Art. V.—*The Stratigraphy of the Mt. Taylor Region, New Mexico;** by H. W. Shimer and Mildred E. Blodgett.

Introduction.

This paper grew out of a week's trip in central New Mexico from Albuquerque to Great Neck and Cabezon, remnants of

*The field work was done by the senior author in connection with a geological excursion through New Mexico, Arizona, and Utah in the summer of 1906. The trip was largely made possible through the kindness of the Mass. Institute of Technology, Harvard University, and private individuals.

ancient volcanoes. After leaving the Albuquerque mesa (Tertiary) the only sedimentary rocks crossed were grayish brown Cretaceous sandstones and shales. These strata have the slight but prevailingly northerly dip of the plateau province, except where given a westerly dip through the influence of the Nacimiento mountain uplift to the east. This slight dip helps to make the country one of flat-topped mesas and broad level valleys; to this general appearance the old level flood plain of the Rio Puerco contributes. The mesas are frequently capped with lava flows.

Projecting up through these strata in the Puerco valley, west and northwest of Prieta mesa, are the many volcanic necks and dikes for which this region is famous.*

These strata are mostly unfossiliferous, but when remains of organisms do occur they are present in considerable numbers; examples of such fossil-bearing horizons are the "gastropod zone" and the "cephalopod zone," as given in the generalized sections of Herrick and Johnson.†

In the region traversed the most conspicuous zone was a well-marked bed of friable shale, frequently 25 to 50 feet thick, carrying calcareous concretions (septaria) and bearing both in the concretions and in the surrounding bed an abundant fauna, consisting mainly of well preserved cephalopods, gastropods and pelecypods.

The concretions average 1½ to 3 feet in diameter and are seamed by dark calcite bands. They consist of a yellowish-brown shale with a calcareous cement.

In all the sections examined this zone occurs between beds of a dark, friable, easily eroded shale. The shale above has a thickness of 50 to 75 feet and is capped by a 5 to 10-foot bed of a brownish yellow sandstone; this latter, being more resistant than the dark shale below, caps the cliffs. The septaria zone shows at times as the top of a cliff but more usually as a line of small hummocks, due to the fact that the septaria weather more slowly than the embedding shales.

Upon this series of beds rests to the west about 100 feet of black shale, capped by about 50 feet of very resistant sandstone.

These characters of the septaria zone remain approximately constant wherever examined,—the northwest corner of the Albuquerque sheet, the southwest portion of the Jemez sheet, and the eastern part of the Mt. Taylor sheet. The more detailed descriptions of the various portions are given below.

* A paper on these necks by Douglas W. Johnson will appear in the bulletin of the G. S. A.

† C. L. Herrick and D. W. Johnson. The geology of the Albuquerque sheet, Bull. Univ. New Mexico, vol. ii, part 1.

Fossils were collected at Great Neck, Neck 14 (a mile southwest of Casa Salazar), Neck 3, and at three localities on the road southeast of Cabezon.

Description of Localities.

Great Neck.—The almost horizontal Cretaceous strata show at its base the septaria zone with a thickness of about 50 feet

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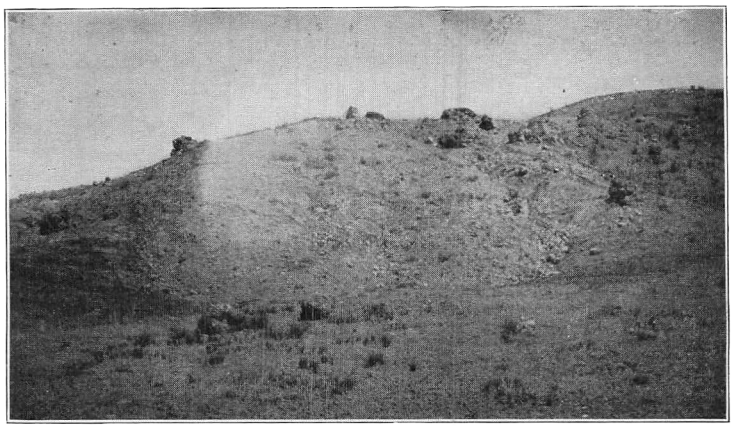


The septaria zone south of Salazar; the septaria lie weathered out upon the surface.

occupying the upper portion. The only fossil found here was *Gryphæa newberryi* Stanton. This was found below the septaria zone in the plain at the foot of Great Neck.

