dressed and evenly-laid courses, and the center packed in solidly with rubble-masonry, looking entirely different from those rooms which had been filled with *débris*, though it is difficult to assign any reason for its being so massively constructed. It was only a portion of a system extending half a mile out into the plains, of much less importance, however, and now only indistinguishable mounds. The town built about this spring was nearly a square mile in extent, the larger and more enduring buildings in the center, while all about were scattered and grouped the remnants of smaller structures, comprising the suburbs.

It was sunset by the time we had secured the photographic views necessary to illustrate the leading features of this group. A camp had to be found, a thing very easily done in most localities, but here one very important constituent was wanting; sage-brush and grass abounded,

but water was sadly deficient. However, by good luck, as we might call it, a few pools of the grateful fluid were found in the nearly dry bed of an old stream, about four miles distant from the ruins. This pretense of a stream is known locally as the McElmo, and flows westwardly into the San Juan. For the greater portion of the year, its course is but a deep dry gulch, the water only coming to the surface near its mouth. The valley or cañon through which it flows is peculiar to this region. Starting from the level plain at the foot of the Mesa Verde, it sinks evenly and gradually down between the *mesa*-lands, they having been rent asunder to prepare for this graded way, and, getting deeper and deeper, is finally engulfed in the great chasms debouching into the Colorado. It preserves a very nearly equal width of from two or three hundred yards, perfectly flat and level, from the foot of one escarpment to that of the other, and covered with the all prevalent artemisia and groups of cedar and piñons.

But a short distance above our camp, and upon the top of the *mesa*, which, at this point, was not more than 25 feet above the valley, we found a tower very similar to that on the Mancos (see Fig. 1,) but considerably larger, and surrounded by a much greater settlement. It was about 50 feet in diameter, and, like the Mancos one, double-walled, the space between the two about 6 feet in width, and subdivided into small apartments by cross-walls pierced with communicating doors or windows. Immediately surrounding this tower was a great mass, of which it was the center, of scattered heaps of stone *débris*, arranged in rectangular order, each little square with a depressed center, suggesting large subdivided buildings, similar to the great community-dwellings of the Pueblos and Moquis and the old ruins of the Chaco. Upon the southeast corner of this group, and upon the very edge of the *mesa*, were the remains of another smaller tower, and below it, founded upon the bottom of a small cañon, which ran up at right angles to the McElmo, was a portion of a heavy wall rising to the base of this lesser tower. This group covered a space of about one hundred yards square; while adjoining it on the *mesa* was group after group, upon the same general plan—a great central tower and smaller surrounding buildings. They covered the whole breadth and length of the land; and, turn which way we would, we stumbled over the old mounds and into the cellars, as we might call them, of these truly aborigines. The same painted, glazed, and otherwise ornamented ware, of which I have spoken, accompanied each settlement, and we were continually picking up new designs and forms.

Starting down the cañon, which gradually deepened as the table-land closed over us, we found upon each hand very old and faint vestiges of this forgotten people, but could give them no more attention than merely noting their existence. Half a dozen miles down, and we came upon several little nest-like dwellings, very similar to those in Figs. 5 and 7, but only about 40 or 50 feet above the valley. Two miles farther, and we came upon the tower shown in Fig. 9, standing upon the summit of a great square block of sandstone, some forty feet in height, detached from the bluff back of it. The building, upon its summit, was square, with apertures like windows upon two faces, looking east and north, and very much ruined, but still standing in some places about 15 feet above the rock on which it was founded. At the base of the rock was a wall running about it, a small portion only remaining, the rest thrown down and covered with *débris* from the house above.

About here we crossed the boundary-line into Utah, and then, two or three miles farther, we came upon a very interesting group. The

valley, at this place, widens out considerably, and in the center stands a solitary butte of dark-red sandstone, upon a perfectly bare and smooth floor of the same, dipping down to the center of the valley at a slight inclination. The butte is but a remnant of a former *mesa*, worn down by time to its present dimensions, some 100 feet in height and 300 in length. It is an irregular mass, seamed and cracked, and gradually going the way its former surroundings have traveled. Running about its base, in irregular lines, are remains of walls, but whether for defense or habitation would be hard now to determine. At the back of the rock, a view of which is had in Fig. 10, are the remains of two quite considerable walls, one above the other; the lower portion—one corner only of a square building, all traces of the remaining portions having entirely disappeared—seemed to serve as a sort of approach to the larger building above, the top of which came up nearly to the summit of the rock. It was about 18 feet in length and 12 in height. Portions only of the side-walls, connecting it with the rock, remained. The stones of which it was built were very uniform in size, angle, and finish, more so than any yet seen, but, like all similarly-exposed buildings, the mortar was washed or worn away entirely from between the outer layers; farther in, it existed as usual. In front was a single aperture of about 18 by 24 inches, whether for door or window would be hard to guess. The only access to the top of the rock was through the window of this house. On top were evidences of some sort of mason-work, that covered it from one end to the other. All the irregular gaps and crevices had been walled up, probably to make an even surface. But few of the stones remained in position; in one or two places, three or four courses—all the rest thrown down and scattered.

In the rear, about fifty yards removed, were other ruins belonging to the same group surrounding the rock. The better-preserved portions consisted of a square tower, with one round corner, about 12 feet in diameter, and upon the lowest side, which stood in a dry run, about 20 feet in height. The walls were 18 inches in thickness, with no signs of apertures. Adjoining this ruin were the ruins of another, but so much thrown down as to be almost unrecognizable; and between these and the rock were circular depressions of some considerable depth, indicating either subterranean apartments or reservoirs. No water could be found anywhere in the neighborhood. The dry bed of the McElmo was fully a mile distant, in which water flows during the winter and spring only.

Aside from the interest attaching to the ruins themselves, there are thrown about this rock and its surroundings the romance and charm of legendary association. The story runs thus, as given us by our guide, and very excellently rendered by Mr. Ingersoll, in his article to the New York Tribune of November 3:

Formerly, the aborigines inhabited all this country we had been over as far west as the headwaters of the San Juan, as far north as the Rio Dolores, west some distance into Utah, and south and southwest throughout Arizona and on down into Mexico. They had lived there from time immemorial—since the earth was a small island, which augmented as its inhabitants multiplied. They cultivated the valley, fashioned whatever utensils and tools they needed very neatly and handsomely out of clay and wood and stone, not knowing any of the useful metals; built their homes and kept their flocks and herds in the fertile river-bottoms, and worshiped the sun. They were an eminently peaceful and prosperous people, living by agriculture rather than by the chase. About a thousand years ago, however, they were visited by savage strangers from the North, whom they treated hospitably. Soon these visits became more frequent and annoying. Then their troublesome neighbors—ancestors of the present Utes—began to forage upon them, and, at last, to massacre them and devastate their farms; so, to save their lives at least, they built houses high upon the cliffs, where they could store food and hide away till the raiders

left. But one summer the invaders did not go back to their mountains as the people expected, but brought their families with them and settled down. So, driven from their homes and lands, starving in their little niches on the high cliffs, they could only steal away during the night, and wander across the cheerless uplands. To one who has traveled these steppes, such a flight seems terrible, and the mind hesitates to picture the suffering of the sad fugitives.

