

CHAPTER XV.

THE BLUFF GROUP, AND THE ALLUVIUM; SERIES XII AND XIII.

1143. In this Chapter are embraced the remaining formations of the State. Two of these appertain to the Mississippi Bluff, or rather to a belt of country which terminates on the west, with the Bluff; two of the others include superficial gravel beds occurring in different parts of Tennessee; and the last groups together the alluvial bottoms and beds of the rivers. They will be briefly considered, and are as follows:

(2) ALLUVIUM, SERIES 13.

(c) *Bottoms, and Alluvial Beds.*

(b) *The Eastern Gravel.*

(a) *Ore-Region Gravel.*

(1) BLUFF GROUP, SERIES 12.

(b) *Bluff Loam.*

(a) *Bluff Gravel.*

SECTION 1.

THE BLUFF GRAVEL. (12,a.)

1144. This bed varies in thickness from ten to fifty feet. It consists generally of coarse yellow and orange sands, with everywhere more or less coarse gravel, and has usually, a layer of white or variegated clay at its base. The gravel is generally the most conspicuous portion. This is sometimes cemented by oxyd of iron (occasionally by calcareous matter) into great blocks of coarse conglomerate. It consists of water-worn pebbles, from the size of a man's fist down to that of a pigeon's egg. The pebbles have been derived mostly from Carboniferous chert.

1145. The Bluff Gravel is remarkable for its extent in a general direction parallel with the river. It is seen along the

face of the *Mississippi Bluff*, (§ 279,) from the Mississippi line to Kentucky, and both ways much beyond these limits.

Its eastern outcrop is not well marked. It appears to extend from 15 to 20 miles eastward from a straight line drawn through the most westerly parts of the bluff. The bed is represented on the Map and in the section by a dotted line. It will be seen that the narrow river-valleys of West Tennessee cut this and the Bluff Loam into sections.

1146. The general character of the formation, and its relations to other groups, are exhibited in sections already given, and to these the reader is referred. (§§ 1137, 1138 and 1139.) At Memphis the highest part of the Bluff is about 100 feet above low water. The lower half of the section at this point belongs to the *Bluff Gravel*, and consists of alternating layers of yellow, orange, and white sands, containing towards its base, more or less gravel. It also contains a few seams of whitish clay. At some points also masses of ferruginous conglomerate occur, as well as thin plates and scrolls of red sandstone. In a branch back from the river a bed of coarse gravel was observed.

SECTION II.

THE BLUFF LOAM. (12,*b*.)

1147. This, the topmost of the Bluff formations, is generally a mass of siliceous loam, somewhat calcareous, and usually of a light ashen yellowish or buff color, but sometimes lacking the yellow tinge. It is indistinctly stratified; contains land and fresh water shells, and frequently oddly shaped calcareous concretions. It has in Tennessee, a maximum thickness of about 100 feet, ranging generally, however, from 30 to 80. In the Bluff at Memphis, it is from 40 to 60 feet thick, and presents in its lower part, along a well-marked horizon, and in a vertical position, earthy ferruginous casts or moulds of what may have been the long tapering tap-roots of some tree.

1148. The Loam rests directly upon the Bluff Gravel, and its range and extent are shown upon the Map by the spaces in-

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cluded within the dotted lines representing the outcrops of the Gravel. Its eastern limit, like the eastern outcrop of the underlying bed, is with difficulty defined; both alike are given approximately.

See also sections in §§ 1137, 1138 and 1139.

1149. This formation is seen to underlie large parts of the following counties, the first tier east of the Mississippi River: Shelby, Tipton, Lauderdale, Dyer and Obion. Its agricultural features are interesting and important; they have been spoken of in § 287, to which the reader is referred.

1150. The following species of shells have been collected from this formation:

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| 1. <i>Helix appressa</i> , Memphis. | 6. <i>Planorbis bicarinatus</i> , Memphis. |
| 2. <i>H. hirsuta</i> , " | 7. <i>Cyclas</i> , sp.? " |
| 3. <i>H. monodon</i> , " | 8. <i>Amnicola lapidaria</i> , " |
| 4. <i>H. solitaria</i> , Dyer County. | 9. <i>Lymnea</i> , sp.? " |
| 5. <i>H. profunda</i> , Hickman, Ky. | 10. <i>Succinea</i> , spo? " |

1151. Dr. Wyman has published a "Notice of Fossil Bones from the neighborhood of Memphis," which he states are representatives of the genera *Mastodon*, *Megalonyx*, *Castor* and *Castoroides*, and that they are "from, as is supposed, the diluvium of the Mississippi."* The geological position, as given here, is very indefinite. I think it, however, more than probable that the bones come from the *Bluff Loam*.