As viewed from the foot of Great Neck, the strata at the sides of Chivato and Prieta mesas dip gently north. Upon their beveled edges rest remnants of the once extensive lava flows.

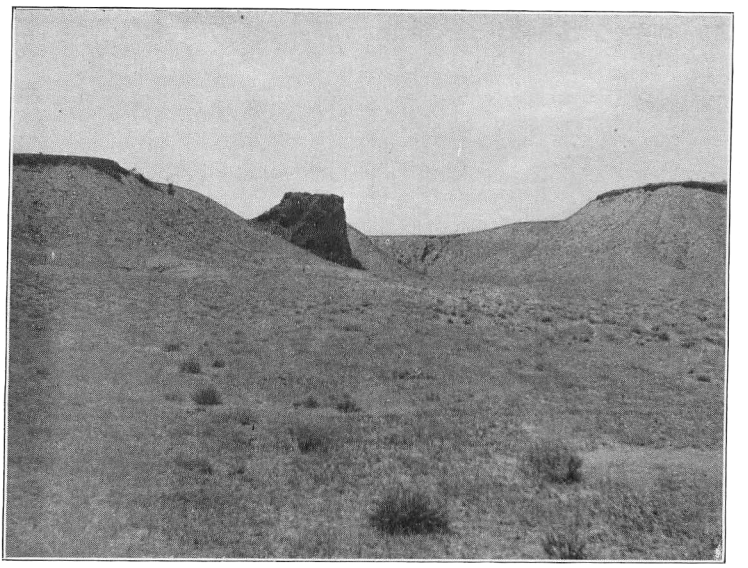
The septaria zone at Great Neck is about 700 feet higher, according to the map contours, than at Salazar, eight miles north, where it is found at the level of the town. From Great Neck to Salazar its thickness of about 50 feet continues rather constant. It is below the middle of a dark shale about 100 feet thick; this shale is capped by a more resistant sandy bed of 10 feet (this is the top bed of fig. 2).

Neck 8, south of Salazar, has Cretaceous strata extending almost to the top on the eastern side. The septaria zone lies at its base.

Salazar. — Fossils were collected from the septaria zone at

the base of the agglomerate neck illustrated in fig. 2, on the western side of the road. This neck is composed almost entirely of agglomerate with very many huge bowlders of sandstone, shale, etc. The approximately horizontal shaly sandstone of

2



A volcanic neck of agglomerate, one mile southwest of Salazar. The septaria bed is somewhat in the foreground. The black shale occupies the main portion of the slope and is capped by a resistant sandy bed.

the surrounding strata has been baked black for three feet from the neck. The fossils identified from this locality were:

Placenticeras ? rotundatum Johnson
? *Prionocyclus wyomingensis* Meek
Lima utahensis Stanton
Stantonoceras stantoni Johnson
Scaphites sp.
Turritella whitei var. *stantoni* S. and B.
? *Ostrea lugubris* Conrad

Turritella whitei and *Ostrea lugubris*, according to Stanton, do not occur above the Colorado formation. *Prionocyclus wyomingensis* is characteristic of the Fort Benton. *Lima utahensis* occurs with a Colorado fauna in the upper Kanab valley, Utah. *Placenticeras? rotundatum* is found by Johnson in the Fort Pierre of the Cerrillos Hills, New Mexico, while

he cites *Stantonoceras stantoni* as from strata of Cretaceous age. The fauna is thus of undoubted Colorado age, though the presence of the *Placenticeras ? rotundatum* would indicate that it was not of the lowest Fort Benton.

The slight northerly dip of these beds causes the septaria zone with its capping of sandstone, seen immediately south of Salazar at about the level of the town, to disappear a short distance north of the town beneath the flood plain of the Rio Puerco. The succeeding strata thus brought into view consist of an alternation of dark shales and brownish yellow shaly sandstones. This alternation continues practically to the divide southwest of Cabezon peak with a much greater predominance of sandstone in the upper beds entered to the north. Thus as the river flows south it enters lower and lower beds.