At the *cristone* they halted, and probably found friends, for the rocks and caves are full of the nests of these human wrens and swallows. Here they collected, erected stone fortifications and watch-towers, dug reservoirs in the rocks to hold a supply of water, which in all cases is precarious in this latitude, and once more stood at bay. Their foes came, and for one long month fought and were beaten back, and returned day after day to the attack as merciless and inevitable as the tide. Meanwhile, the families of the defenders were evacuating and moving south, and bravely did their protectors shield them till they were all safely a hundred miles away. The besiegers were beaten back and went away. But the narrative tells us that the hollows of the rocks were filled to the brim with the mingled blood of conquerors and conquered, and red veins of it ran down into the cañon. It was such a victory as they could not afford to gain again, and they were glad when the long fight was over to follow their wives and little ones to the South. There, in the deserts of Arizona, on well-nigh unapproachable isolated bluffs, they built new towns, and their few descendants, the Moquis, live in them to this day, preserving more carefully and purely the history and veneration of their forefathers than their skill or wisdom. It was from one of their old men that this traditional sketch was obtained.

The bare floor of nearly white sandstone, upon which the butte stands¹ is stained in gory streaks and blotches by the action of an iron constituent in another portion of the adjoining bluffs, and this feature probably gave rise to the legend. Half a mile back, or north from this historic butte, is a group of small cave-houses. A long bluff line, about 100 feet in height, of alternating bands of red and white sandstone, has, along a line of its upper strata, quite a number of shallow caves, in which were snug little retreats, securely walled in, the masonry perfect and substantial. Along the top of the bluff were traces of old walls, but well-nigh obliterated.

While passing the mouth of a wide side-cañon, coming in from the right, a tall, black-looking tower caught our eye, perched upon the very brink of the *mesa*, overlooking the valley. Tying our riding-animals at the foot, and leading the pack-mule, with photographic kit, we soon struck into an old trail, worn deep into the rocks, winding and twisting among great boulders, and overgrown and obstructed with rank growth of sage, cedar, and cacti. In its day, the trail had been a good one; now it was anything but such. Bad as it was, however, it was the only way to the summit, and we were thankful for it. Skirting the edge of the *mesa* a few yards, we came to the tower, the trail passing back of it and on up to a higher level. From above had rolled down a huge block of sandstone, lodging upon the brink, and upon this the tower was built, so that from below both appeared as one. They were of the same diameter, about 10 feet, and some 18 feet in height, equally divided between rock and tower. In construction, it was similar to those already described, of single wall. It was evidently an outpost or watch-tower, guarding the approach to a large settlement upon or beyond the *mesa* lying above it. From this point we now struck out for another group of ruins lying upon a nameless stream, some eight or ten miles farther west. Four or five miles we followed the McElmo down, the trail good, the whole surface covered with a dense growth of artemisia and groves of cedar and piñon, with cottonwoods fringing the dry stream. Branching off at right angles, crossing the heads of two cañons which opened out quickly into great gorges, and then descending into a valley densely covered with greasewood, we came upon the ruins we were in search of. Through the valley ran a deep gulch, a narrow thread of warm, brackish water appearing at intervals in its bed, and gathering into pools in basins a short distance below the ruins.

In Fig. 11 of Plate II, I have sketched a ground-plan of the "city," showing its general arrangement. The stream referred to, and shown in the sketch, sweeps the foot of a rocky sandstone ledge, some 40 or 50 feet in height, upon which is built the highest and better-preserved portion of the settlement. Its semicircular sweep conforms to the ledge; each little house of the outer circle being built close upon its edge. Below the level of these upper houses some 10 or 12 feet, and within the semicircular sweep, were seven distinctly-marked depressions, each separated from the other by rocky *débris*, the lower or first series probably of a small community-house. Upon either flank, and founded upon rocks, were buildings similar in size and in other respects to the large ones on the line above. As paced off, the upper or convex surface measured one hundred yards in length. Each little apartment was small and narrow, averaging 6 feet in width and 8 feet in length, the walls being 18 inches in thickness. The stones of which the entire group was built were dressed to nearly uniform size and laid in mortar. A peculiar feature here was in the round corners, one at least appearing upon nearly every little house. They were turned with considerable care and skill; being two curves, all the corners were solidly bound together and resisted the destroying influences the longest.

With this last our observations of these interesting relics came to an end. Our trip was short and rapid, and instituted in the first place, as I have said, for a quest of the picturesque, and we found it. For a much more complete and faithful exposition of this interesting subject, the reader is referred to the series of views, a catalogue and descriptive list of which will be found appended.

It does not seem worth while for me to advance any theories, or to speculate either upon the age of these ruins or of the ancestry of the builders. The subject is fraught with exceeding great interest, and there is much yet to learn and to discover; for the field of their operations is, as yet, but partially explored. In New Mexico and Arizona, the whole country is covered with somewhat similar remains, that have been described again and again, from the early part of the sixteenth century, when Vaca saw many of them occupied, down to the present day; while over in Utah, upon the great plateau bordering the cañons of the Colorado, are many other groups, spoken of by Powell and Newberry, which resemble more closely these I have described than those to the south. I have not been able to find any published record of the cliff-houses and towers of Colorado, or, for that matter, of any of the others. In 1859, an expedition under Captain Macomb passed both the head and the mouth of the Rio Mancos, and must have seen many ruins similar to the ones I have spoken of. The older forms, out on the open land, were so abundant, that any traveler would notice them; but those hid away in the cañons, I can safely assert, have been seen by very few eyes, indeed, of the present time.

I cannot close without extending thanks to Captain John Moss, of La Plata, our volunteer guide, who accompanied us over the route comprising the ruins. To his accurate knowledge of their locality, and the best way to reach them, as well as of the language of the Indians, is due much of the success of the trip; for it enabled us to make every day count, and no false moves.

DESCRIPTION OF THE ACCOMPANYING PLATES.

PLATE I.