SECTION III.

ORE-REGION GRAVEL. (13,a.)

1152. It would have been better, perhaps, if this description had been placed as an Appendix after that of the *Bluff Gravel*. The age of this formation is only known approximately. It is certainly of later date than the Cretaceous beds in the Western Valley.† (Page 104.) It may be

* Amer. Jour. Sci., [2.] X, 56.

† At no point in Tennessee have I seen Gravel running under the Cretaceous beds. In northeastern Mississippi I have observed some doubtful evidences of this. Should such beds be found, it will make the Gravel of different ages. In the latter case, a portion of the deposits might be the remains of the ancient shingle of the Cretaceous sea, or estuary. So far, however, as my observations have extended, I am compelled to refer all the deposits, in Tennessee at least, to the same epoch.

synchronous with the Gravel of the Bluff; but of this I have no satisfactory proof. The formation is not indicated upon the Map.

1153. This is a wide-spreading, superficial formation. It is most conspicuous in the *Western Valley*; but its pebbles, sometimes in considerable beds, sometimes thinly strewn over the surface, are found on nearly all the high ridges lying between the Western Valley and the *Central Basin*; they occur, as will be seen, at the ore-banks, and are often a part of the matrix in which the ore is found.

1154. This gravel formation is by no means continuous. It occurs in patches, or detached beds, depending much, in this respect, upon the nature of the surface on which it rests, and upon the extent to which it has been denuded. The beds, however, in the Western Valley especially, cover locally large areas, the observer traveling upon them without a break for many miles. Their thickness is not great, rarely exceeding fifty or sixty feet, and being generally much less.

The gravel beds overlying the *Coffee Sand*, and forming the cap strata in the sections taken at Pittsburg and Coffee Landings, and given on previous pages, belong to this formation.

1155. The material of the formation was doubtless deposited after the Valley of the Tennessee had received, for the most part, its present general form. Its beds are found upon the bluffs of the river, upon the uplands back of the bottoms, on the western as well as the eastern side. Its extension westward is eight or ten miles. In a northerly and southerly direction, it skirts the river on both sides, from Alabama and Mississippi to the Kentucky line.

1156. The materials of the formation are water-worn siliceous pebbles, with more or less sand, the latter, however, not prominent. The pebbles have been derived mostly from Carboniferous rocks. The worn pebbles are sometimes locally mingled with angular cherty fragments; but in such cases the beds are in the vicinity of Paleozoic rocks, the known source of the angular chert. Not unfrequently masses of the gravel may be seen cemented, usually by oxyd of iron, into heavy blocks of coarse conglomerate. At the iron-ore banks, sections present

mingled masses of worn pebbles, angular chert, and limonite, in irregular forms and in "pots," the masses occasionally cemented into solid blocks.

1157. The *Western Iron Region* may be noticed here, as its ores are often associated with the gravel of this formation, and may be, as already suggested, of the same age. (§ 910.)

This is a large belt of the State in which "banks," or accumulations of iron-ore, occur at intervals. The area includes, in Tennessee, all or parts of the following counties: Lawrence, Wayne, Hardin, Lewis, Perry, Decatur, Hickman, Humphreys, Benton, Dickson, Montgomery and Stewart. It also extends further north into Kentucky. Over this whole region more or less ore occurs. At *certain centres*, which are called *banks*, it is found accumulated in deposits, many of which are of great extent and highly valuable.

1158. The *banks* generally have a high position, being located, with rare exceptions, on the tops or edges, of the plateau-ridges, which, in good part, make up this section of the State. To appreciate their geological relations, it must be recollected that these ridges are capped with the leached remains, the debris of the strata of the Siliceous Group, consisting of angular fragments of half-decomposed, and often bleached, chert, and of soft sandstones, imbedded in clay, with which there is often more or less sand. To this, matter is very frequently added above the water-worn gravel of the formation just described. Among the cherty masses, specimens of *Lithostroton Canadense*, and other fossils, are often found. (Compare §§ 888, 889 and 910-912.

1159. This bed of debris is from a few feet to 100 feet in thickness, and has no special stratification, excepting that here and there traces of the original bedding are left. In this bed, as a matrix, the iron ore, at certain centres, as stated, has accumulated and given us the "banks."

1160. The ore is *Limonite*. * Its source, I am inclined to be-

* There is but one exception to this, and that is found in the Red Ore Bank of Marion Furnace, near Clifton, in Wayne County, which is mostly *Hematite*. The ore occurs here in irregular layers, and presents features different from those of the other banks.

lieve, as I have already stated, (§§ 888 and 912,) has been the ferruginous chert of the Lithostrotion Bed.