Neck 3.— At the eastern side of this neck some fossils were collected from the strata on the western side of the road at distances varying from 30 to 100 feet from the base of the neck. These fossiliferous beds are yellowish shaly sandstones. The following fossils were found here:

Trigonarca depressa White
Lucina cf. *subundata* H. and M.
Pteria linguiformis (E. and S.)
Solemya ? obscura Stanton
Pinna sp.
Actæon propinquus Stanton

Plant remains in extremely minute fragments are very abundant in many strata.

Actæon propinquus and *Solemya ? obscura* were found by Stanton in the Pugnellus sandstone (upper Fort Benton) of Colorado, and thus are there characteristic of the Fort Benton. *Pteria linguiformis* is of Montana age and the type of *Lucina subundata* of Fort Pierre, though this latter is found at Upper Kanab, associated also with a Colorado fauna. *Trigonarca depressa* has apparently not been found outside the valley of the Rio Puerco; the type was found in lower strata six miles south of Salazar on the east side of the river. While thus two species are characteristic of the upper Fort Benton and one of the Montana, with one occurring in both, an uppermost Fort Benton age for the fauna would appear to be indicated, unless we suppose that the apparent absence of clear water here during Niobrara time would cause the absence of the typical Niobrara fauna and a persistence of the Fort Benton fauna to Montana times. These strata under such a supposition might represent the Niobrara time without the typical Niobrara fauna.

Fossiliferous stations southeast of Cabezon peak.—A little northeast of Prieta mesa, as the road enters the Jemez sheet, and thence to Sierrita mesa, the strata have a slight westerly

dip; this dip increases toward the Nacimiento mountains lying to the east. Thus under the influence of the Nacimiento mountain uplift, these strata have a westerly dip practically to the western limits of the Albuquerque and Jemez sheets, though at this distance from the mountains it is very faint. West of this, the strata take again the slight but dominant northward dip characteristic of the plateau strata as a whole, lying north of the old land of southern New Mexico and Arizona.

A fossiliferous septaria zone appears again on the southwestern corner of the Jemez sheet (locality A). It forms a solid stratum about five feet thick and occurs in the midst of a dark shale which is capped by a thin sandstone stratum. Above this sandstone to the west is seen the steep eastern face of another dark shale capped by a thick, heavy-bedded sandstone. The two following fossils were found in this locality:

Prionotropis woolgari (Mantell)
Placenticeras placenta (Dekay)

The first species is a good Fort Benton index fossil. The second, though much more characteristic of the Montana, is also rarely found in the Colorado formation. These fossils thus indicate an age not earlier than upper Fort Benton. This finds confirmation in the presence of the Fort Pierre species, *Astarte evansi*, in but slightly higher strata to the northwest, though this would leave but little thickness for the presence of Niobrara between.

Along the Cabezon road a short distance east of Cabezon peak, a specimen of *Astarte evansi* (H. and M.) Whitfield was found in thin-bedded sandstone. This species, so far as the writers know, is restricted to the Fort Pierre.

On the northwestern portion of the Albuquerque sheet at locality B the following section was noted:

Brownish yellow sandstone; fossiliferous....10 feet.
Yellow shales; fossiliferous in layers.....30 feet.
Black shale; apparently unfossiliferous.....20 feet.

The following fossils were collected here:

Gryphæa newberryi Stanton
Inoceramus labiatus (Schlotheim)
I. dimidius var. *labiatoides* S. and B.
? *Yoldia subelliptica* Stanton
Anomia propatoris White
Ostrea lugubris Conrad
O. anomioides var. *nanus* Johnson
Cardium pauperculum Meek
Turritella whitei var. *stantoni* S. and B.
Lunatia concinna (H. and M.)
Priontropis hyatti Stanton
P. woolgari (Mantell)

Of these fossils the following are cited by Stanton* as not ranging above the Colorado: *Gryphæa newberryi*, *Inoceramus labiatus*, *I. dimidius*, *Ostrea lugubris*, *Cardium pauperculum;* this is also true of the genus Prionotropis, while *P. woolgari* is characteristic of the Fort Benton. *Yoldia subelliptica* and *Anomia propatoris* are characteristic of the Pugnellus sandstone (upper Fort Benton) in Colorado. *Lunatia concinna* occurs in the upper Kanab valley in Utah associated with a Colorado fauna. *Ostrea anomioides* var. *nanus* has been found only in the Fort Pierre of the Cerrillos Hills, New Mexico.†

Thus all except the last indicate a Colorado age for the strata, while the presence of this last variety and the forms characteristic of the Pugnellus sandstone give it a late Fort Benton aspect.