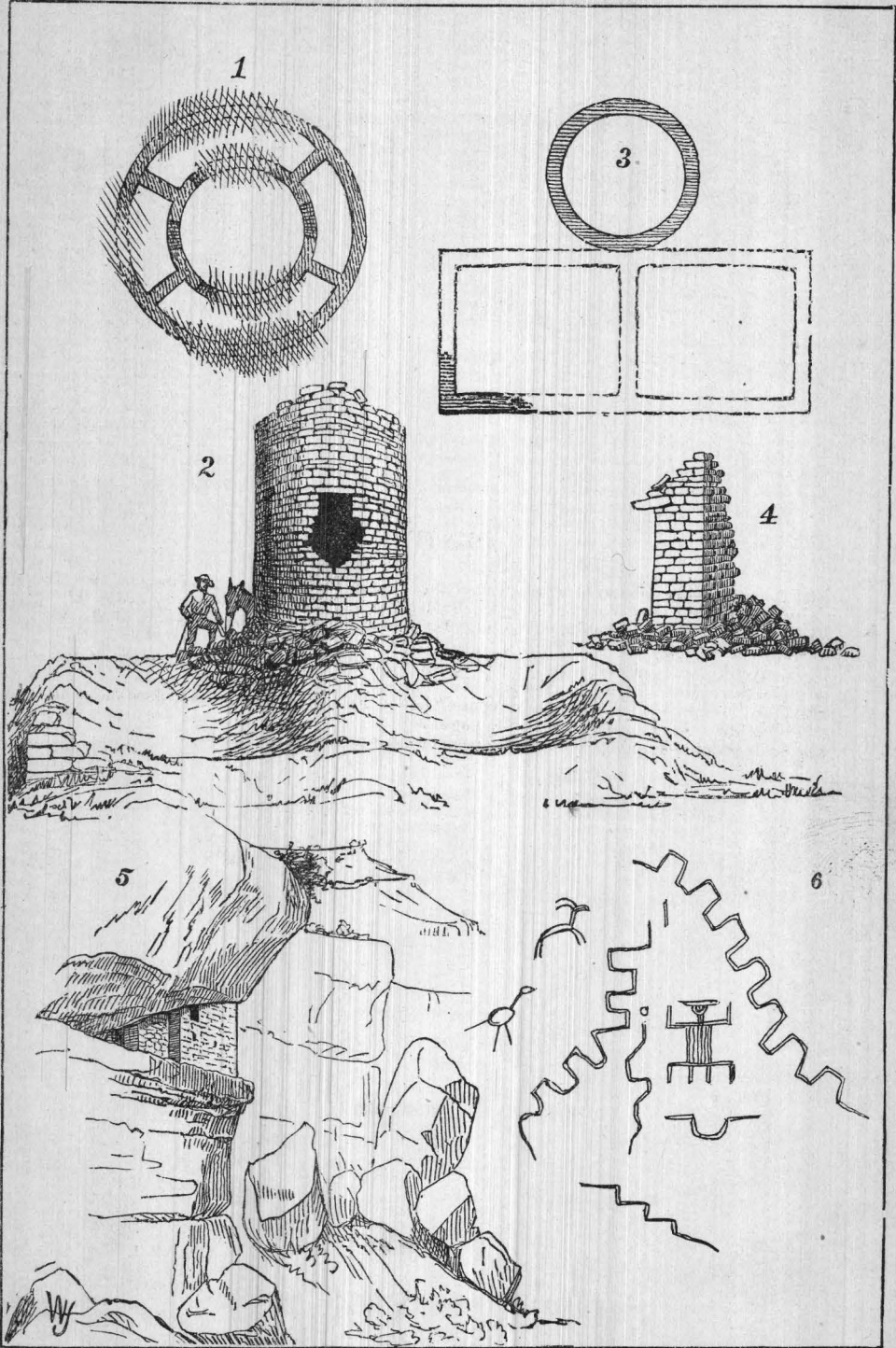
Fig. 1. Ground-plan of round tower in the cañon of the Rio Mancos, consisting of two circular walls, with the intervening space divided into separate apartments. See page 22.

Figs. 2 and 3. Tower adjoining a rectangular foundation in the lower cañon of the Rio Mancos. See page 24.

Fig. 4. A portion of the doorway and one corner of a carefully-built house. Height of doorway 6 feet. Mancos Cañon. See page 25.

Fig. 5. Cliff-house in the rocks of Mancos Cañon at Rattlesnake Bend, 100 feet above the level of the bottom of the cañon. See page 23.

Fig. 6. Inscriptions upon the walls of the cañon near the above. Page 23.



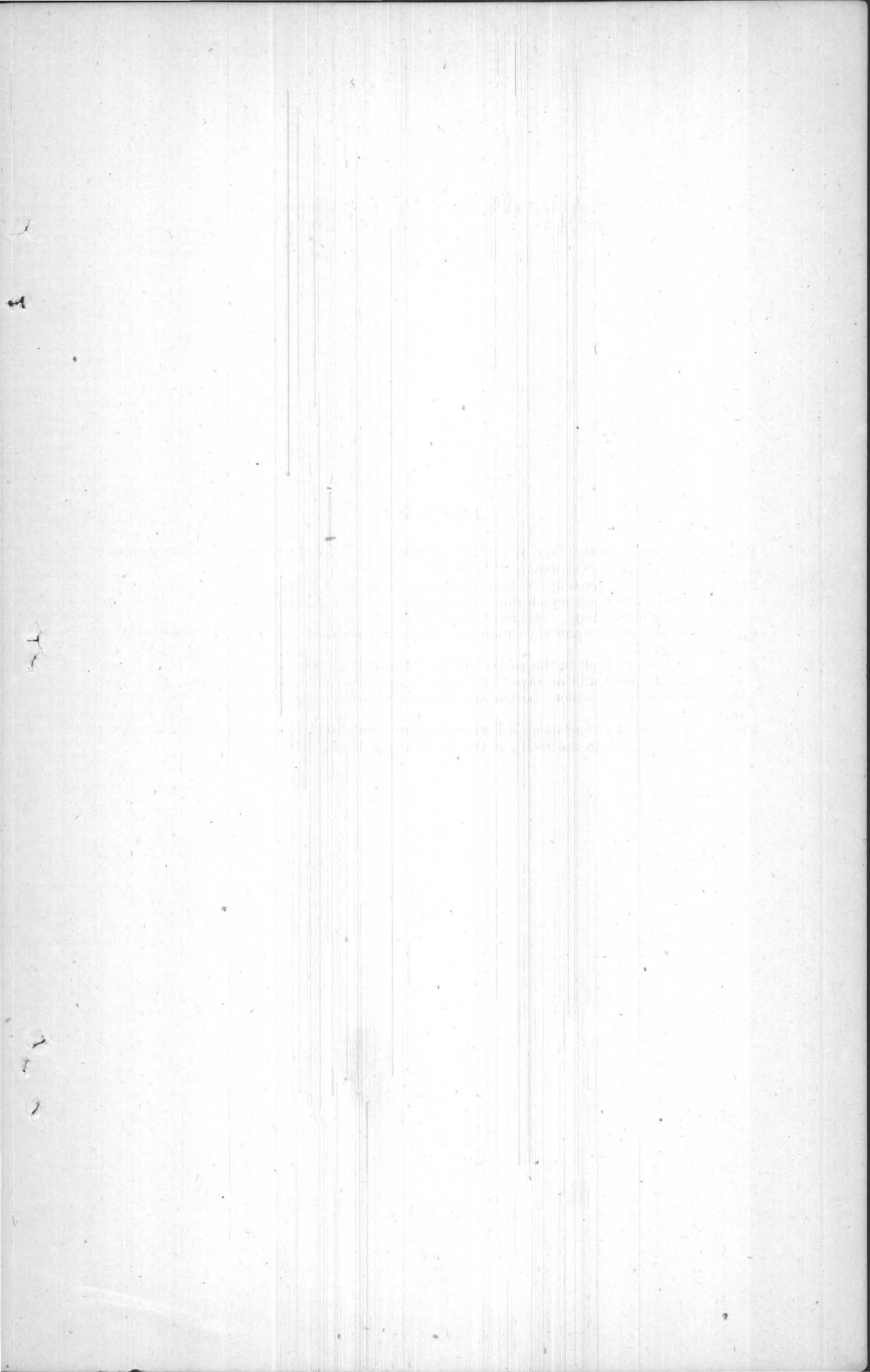


PLATE II.