1161. It occurs in irregular lumps or in hollow concretions called "pots," scattered through the matrix. These are often amassed in bodies of greater or less size, which present frequently the appearance of very irregular veins winding through the bank in different directions, and then again are mere shapeless masses. These bodies are often congeries of small pots; but sometimes have an open, spongy, or "honeycomb" structure throughout. The ore masses, both large and small, not unusually contain imbedded fragments of chert, from the size of a grain of corn to that of a man's head, or larger.

The principal varieties of ore are the *compact*, "*honey-comb*," *pot*, and *pipe ores* and *ochre*. The first three are common, and are found at nearly all the banks. "Pots" often occur, filled with decomposing chert, frequently with water, and a few have been observed enclosing splendid crystals of selenite. I have one in my cabinet enclosing a specimen of *Lithostrotion Canadense*. The pots vary in size from that of an orange, or smaller, to rough hollow spheres two feet in diameter. Pipe ore, in workable quantity, occurs at some localities in Stewart County.

1162. It is difficult to determine how much of the mass of matter in anyone bank is ore. The banks differ very much in richness. It may be near the truth to say, that the best of them afford on an average from one fourth to one third ore out of the material removed. The mode of occurrence of the ore in the banks is very irregular. It is found aggregated in bunches, or pockets, in irregular veins or beds, and columns, imbedded in, or traversing the matrix in different directions. These are of all dimensions up to masses twenty or more feet through. Or it occurs in isolated lumps of small size, scattered through the matrix. The large masses sometimes supply scores of tons of ore before they run out. In the excavations a mass is struck and followed until it disappears, when another is sought for. In a following chapter, other facts with reference to this iron region will be given.

I omitted to state in the proper place, that it is a rare circumstance to meet with beds of gravel or sand outside of the reach of the water cour-

ses in the *Central Basin*. In Wilson County, however, a belt of sand and gravel of this kind, several miles in length, lies between Lebanon and the Cumberland River. From one point of this, Lebanon is supplied with sand for building purposes.

SECTION IV.

THE EASTERN GRAVEL; RIVER BOTTOMS AND ALLUVIAL BEDS.

1163. A. *The Eastern Gravel*.—As in the western part of the State the Tennessee River is bordered with gravel on high points, so in the Valley of East Tennessee, nearly all the rivers, and especially those that flow into the State through the gaps of the Unaka Chain, (§ 6,) have belts of similar material skirting them. Approaching within two or three miles of these rivers, the traveler very often meets with coarse gravel, (coarser than that of the Ore-Region Gravel,) on the ridges, and often at a height of 300 or 400 feet above the level of the streams. The appearance of such material has more than once been to the writer the first intimation of the proximity of a river.

1164. These pebbles, of all sizes below that of a man's head, have doubtless been brought from the Unakas, and from the mountains in North Carolina. Some of them are from *Chilhowee Sandstone* mountains, (§§ 479-485,) and show the characteristic *Scolithus*-rods. They are found back from the rivers, as far as from one to three or four miles. The fact is an interesting one, but I do not propose, at present, to inquire how or when they got there, or, as to what changes have occurred since that time.

1164. B. *River Bottoms, and Alluvial Beds*.—From an agricultural point of view, the river bottoms are full of interest. They contribute to the State many thousands of acres of first class lands. Many of them have one drawback, and that is their exposure to overflow; but many of them are above ordinary high-water mark, and most of those that are not, are free from water the greater part of the year, and permit of the raising of splendid crops of corn.

As yet but little attention has been given to the geology

of our river beds, and alluvial bottoms. This remains to be done.

By far the most important alluvial area in Tennessee, is the *Mississippi Bottom*. The topographical features of this area have been given in the First Part of the Report, (page 119,) and to this the reader is referred.

SUPPLEMENT TO SILICEOUS GROUP. (Page 338.)

1165. In 1866, Dr. A. Winchell, of Ann Arbor, Michigan, and myself, agreed to prepare, jointly, a paper on the *Siliceous Group*. With a view to this, I was to put into his hands such species as I might have, or might collect, for examination and comparison. The same year I discovered what was, to me, a *new fauna*, and one that interested me much, and to which, as well as to the calcareo-siliceous, fetid shale in which the species occur, I have referred in §§ 883 and 884. A series of the fossils of this fauna, as well as others, from the base of the Siliceous Group, was sent to Dr. Winchell.

1166. After this, both of us being much engaged in other matters, nothing was done towards the carrying out of our mutual project, excepting that the fossils from near Manchester, and the Orthis, from White's Creek, were examined, and the results communicated to me. But so far as the others were concerned, nothing was done with them until within a few weeks; and since the section on the *Siliceous Group* has been in print, I have received the following paper.