Summary.

The area under consideration is near the central part of New Mexico and is mapped on the eastern edge of the Mt. Taylor sheet and the southwestern and northwestern corners respectively of the Jemez and Albuquerque sheets. The road traveled followed up the Puerco river valley, on the western side of the Prieta mesa, as far as the village of Cabezon, thence bending southeast down the eastern side of the mesa.

A well-marked zone bearing calcareous septaria was observed along the western side of the mesa from the base of Great Neck near contour line 6500, north to Salazar at contour line 5800, where it disappears from view beneath the old flood plain of the Rio Puerco.

The fossils collected from this zone show the strata to be of Colorado age, probably of the Fort Benton.

A fossiliferous zone likewise characterized by septaria similar to those on the western side of the Prieta mesa was noted on the northeastern side. The fauna, however, is entirely different from that on the opposite side and the beds were found at an altitude 300 feet higher than that southwest of Salazar,—a difference too great to be offset by the slight westerly dip.

Hence it is evident that at least two septaria zones are present in the Cretaceous strata of the Puerco valley, though in no one place were two such zones noted even in sections of a thousand feet. Evidence of still another such zone is suggested in the almost totally distinct fauna of the "cephalopod zone" mentioned by Herrick and Johnson as occurring on the southwest corner of the Albuquerque sheet. Their faunal list is as follows:

*U. S. G. S. Bull. 106, p. 48.

†D. W. Johnson, Geology of the Cerrillos Hills, New Mexico School of Mines Quart. 1903, Jan.-Oct.

Ostrea lugubris Conrad
O. translucida M. and H.
?*O. sannionensis* White
Caryates veta Whitfield
Pinna petrina White
Sphenodiscus lenticulare (Owen)
Buchiceras swallovi (Shumard)
Placenticeras placenta (Dekay)
P. costata Herrick and Johnson
Exogyra læviuscula Roemer
E. columbella Meek
Liopistha concentrica Stanton
Camptonectes symmetricus Herrick and Johnson
Baculites gracilis Shumard
Prionotropis woolgari (Mantell)

The strata vary in age from the Fort Benton at Great Neck to doubtful Fort Pierre east of Cabezon; this latter determination was made upon but one fossil, *Astarte evansi.* The other faunas, especially those from Necks 14, 3 and from locality B show a commingling of many specimens of the Colorado formation with a few of the Montana. This would apparently indicate an upper Fort Benton age for the beds, unless we suppose that the apparent absence of clear water in this region during Niobrara times would cause the absence of the typical Niobrara fauna and the persistence of the Fort Benton fauna to Montana times. Under such a supposition, some of these intermediate strata would represent the Niobrara time, without the presence of the typical Niobrara fauna.

The strata where penetrated by the igneous rocks (dikes, necks, etc.) maintain their normal dip even up to contact with the igneous rock, nor do they show much more jointing near such contact than away from it. The baking of these sandy shales is comparatively slight. At Neck 4, south of Salazar, contact metamorphism is shown for only three feet from the narrow igneous intrusion. At Neck 5 an excellent contact is seen on the western side. The shales are here baked black for 10 feet; for the next 15 feet the baking is slight, the shales being darker than the unaltered beds, while beyond 25 or 30 feet the strata are practically unchanged.

Description of Species.

Mollusca.

Pelecypoda.

Ostrea lugubris Conrad.

(Bull. U. S. G. S. 106, p. 48.)

Agrees with description in size, general shape, and in plications and concentric lines.

One specimen of larger size than *O. lugubris* as described by Conrad may be classed with *O. bellaplicata* or *O. blackii*, although Stanton regards all as the same species, *O. lugubris* being a form dwarfed by conditions.

Locality and position,—Found rarely in brownish shales along the road fifteen miles southeast of Cabezon in the northwestern part of the Albuquerque sheet, and in similar shales along the road one mile southwest of Casa Salazar. The strata of both localities are Fort Benton.