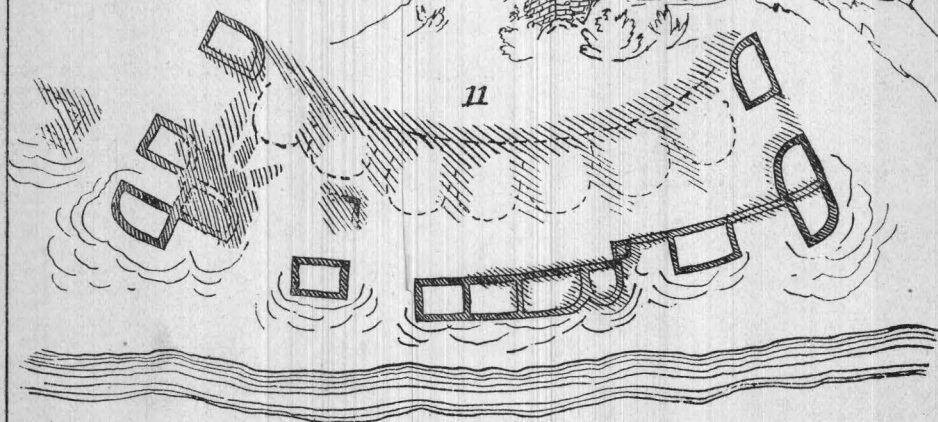
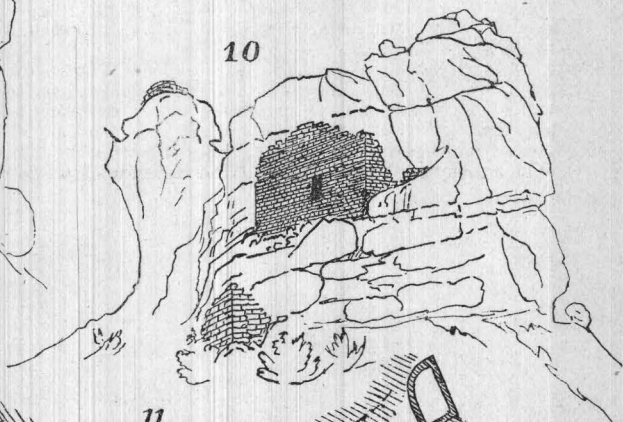
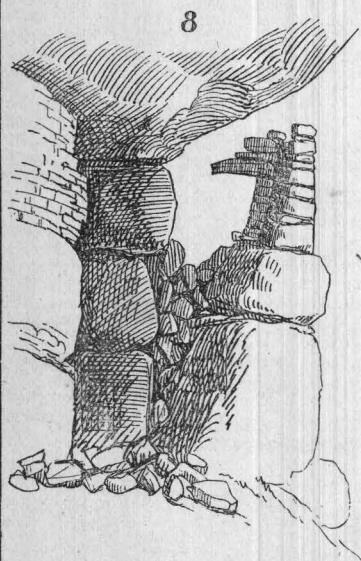
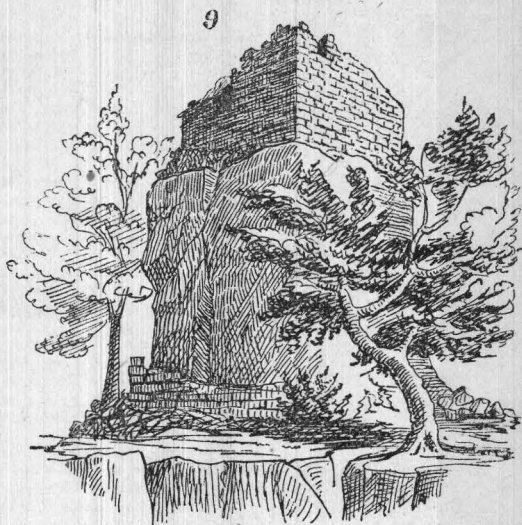
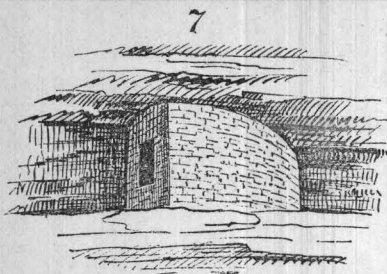
Fig. 7. Cliff-house, in the face of a bluff 1,000 feet in height, 800 feet above the ground, near the lower end of the cañon of the Mancos. See page 24.

Fig. 8. Showing the tenacity of the cementing material of these people. Time has rent asunder the rocks upon which this house stood, but each portion still remains firmly attached to its foundation. (Mancos Cañon, page 23.)

Fig. 9. A square tower upon the summit of an isolated rock, in the valley of the McElmo, Utah. Page 27.

Fig. 10. An isolated rock in the valley of the McElmo, covered with ruined houses and walls. A Moquis tradition says that there, in ages past, their ancestors made their last stand against the northern barbarians before retreating to their present villages. See page 28.

Fig. 11. Ground-plan of an extended series of houses, one hundred yards in length, arranged upon a rocky bluff, in the valley of the Hovenweep, Utah. See page 30.



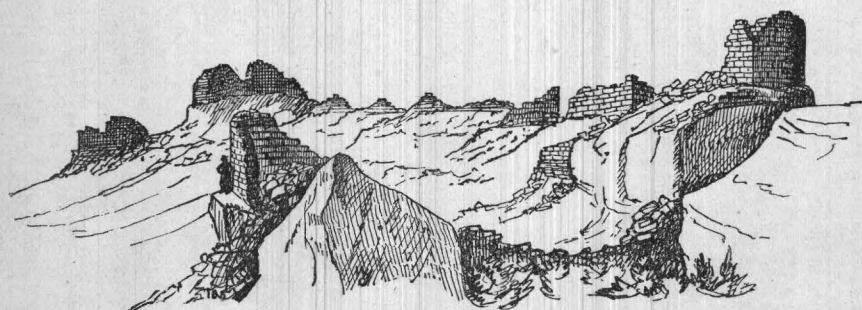
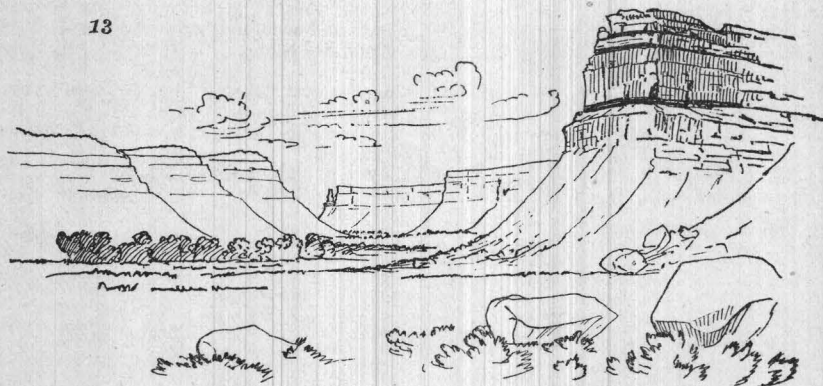
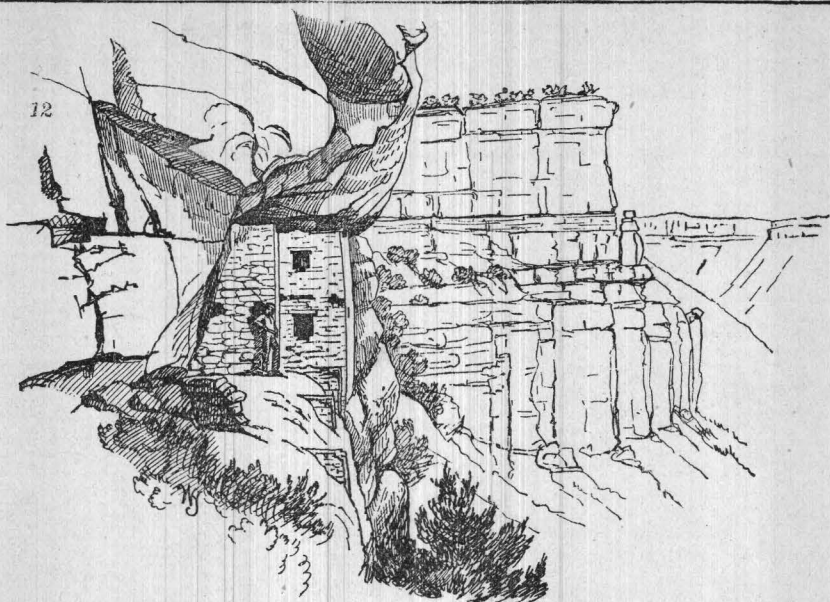
W

PLATE III.

Fig. 12. A two-story house in the crevices of the escarpment of the Mancos Cañon, 800 feet vertically above the stream at its base. This house is remarkable, not only upon account of its position, but in having walls of carefully-built and accurately-dressed stone, and the inside surfaces plastered, and painted in two colors, red center with white margin. For description, see page 20.

Fig. 13. A general view of the cañon of the Rio Mancos near its outlet from the Mesa Verde. The table-lands upon either hand vary from 500 to 1,000 feet in height, and it is in the darkly-shaded lines in the upper half of the high bluff on the right that the little houses are found, as shown in Figs. 5, 7, and 12. See page 24.

Fig. 14. A view of the ruined village, in the valley of the Hovenweep, Utah, of which Fig. 11 is a ground-plan. See page 30.



A LIST OF THE PHOTOGRAPHS ILLUSTRATING THE RUINS IN SOUTH-
WESTERN COLORADO AND UTAH,

5 × 8.

- No. 156. Cliff-house, in the cañon of the Mancos; same as that in Fig. 12. See page 20.
No. 157. Cliff-house, near the above and described on page 22 of the preceding article.
No. 158. A portion of the walls of the round tower in bottom of the cañon of the Mancos.
Page 22.
No. 159. A bluff 1,000 feet in height, upon the face of which are small houses, one being shown in Fig. 7. Page 24.
No. 160. Table-lands bordering Mancos Cañon, ranging from 500 to 1,000 feet in height, upon the escarpment of which are the houses of Nos. 156, 157, &c. Page 24.
Nos. 161 and 162. Ruins at Aztec Springs, of walls of great thickness, massive houses and reservoirs, and showing the western face of the Mesa Verde, described on page 26.
No. 163. A ruined tower, surrounded by extensive remains of other buildings, at the head of the McElmo. Ute Mountain in the distance lies across the boundary-line between Colorado and Utah. See page 27.
Nos. 164 and 165. A front and back view of the legendary rock in the valley of the McElmo, Utah, showing the walls built upon its face and the walls surrounding it. See page 28 for description.
Nos. 166 and 167. Cliff-houses, in the face of a low sandstone bluff, half a mile back of the legendary rock.
No. 168. The watch tower, upon the summit of a great rock close to the edge of the mesa, overlooking the valley beneath. See page 29.
Nos. 169 and 170. Ruined village in the valley of the Hovenweep, Utah; view from across the little stream, at its outer or bluff face, and—
Nos. 171 and 172. Views, looking inside; the first a general view, and the last close to, and showing more detail, for a description of which see page 30.

STEREOSCOPIC.

- Nos. 795 and 796. Two-story cliff-house of the Rio Mancos.
No. 797. Ruined cliff-house, near the above.
No. 798. Ruined tower in the Cañon of the Mancos.
No. 799. Great wall in the Mancos Cañon, upon the face of which are the cliff-houses.
Nos. 800, 801 and 802. Ruined tower at the head of the McElmo.
Nos. 803 and 804. The legendary rock, in the valley of the McElmo, Utah.
No. 805. Ruins in the rear of the legendary rock.
No. 806. Cave-house, valley of the McElmo.
No. 807. Curious weathering of the bluffs near the cave-houses.
No. 808. Watch-tower, valley of the McElmo.
No. 809. Ruins on the Hovenweep, view from the front.
Nos. 810 and 811. Ruins on the Hovenweep, view of the interior,

NOTE ON SOME FOSSILS FROM NEAR THE EASTERN BASE OF
THE ROCKY MOUNTAINS, WEST OF GREELEY AND EVANS,
COLORADO, AND OTHERS FROM ABOUT TWO HUNDRED
MILES FARTHER EASTWARD, WITH DESCRIPTIONS OF A
FEW NEW SPECIES.

BY F. B. MEEK, PALÆONTOLOGIST.

The fossils collected during the past summer on Cache La Poudre River, six to ten miles west of Greeley; from five miles below Platteville, on Platte River; from four miles west of Evans, on Thompson River; and at the junction of Little and Big Thompson Rivers, some three or four miles farther westward, are all so obviously from the same horizon, and the localities are so near each other, that they may be all noticed together. In the first place, however, the following list of the species collected at these localities will be given:

1. *Halymenites*.
2. *Avicula (Oxytoma) Nebrascana*, E. & S.
3. *Nucula cancellata*, M. & H.
4. *Nucula planimarginata*, M. & H.
5. *Yoldia Evansi*, M. & H.
6. *Veniella humilis*, M. & H.
7. *Tancredia Americana*, M. & H.*
8. *Sphæriola? obliqua*, sp. n. (See end of this note.)
9. *Cardium speciosum*, M. & H.*
10. *Tellina scitula*, M. & H.
11. *Mactra Warrenana*, M. & H.
12. *Mactra formosa*, M. & H.*
13. *Mactra alta*, M. & H.*
14. *Mactra gracilis*, M. & H., with several other undetermined bivalves.
15. *Dentalium*.
16. *Cylichna scitula*, M. & H.
17. *Lunatia Moreauensis*, M. & H.
18. *Piostocheilus Scarboroughi*, M. & H.
19. *Anchura*.
20. *Ammonites lobatus*, Tuomey.

This group of species, coming, as the specimens evidently did, all from the same horizon, is of some interest, because it gives us the first clew we have had in regard to the exact position in the Cretaceous section of a rock at the mouth of Judith River, on the Upper Missouri, with relation to the other subdivisions of this series there.*

The rock alluded to has not yet been recognized at any other locality in the Upper Missouri country than that mentioned; and as it does not there occur, so far as known, in association with any of the other beds belonging to well-determined horizons of the Cretaceous of that region,

* I do not allude here to the brackish-water beds at that locality, in regard to the exact age of which there have been some doubts, but to a well-defined Cretaceous rock, containing *Baculites*, *Inoceramus*, and other Cretaceous types of fossils.

and the few fossils found in it there seem to be nearly or quite all distinct from those occurring in the several known horizons, we have been at a loss to decide in regard to its exact place in the Cretaceous section. I have long suspected, however, from the affinities of its organic remains, that its position is near the horizon of the top of the Fox Hills group; and although the illustrations of its fossils have been arranged by themselves on separate plates, in the unpublished report on the invertebrate palæontology of the Upper Missouri, I had, some time back, numbered the plates of this work so as to bring those containing the illustrations of the species from this rock, in the ascending series, directly in after those on which the fossils from the Fox Hills group are arranged.

The correctness of this view, in regard to the position of these beds, seems to be sustained by the Colorado collections under consideration. This will be the more clearly understood by reference to the foregoing list of species. This list, it will be seen, contains some seventeen determined species of Cretaceous molluscan remains, four of which (those marked with an asterisk) are certainly identical with forms that have, in the Upper Missouri, only been found in the rock mentioned at the mouth of Judith River; while they are also very characteristic species too of that rock and locality. At the same time, the other thirteen identified species of *Mollusca* mentioned in the list, all occur at numerous Upper Missouri localities in the Fox Hills group; and, with the exception of some three or four of the species that also occur in the Fort Pierre group below, they seem to be all highly characteristic species of the Fox Hills division.