O. anomioides var. *nanus* Johnson.

(The Geology of the Cerrillos Hills, New Mexico, by Douglas W. Johnson. School of Mines Quart. 1903, p. 113.)

Specimens agree with type description. This variety differs from the species *anomioides* only in being smaller and thus more delicate.

Locality and position,—Common in a dark sandy shale in the northwest corner of the Albuquerque sheet, fifteen miles southeast of Cabezon. The strata are of uppermost Fort Benton age.

Gryphæa newberryi Stanton.

(Bull. U. S. G. S. 106, p. 60.)

Agrees with description in all respects except the radiating striæ, which are absent in our specimens. This may be due to imperfect preservation.

Locality and position,—A single specimen was found in the sandy shales of Fort Benton age at the foot of Great Neck, and several in the brownish shales of upper Fort Benton along the road fifteen miles southeast of Cabezon.

Inoceramus labiatus Schlotheim.

(Bull. U. S. G. S. 106, p. 77.)

Well preserved internal mold of one specimen.

Locality and position,—The specimen was found east of the road in brownish yellow sandy shales of upper Fort Benton or possibly Niobrara age, fifteen miles southeast of Cabezon.

I. dimidius var. *labiatoides* nov. var. (Fig. 3.)

The specimens are well preserved and agree with the species description in every particular except the surface markings. Here minor concentric folds cover the larger folds and interspaces alike. There are usually from two to four minor folds between consecutive major ones. The major ones become less and less prominent toward the beak, but the minor ones continue to be almost as strong over the umbo. Named from *I. labiatus* because of similarity of surface markings.

Locality and position,—This variety occurs rather abundantly in a gray shaly sandstone of upper Fort Benton age.

The specimens were found along the road fifteen miles southeast of Cabezon on the northwestern part of the Albuquerque sheet.

The type specimen is now in the collection of the Boston Society of Natural History; catalogue number 13,342.

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Inoceramus dimidius var. *labiatoides* nov. var.

Pteria linguiformis E. and S.

(U. S. G. S. Terr. ix, p. 32.)

A somewhat imperfect right valve of a young specimen. As far as can be seen it agrees with the original description in shape of shell, relative length of hinge line, position and obliquity of beaks, and, as far as preserved, the surface ornamentation.

Locality and position,—A single specimen was found in a yellowish, rather heavy-bedded sandstone at the foot of Neck 3, on its northwestern side. The strata are of uppermost Fort Benton or possibly of Niobrara age.

Trigonarca depressa White.

(U. S. G. S. Bull. 106, p. 93.)

The specimens agree closely with the original description in size and shape of shell, and in ornamentation, though the broad, flat, radiating costæ are faintly visible only upon the younger shells. The prominent, radiating, raised line on the flattened triangular space posterior to the umbonal ridge is wanting. A ridge covered with radiating vascular grooves extends around the interior of the valve some distance from its margin; this shows rather conspicuously on the internal mold.

Locality and position,—This species is present in very great numbers in the heavy-bedded brownish sandstone at the northwestern foot of Neck 3 in strata of upper Fort Benton or possibly of Niobrara age. In layers it occurs so abundantly as to make up the rock mass. The type of the species was found some fifteen miles farther down the Rio Puerco valley. It has also been found by Herrick and Johnson southeast of the Prieta mesa.

Astarte evansi (H. and M.) Whitfield.

(Rep. Geol. Black Hills, p. 413.)

The individuals of this species are well preserved. The surface ornamentation is usually of broad, concentric undulations, separated by narrow interspaces.

Locality and position,—This species is abundant in the yellowish sandy shales along the road five miles southeast of Cabezon. It is a fairly good index fossil of the Fort Pierre which, taken with its stratigraphic position, may be sufficient to refer these strata provisionally to the Fort Pierre, even though but this one species was found here.

Lima utahensis Stanton.

(Bull. U. S. G. S. 106, p. 71.)

Two specimens, an internal and an external mold, are represented in our collections. They agree perfectly with the description in every respect except size, our specimens being less than half as large as Stanton's type, which is from the upper Kanab valley of Utah.

Locality and position,—In dark sandy shales of Fort Benton age, one mile southwest of Casa Salazar at Neck 14. Only two specimens were found.

Cardium pauperculum Meek.

(Bull. U. S. G. S. 106, p. 99.)