From this blending-together of the Fox Hills species, and those of the marine Cretaceous beds found at the mouth of Judith River on the Upper Missouri, it is evident, I think, that we cannot be far wrong in regarding the latter beds as holding a position at the horizon of the top of the Fox Hills group. Whether they may, however, in the Upper Missouri country, be distinct enough from the Fox Hills group to form a sixth subdivision of the Cretaceous series, holding a position just above the latter, or whether they ought rather to be regarded as merely an upper member of the Fox Hills group, may admit of some doubt in the present state of our knowledge; though I strongly incline to the latter opinion. It is true, however, that they might really be properly distinct, as a subdivision of the Cretaceous, from the Fox Hills group, and still be so intimately related to the latter that some of their characteristic species of fossils might range down into the same at the Colorado localities (just as some of the Fox Hills types also occur in the Fort Pierre group below, at many localities), without necessarily proving that these two subdivisions should not be treated as distinct rocks.

In another point of view, the collections under consideration will doubtless prove to be of some interest—that is, from their bearing on the mooted question respecting the age of the Brown-coal formation along the eastern base of the Rocky Mountains, in Colorado, and at other localities farther westward. Not having myself visited the particular localities at which these fossils were collected, I, of course, cannot speak from personal observation in regard to the stratigraphical relations of these marine Cretaceous beds to the brackish-water coal-bearing strata alluded to; though I am assured by the gentlemen who collected the specimens that, although they came from the very upper beds of well-defined marine Cretaceous, they, nevertheless, in all cases, hold a position below the horizon of all the coal-bearing strata of that region; although, in some instances, they were found not far below the

horizon of thin seams of coal. However this may be, I can assert, in the most positive manner, that the beds from which these fossils came, are clearly, and beyond all question, of Cretaceous age. This is not only shown by the presence, among the fossils found in them, of the well-known and widely-distributed Cretaceous genus and species *Ammonites lobatus*, Tuomey,* but even more clearly by the fact that *all* of the other identified species of bivalves and univalves are certainly identical with species widely distributed in the Upper Missouri country in beds containing numerous examples of *Ammonites*, *Scaphites*, *Baculites*, *Inoceramus*, and other decided Cretaceous types.

At the same time that all of the identified molluscan remains from these beds are such decided Cretaceous types, it will be observed that a number of specimens, which I am entirely unable to distinguish from a fucoid referred, by Professor Lesquereux, to the genus *Halymenites*, and widely distributed in the Brown-coal deposits of the far-west, also occur here directly associated with these Cretaceous shells. This fucoid has been considered a Tertiary type by my able and distinguished friend, Professor Lesquereux, and relied upon as at least one of the evidences that these Brown-coal deposits belong to the Tertiary epoch, and not to the Cretaceous. It seems to me evident, however, from the occurrence of this fossil here, along with numerous decidedly Cretaceous shells, as well as at Coalville in Utah, where I found it at least 1,000 feet below the horizon of well-marked Cretaceous strata, that *it*, at least, can no longer be regarded as an exclusively Tertiary type.

I should not omit to state here, however, that Mr. Holmes, who collected most of the fossils under consideration, informed me that he did not find, in the beds from which they were obtained, any of the dicotyledonous leaves so numerous in the coal-strata very widely distributed in Wyoming, Colorado, and other parts of the far-west. This is also precisely the case at Coalville, Utah, where I found this fucoid ranging far down below well-defined Cretaceous strata; while a two-weeks' careful search there by Doctor Bannister and myself failed to discover any of these dicotyledonous leaves so common, along with this same fucoid, at Black Butte, and other localities in Wyoming, as well as in Colorado.

It should also be noticed that not a single species of these animal remains (which are very abundant in individuals at the Colorado localities under consideration) can be identified with any of the forms yet known from the coal-bearing strata of that region, or from Wyoming and other localities farther westward.

The specimens from farther eastward were taken from a shaft sunk on the Kansas Pacific Railroad, at a locality about two hundred miles east of Denver, Col. I have seen no section of the strata penetrated by this shaft, but have been informed that it was sunk to a depth of 1,200 feet, and that it passed through many beds of sandstone and some shale and brown coal. The specimens submitted to me were found at two different horizons: one about 400 feet below the surface; and the other at a depth of about 45 feet. Whether or not any of the other beds struck contained fossils, I have not been informed. Those from the lower horizon are contained in a rather firm, dark shale, said to overlie

* I am now almost entirely satisfied that this species is identical with an Upper-chalk form of Limbourg, that has been identified by Binkhorst with *Ammonites Peder-nalis*, von Buch. (See Mong. Gast. et des Cephalop. de la Craie sup. du Duché de Limbourg, 21, pl. V^{ai}, figs. 6 a, b, &c.). I have not at hand von Buch's figures and description of his species, but the shell figured by Binkhorst is apparently not distinct from that before me; though I doubt its identity with the Texas shell figured by Roemer under von Buch's name.

a three-foot bed of coal. In the specimens of this shale, I was somewhat surprised to find two of the same Cyrenoid shells that occur in an exactly similar shale over one of the coal-beds at Hallville, on the Union Pacific Railroad, in Wyoming, five hundred miles farther westward, and at about 2,800 feet greater elevation above tide. The specimens of shale from these two localities are exactly alike in all respects, and the fossils contained in them are not only beyond question the same species, but so precisely similar in their state of preservation that it would be quite impossible to distinguish in any way the collections from the two localities.

The specimens from the other horizon, 45 feet below the surface, in this shaft, consist of a conglomeration of shells, with merely enough gray clay, and some sand, to fill the interstices. The shells, so far as seen, are all bivalves, generally in so tender a condition that it is very difficult to separate any of them from the matrix in a good state of preservation, though they were evidently, in most cases at least, not broken or water-worn before being buried in the mud and sand forming the stratum in which they are found. They consist, so far as determined, of an *Anomia*, and perhaps two or three species of Cyrenoid shells, with a few fragments of other undetermined bivalves. The *Anomia* I believe to be identical with a species found at Black Butte station, Wyoming, on the Union Pacific Railroad, only about two miles east of Hallville coal-mines, and perhaps 600 to 800 feet higher in the same series. The Cyrenoid shells are also closely allied to, and possibly in some cases identical with, forms found at Black Butte station.

A single fragment of a bivalve, found among the specimens, consisting of most of the hinge of a right valve, certainly belongs either to the genus *Cyprina* or *Veniella* (= *Venilia*, Morton). The hinges of these two types are so similar in some of the species that it is not always easy to distinguish the two without pretty good specimens, or at least such as give a moderately clear idea of the form and general external appearances of the shell. The specimen mentioned does not show the posterior lateral tooth; but its cardinal and anterior lateral teeth are *very similar* to those of *Veniella*. The scar of its pedal muscle, however, *seems* to be very nearly, if not quite, connected with that of the anterior adductor, as in *Cyprina*. I regret very much that I could not find an entire valve of this shell among the specimens, so as to be able to decide the question in regard to which of these two genera this shell really belongs; because, if it is a *Veniella*, it would furnish a strong argument in favor of the conclusion that this whole formation belongs to the Cretaceous period, and not to the Tertiary; if a *Cyprina*, however, it would prove nothing either way, that genus being common to both Cretaceous and Tertiary rocks, as well as to our existing seas.

That the formation from which these fossils came, however, is the same as the Bitter Creek series of Wyoming, including the Black Butte beds, the Hallville coal-mines, Point of Rocks, and Rock Spring coal-mines, &c., I have scarcely a shadow of doubt; and the determination of this fact is one of considerable interest in several points of view. In the first place, it shows that the Bitter Creek series, that contains such valuable deposits of an excellent quality of brown coal, extends far out under the plains east of the Rocky Mountains, and at least holds out a reasonable prospect that valuable deposits of this useful substance may be found by sinking shafts in these treeless plains (if the discovery has not already been made*), where a good supply of fuel is of such great

*I do not know whether workable beds of coal were found in the shaft already sunk or not.

importance to the present and future inhabitants of the country. Again, as these deposits, now occupying such different elevations in Wyoming and Colorado, are evidently of brackish-water or estuary origin, and consequently were originally formed at the same level (that of the sea), their present different elevations give us some idea of the great changes in the physical features of this internal region of the continent that have taken place in comparatively modern geological times.

A species of bivalve, that I have described on one of the following pages under the name *Cyrena? Holmesi*, came from four miles north of Golden City, Col., at the eastern base of the Rocky Mountains. According to Mr. Holmes's observations, the bed in which this fossil occurs holds a position about 500 feet above the horizon of the coal-beds mined near there. The specimens of this shell brought in, although showing, in some cases, the form and ornamentation of the species well enough, unfortunately in no instance give any satisfactory information in regard to its generic relations; and, as the species is new and distinct from all of those we have yet had from the well-determined horizons of this region, it gives little or no information in regard to the age of the rock in which it was found, though it is most probably Tertiary.

ANOMIA MICRONEMA, Meek.

Shell of medium size, thin, orbicular, subovate, or somewhat irregular; upper valve moderately convex, or more or less depressed, even nearly to flatness in some cases; beak very small, depressed, and nearly, but not quite, marginal; cardinal margin generally a little truncated and slightly thickened; surface ornamented by very fine, regular, often deflected, radiating stria, and small, sometimes regularly-disposed, concentric marks of growth. (Under valve unknown.)

Diameter of well-developed specimens generally about 1 inch.

This species is quite abundant, and generally moderately well preserved at the locality. As usual with fossil species of the genus, only upper valves were found. These show the muscular impressions to be exactly as in true *Anomia*.

Locality and position.—From a shaft sunk on the Kansas Pacific Railroad, two hundred miles east of Denver, Col., 45 feet below the surface, from beds of the age of the Wyoming Bitter Creek coal-series.

CORBICULA? (LEPTESTHES) PLANUMBONA, Meek.

Shell attaining a moderately large size, rather thick and strong, especially about the hinge of large specimens, generally of a short transversely-oval or subelliptic form, but rather variable in outline, moderately and evenly gibbous, the greatest convexity being in the central region; anterior margin prominently and rather narrowly rounded; posterior vertically subtruncated; base forming a more or less nearly semi-elliptic or semi-ovate curve; dorsal outline sloping from the beaks, the anterior slope being more abrupt and concave in outline, while the posterior is generally convex; umbones subcentral, moderately prominent or somewhat depressed, usually eroded, and more or less flattened near the apices, which are not strongly incurved, distinctly pointed, or raised much above the hinge-margin; lunular region, in the specimens, with more gibbous umbones, somewhat excavated, but not distinctly impressed, or with defined margins; ligament narrow and not very prominent; anterior muscular impression ovate, well defined, and distinct from the small pedal scar under the hinge, above and behind its

upper end; posterior muscular impression broader and more shallow; pallial line usually well defined, and provided with a shallow, rounded, or semicircular sinus; hinge rather strong, with the three cardinal teeth well developed in each valve, the anterior two of the left valve, and the posterior two of the right, being more or less sulcated; anterior lateral teeth long, linear, and not very prominent; posterior shorter and very remote from the cardinals; both anterior and posterior laterals very nearly smooth, or minutely granulo-striate.

Length of a medium-sized adult specimen, 1.62 inches; height, 1.28 inches; convexity, 0.92 inch. Some fragments indicate about one-third greater size for the largest.

Along with the specimens in which the foregoing characters were observed, there are a few others of smaller size, that are proportionally shorter and more nearly trigonal in outline, the beaks being also more elevated, central, and not at all flattened or eroded. These probably belong to a distinct species; but as the typical specimens of the species just described vary considerably in form, and all are in a very unsatisfactory condition of preservation, I have some doubts in regard to the propriety of separating the shorter form as a distinct species. Should additional collections, in a better state of preservation, show this form to be distinct, however, it might be called *C. (Leptesthes) umbonella*. I suspect that there are still one or two other species represented among the numerous broken and distorted specimens in the collection, but the material is not sufficient to settle this question.

The species here described seems to be most nearly allied to some of the shorter of the forms described by me in Dr. Hayden's Sixth Annual Report, page 512, doubtfully as a variety of *C. fracta*, under the name *C. ? fracta*, var. *crassiuscula*, but which are probably distinct from *C. fracta*. At any rate, the species here described is a still shorter, more nearly equilateral, and generally more gibbous shell, which also usually differs in the peculiar flattening of its umbones. All of these shells, however, as well as the typical *C. fracta*, agree closely in their hinge-characters, and form a very peculiar group.

In first proposing the subgeneric name *Leptesthes* for the reception of *C. fracta* and the supposed variety *crassiuscula*, from the Bitter Creek beds at Hallville and Black Butte, Wyo., I called attention to the fact that these shells seem to combine the characters of both *Cyrena* and *Corbicula*. In the elongation and striation of their lateral teeth, particularly the anterior laterals, they agree most nearly with *Corbicula*; but in the much more transverse form of the shell in most cases, as well as in size and general appearance, they agree better with the *Cyrenas*, particularly with such species as *Cyrena Floridana*, Conrad; *C. colorata*, Prime; and *C. salmacida*, Morelet, than with at least the existing forms of *Corbicula*. The name *Leptesthes* was suggested by the extreme thinness of the typical species *C. fracta*; but we now know that this character is not constant in the group, the other species being generally quite thick. Nor is the very transverse form of the typical species, and the species or variety *C. crassiuscula*, a constant character, some of the others now before me from Colorado being as short as several existing species of *Corbicula*. These shells, however, present certain peculiar hinge-characters that seem to be constant. These are the narrow, elongated form of the antero-lateral teeth, like those of *Corbicula*, and, at the same time, the rather narrow but shorter form, and remote position of the posterior laterals, more like those of *Cyrena*, excepting that they are separated from the cardinal teeth by a more or less broad-flat space in each valve, fitting closely together when the valves are united. In the striation of the

lateral teeth, these shells correspond more nearly to *Corbicula*; but the striae are very much less distinct than we usually see in the latter, and often very nearly obsolete (quite so in slightly-worn specimens), while they are mainly broken up into little granulations.

I also observe that, in all of our species of this type, the little pedal muscular scar is detached from the anterior adductor. Having no specimens of *Corbicula* at hand (here in Florida, where I am writing) for examination, and nothing being said on this point in any of the descriptions of that genus within reach, I do not know whether or not our shells agree in this character with the existing species of *Corbicula*. They certainly differ, however, decidedly in this respect from two of the existing Florida species of *Cyrena*, now before me, in which the pedal scar of each valve is distinctly connected with the anterior adductor.