A single well preserved internal mold of this species was found in brownish shales on the eastern side of the road fifteen miles southeast of Cabezon at locality B. The strata are uppermost Fort Benton.

? Yoldia subelliptica Stanton.

(Bull. U. S. G. S. 106, p. 94.)

A poorly preserved internal mold is referred with extreme doubt to this species. It occurs in a dark brown sandstone at locality B.

Lucina cf. *subundata* H. and M.

(Bull. U. S. G. S. 106, p. 97.)

An internal and a poor external mold. Specimens imperfect. Agree with original description in marginal outline as far as retained, position, shape and prominence of the beaks. Slight traces of concentric striæ are present near the margin, but no radiating striæ. Shells slightly smaller than those of original description.

Locality and position,—This species was found associated with *Trigonarca depressa* at the foot of Neck 3. Age is uppermost Fort Benton or possibly Niobrara.

Solemya ? obscura Stanton.

(Bull. U. S. G. S. 106, p. 95.)

Our single specimen agrees with the original description in size, general shape, growth lines, and in the position of the beak.

Locality and position,—Occurs with *Trigonarca depressa* at Neck 3.

Anomia propatoris White.

(Bull. U. S. G. S. 106, p. 67.)

Specimens agree closely with the type except that they are slightly irregular in shape.

Locality and position,—This species is rather abundant in layers in a dark sandy shale on the eastern side of the road fifteen miles southeast of Cabezon on the northwestern portion of the Albuquerque sheet. The strata are uppermost Fort Benton.

GASTROPODA.

Turritella whitei var *stantoni* n. var.

Shell rather large, 20 to 35^{mm} long with diameter of the last whorl 10 to 12^{mm}. Sides straight. Sutures broadly but rather shallowly impressed. Larger shells have from 18 to 20 whorls. Surface of each whorl marked with three to five compressed and elevated spirals, separated by wider interspaces which are either smooth or covered by finer revolving striæ. The larger spirals upon the larger whorls are rarely nodose. The apical angle varies from 15° to 17°.

This variety differs from the species *T. whitei* in that it has fewer large spirals, the smaller ones usually absent, and the larger ones very seldom nodose (but one nodose spiral was noted). This form evidently completely agrees with the varietal form from Colorado noted by Stanton but not named by him.*

With these differences so constant over such a wide territory, it seems to us that for the sake of stratigraphic exactness a distinction should be made.

This variety differs from *T. galisteoensis* Johnson in its shorter whorls and smaller apical angle. That form has 10 whorls in a length of 30^{mm} from the apex of the shell, and according to the pictures the apical angle is about 20°. The finer intermediate revolving striæ are totally absent in that species.

*U. S. G. S. Bull. 106, p. 131.

Locality and position.—This variety occurs in very great abundance in layers in a dark shaly sandstone, one mile southwest of Casa Salazar at Neck 14. In places it constitutes the mass of the rock. In age the strata are Fort Benton. It is also found quite abundantly southeast of Cabezon at locality B associated with *Ostrea anomioides* var. *nanus*.

The type specimen is now in the collection of the Boston Society of Natural History; catalogue number 13,343.

Lunatia concinna M. and H.

(Bull. U. S. G. S. 106, p. 134.)

A single specimen of this species was found.

Locality and position,—In a brownish sandstone of uppermost Fort Benton age.

Actæon propinquus Stanton.

(Bull. U. S. G. S. 106, p. 161.)

Specimen imperfect and only a small portion of the shell retained upon the internal mold. Agrees with the description in size, shape, ornamentation, as far as visible, and in shape and size of aperture. The columella is not visible.

Locality and position,—Found rarely in the brownish sandstones at Neck 3_2 northwestern side, in strata of uppermost Fort Benton or possibly Niobrara age.

CEPHALOPODA.

AMMONOIDEA.

Placenticeras placenta Dekay.

(Bull. U. S. G. S. 106, p. 169.)

Our specimen measures in width of last whorl 2·6 inches; in thickness of shell 1·5 inches. It agrees with Meek's description in general form, size of umbilicus, nature of volutions, shape of aperture and condition of the surface. There is, however, no evidence of nodes or other prominences, and the periphery is more narrowly truncate than is shown in Meek's figure. Septa not very clearly shown.