On the whole, although still regarding these fossil shells as being perhaps more nearly allied to *Corbicula* than to *Cyrena*, I am now more than ever impressed with their intermediate combination of characters, and think that they might, with almost equal propriety, be ranged as a subgenus under *Cyrena*; if so, of course the name of the species here described would become *Cyrena* (*Leptesthes*) *planumbona*.

Locality and position.—Two hundred miles east of Denver City, on the Kansas Pacific Railroad, where they were found in a shaft at a depth of 40 feet below the surface.

CYRENA ? HOLMESI, Meek.

Shell under medium size, thin, transversely ovate or subtrigonal, rather compressed; anterior side shorter than the other, and rounded in outline; posterior moderately produced and subtruncated at the extremity; basal margin transversely semi-ovate, its most prominent part being antero-centrally; beaks somewhat depressed, and placed about half-way between the middle and the anterior; dorsal margins forming a rather long, nearly straight, or slightly convex, gentle slope behind the beaks, and declining more abruptly in front, with a distinctly sinuous outline just before the beaks; surface ornamented by numerous fine, regular, sharply-defined, concentric lines.

Length, 0.62 inch; height, 0.54 inch; convexity, about 0.32 inch.

There are among the specimens, apparently of this species, quite a variety of forms, produced, as I am inclined to believe, mainly at least, by accidental distortion, though they may represent several distinct species. The specimen from which the foregoing description and measurements were derived presents the appearance of not having been distorted, and, as may be seen by the measurements, is decidedly longer than high. Others, however, agreeing exactly in surface-markings and most other characters, have the length and height nearly equal, or the latter even a little greater than the former. Some of the specimens also differ from that taken as the type of the species, in having the posterior umbonal slopes prominent and subangular all the way from the beaks to the posterior basal extremity, instead of only moderately convex. As above intimated, however, all of the specimens departing decidedly from the typical form show more or less indications of accidental distortion, and present precisely the same surface-markings as the typical specimen.

In regard to the generic relations of these shells, the specimens are far from satisfactory, none of them showing the muscular or pallial impression, or the cardinal teeth. Some of the casts, however, show that there was a posterior lateral tooth in one or both valves, rather elongated

parallel to the posterior dorsal margin, and a much shorter anterior lateral close to the beak. Of course, it will be impossible to determine the generic characters of these shells until more satisfactory specimens can be obtained, and it is only provisionally that the species is now referred to the genus *Cyrena*.

I have had this species under consideration for some years, hoping that better specimens would be found; but, as a second visit to the locality has failed to bring to light any more satisfactory material, and the geologists of the survey desire to have a name by which they can refer to the shell, I have concluded to describe it doubtfully under the genus *Cyrena*. The specific name is given in honor of Mr. William H. Holmes, the artist of the survey, who discovered the type-specimens.

Locality and position.—On Ralston Creek, three to four miles north of Golden City, Col., from beds supposed to hold a position from 400 to 500 feet above the beds of coal mined at Golden City. Probably of Tertiary age. I think Dr. Pale found the same species farther south, between Golden and Colorado Springs, not far from the latter. No other fossils were found associated with it

SPHÆRIOLA ? OBLIQUA, Meek.

Shell (as determined from an internal cast) obliquely oval-subcordate, very gibbous, the greatest convexity being in the central region of the valves; posterior side very short, and rounding somewhat obliquely downward and forward into the base, which forms a transversely-semi-ovate or semi-elliptic curve; anterior side longer and more or less regularly rounded; hinge very short; beaks prominent, gibbous, and moderately incurved, but not directed very obliquely forward, situated at the anterior end of the hinge, nearly over the middle of the valves; muscular impressions faintly marked, the posterior being placed close up under the end of the hinge; pallial line obscure, but apparently simple. (Surface-markings and hinge unknown.)

Length, 1.95 inches; height, 1.94 inches; convexity, 1.57 inches.

I merely place this species provisionally in the genus *Sphæriola*, as I have done with two similar Upper Missouri Cretaceous forms; nothing being yet known in regard to the hinges of these shells beyond the fact that they have no lateral teeth. It is quite as probable, and perhaps even more so, that when their hinge-characters can be determined, these species will all be found to present generic differences from *Sphæriola*.

The species here under consideration seems to agree most nearly with the Upper Missouri form that we have called *S. ? cordata*, but it has less elevated and less pointed beaks, and differs materially in its much more oblique form; its anterior basal margin being so much more prominent than the posterior as to give a decided backward obliquity to the umbones, excepting their points, which are turned a little forward.

Locality and position.—From the highest Cretaceous beds on Left-hand Creek, half-way between Long Mont and Boulder City, Col.

RHYNCHONELLA ENDLICH, Meek.

Shell attaining a rather large size, subtrigonal, with breadth nearly or quite equaling the length, the widest part being in advance of the middle, becoming very convex with age anteriorly; posterior lateral margins straight, or but slightly convex in outline, laterally compressed or flattened, and diverging from the beaks, in adult specimens, usually at about right angles or less; anterior lateral margins rounding to the

front, which is generally more or less produced, and, as seen in a direct view from above or below, transversely truncated or a little sinuous at the middle. Dorsal valve very convex, particularly along the middle, the elevation increasing rapidly to the front, which is raised so as to form a very prominent, broad, rounded, or somewhat flattened, and slightly-defined mesial fold, rarely traceable back to the central region, while, on each side, the lateral slopes descend abruptly to connect with those of the other valve; beak moderately prominent, and incurved more or less nearly at right angles to general plane of the valves; interior with a prominent mesial septum extending forward nearly half-way to the front. Ventral valve flattened at the umbo, and so broadly and profoundly sinuous from near the same anteriorly as to leave only a prominent angular margin on each side, the sinus being broadly flattened along the middle, and increasing rapidly in depth to the front margin, which is curved upward more or less nearly at right angles to the plane of the valves, and produced in the middle, in the form of a large extension fitting into a corresponding sinuosity in the middle of the front of the other valve; anterior lateral margins on each side of the sinus meeting those of the other valve at acute angles; posterior lateral margins very abruptly deflected and rectangularly deflected along each side of the sinus, to meet those of the other valve; beak comparatively small. Surface of both valves ornamented by numerous radiating costæ, which, on the umbones, are merely distinct raised lines, but increase in size anteriorly, particularly those in the sinus and on the mesial fold, where, toward the front of adult specimens, they become moderate-sized, rounded ribs, of which four to six or seven may be counted in the immediate flattened bottom of the sinus, and two or three more on the fold, while those on the lateral slopes bifurcate, and continue, of smaller size, to the anterior and antero-lateral margins. (Finer surface-markings unknown.)

Length of an adult specimen, 1.78 inches; breadth, 1.53 inches; convexity, about 1.24 inches.

This is a fine species, more nearly resembling some Devonian and Upper Silurian forms than the usual Carboniferous types. Its most marked features are the large size of its mesial sinus, the flattening of its posterior lateral slopes, and the angularity of the posterior lateral margins of its ventral valve on each side of the sinus, formed by the abrupt flexure of those margins to meet those of the other valve. This inflection of the posterior lateral margins gives this part of the shell a peculiar truncated, rectangular appearance, contrasting strongly with the very acute angles formed by the connection of the antero-lateral margins of the valves.

The specific name is given in honor of Dr. Endlich, of the United States geological survey of the Territories.

Locality and position.—East of Animas River, Colorado Territory, where it occurs associated with a small *Productus* of the type of *P. subaculeatus*. According to Dr. Endlich's sections, as well as from its affinities, it would seem to be most probably an Upper Devonian species. Fragments of it have been brought in from other localities in the Rocky Mountains.