Locality and position,—The single specimen was found in a brownish yellow sandstone twelve miles southeast of Cabezon at locality A. Associated with it was *Prionotropis woolgari*, a typical Fort Benton species, but the stratigraphic relations in the field are such as to make the formation either uppermost Fort Benton or Niobrara, since *Astarte evansi* was found in abundance in slightly higher strata a short distance to the northwest, while slightly lower strata to the southeast contain a mixture of Fort Benton and Montana species.

P. ? rotundatum Johnson.

(Geol. Cerrillos Hills, p. 135.)

Our specimens agree quite closely with the type description.

Locality and position,—They were found in a septarium in the midst of a dark shaly sandstone a mile southwest of Casa Salazar at Neck 14. Age of strata is Fort Benton.

? *Prionocyclus wyomingensis* Meek.

(Bull. U. S. G. S. 106, p. 171.)

External mold of a part of a volution. May be referred to this species.

Locality and position,—It was found in a brownish yellow sandstone at the foot of Neck 14, one mile southwest of Casa Salazar. The strata are Fort Benton.

Prionotropis hyatti Stanton.

(Bull. U. S. G. S. 106, p. 176.)

A young specimen of this species measures $\frac{3}{4}$ inch in diameter and consists of four whorls. The costæ are too unequal for the form to be the young of *P. woolgari* and the keel is too prominent. This species was found by Stanton in the Pugnellus sandstone (upper Fort Benton) of Colorado. The genus, according to him, is not found above the Colorado formation.

Locality and position,—Two young specimens of this species were found at locality B on the northwestern corner of the Albuquerque sheet, in a dark shaly sandstone of uppermost Fort Benton age.

P. woolgari Mantell.

(Bull. U. S. G. S. 106, p. 174.)

Three specimens were found with diameter 7, 5, and $\frac{1}{2}$ inches respectively. The largest specimen agrees with Meek's description in general size and shape. The outer whorl, however, shows a flattening and broadening of costæ unlike the wing-like appearance noted in his description, and is more quadrangular in outline. The specimen of medium size resembles the first and second whorls of the larger except that the whole is flatter, with larger umbilicus and less prominent nodes and costæ. This larger specimen seems to show gerontic characteristics and to be intermediate in stage between the type specimen and the gerontic individual described by Johnson in the Geology of the Cerrillos Hills, page 142.

The smallest specimen of this species is a little over a half inch in diameter, and is composed of three whorls. It has developed no nodes on the simple ribs, while the keel is low with a well developed flattening of the shell on each side of it.

Locality and position,—Two specimens of this species were found in a brownish yellow sandstone at locality A, twelve miles southeast of Cabezon. The strata are of uppermost Fort Benton age or possibly Niobrara. A fragment of another specimen was found at locality B in a brown sandstone of upper Fort Benton age.

Scaphites sp.

Several external molds, with a narrow but deep umbilicus and radiating ribs increasing by implantation are referred to this genus. One looks very much like *S. ventricosum.*

Locality and position,—Found in a dark calcareous shale, one mile southwest of Casa Salazar, at Neck 14; they were associated with fossils of Fort Benton age.

Summary.

The specimens are, as a rule, comparatively well preserved considering that they usually occur on arenaceous beds. The character of the beds likewise explains the predominance of pelecypods over other classes. Moreover the presence in several of the beds of an abundance of plant fragments indicates also the comparative nearness of land areas.

As suggestive of an unfavorable environment, it is interesting to note the presence of several dwarf varieties of mollusks in various localities in New Mexico, as well as at times extending north into Colorado. *Lima utahensis* Stanton attained here only about one half the size to which it grew at the type locality "southeast of Paria, Utah," and in the upper Kanab valley, Utah. *Ostrea anomioides* var. *nanus* Johnson is a dwarf form of the species *O. anomioides* Meek. *Lucina subundata* H. and M. occurs in the Rio Puerco valley slightly smaller than in Utah. The type of *Ostrea lugubris* Conrad was obtained from the old Santa Fé trail east of Canadian river, New Mexico; it is spoken of by Stanton as a dwarfed form which, under favorable conditions, grows much larger into the forms *O. blackii* and *O. bellaplicata.* This small form of *O. lugubris* is somewhat common also in the Mt. Taylor region of New Mexico.

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