1167. It will be seen that Dr. Winchell has described a number of species. This was done in accordance with my wish. It is to be noted, that he makes the shale of the age of the Kinderhook Formation of the northwestern States. This, to my mind, makes the Kinderhook Carboniferous; for it does appear to me, that the fetid (fragrant) shale is inseparably connected with the main mass of the "*Protean Member*." Of this, however, more hereafter.

NOTES ON FOSSILS FROM TENNESSEE, COLLECTED FROM STRATA IMMEDIATELY OVERLYING THE BLACK SHALE, AND TRANSMITTED FOR EXAMINATION BY DR. J. M. SAFFORD.

These fossils, so far as I know, are the only ones which have been discovered in Tennessee, in strata immediately above the *Black Shale*; and I entered upon the study of them with a great degree of interest. This interest had been enhanced by the opportunity of making personal examinations in Tennessee, in the winter and spring of 1866, along a line from Nashville, through Lebanon and Sparta, to the Cumberland Table-land. On this tour, I was enabled to verify the statements made in the "Geological Reconnoissance of Tennessee," and in Part First of "The Geology of Tennessee," in reference to the physical geography and geology of a remarkable portion of the earth's surface. I satisfied myself then, and so announced in a Report, which I afterwards made to a private company, that the "Siliceous Group" is, strictly, the prolongation of the "Knob Formation," of Kentucky and Indiana, and that it corresponds to some of the lower members of the Mountain Limestone series of America. It was still more apparent, that the St. Louis Limestone, in a siliceous condition, is spread out over most of the "Highland Rim" on the northern and eastern sides of the "Central Basin;" while the great mass of Limestone beneath the "False Coal Measures" of the Cumberland Table-land, is the Kaskaskia.

The fossils which I have now submitted to a careful investigation, were obtained from three different localities on the borders of the Highland Rim—one upon the eastern border of the Central Basin, one upon the northern, and one upon the western. Their stratigraphical position in each case, is such, that their identification must determine the age of the formation reposing directly upon the Black Shale. The fossils from the eastern and northern borders are:

1. *Spirifera Logani*?* Hall, a Keokuk Limestone species.
2. *Producta semireticulata*, Martin, sp., which ranges through the Carboniferous rocks.
3. *Orthis Michelini*, L'Eveille, also a Carboniferous species, and found in the "Knobs" of Kentucky.

Higher up in the Siliceous Group, I have heretofore identified *Rhynchonella Verneuilana*, a Chester Limestone species; and still higher, numerous species of the St. Louis Limestone, such as *Lithostrotion Canadense*, *Producta semireticulata*, *Streptorhynchus umbraculum*, *Spirifera Keokuk*, Var., and *perinflata*?

It is probable, therefore, that, in these portions of the State, the Siliceous Group embraces representations of the Keokuk, Chester and St. Louis Limestones.

*Better specimens than those in the hands of Dr. Winchell show this, in my opinion, to be *S. imbrex* of the *Burlington Limestone*. See page 342.—Safford.

Greatly to my surprise, the collection of fossils from Hickman and Maury counties, on the western side of the "Highland Rim," discloses the existence of a formation hitherto unknown in Tennessee—the representative of the Kinderhook Group, of Illinois, and its equivalents. The following identifications have been made:

1. *Spirifera hirta*? White and Whitfield, from the Yellow Sandstones of Iowa.
2. *Rhynchonella Sageriana*, Win., from the Marshall Group, of Michigan and Ohio.
3. *Chonetes multicosta*, Win., from the Yellow Sandstones of Iowa.
4. *Chonetes pulchella*? Win., from the Marshall Group, of Michigan and Ohio
5. *Producta concentrica*, Hall, from the Yellow Sandstones of Iowa, and the same horizon in Michigan, Ohio and Indiana.
6. *Chonetes Fischeri*, Nor. and Prat., from the Yellow Sandstones of Iowa.
7. *Lingula subspatulata*? Meek and Wor., from the Black Slate, of Illinois, and a black shale embraced in the Waverly, of Ohio.
8. *Zaphrentis Ida*? Win., from the Rockford Goniatile Beds.
9. *Conularia byblis*, White, from the Yellow Sandstones of Iowa.
10. *Leda bellistriata*? Stevens, from the Marshall Group, of Michigan.
11. *Solen scalpriformis*, Win., from the Marshall Group, of Michigan.

This is a list of identifications from a collection of 18 species; of which two others are more doubtfully identified with known species. Unexpected as this result may be, and questionable as two or three of the identifications may be, I feel constrained to state, that the indications of a majority of the specimens point conclusively to the existence in Tennessee, of a feeble representation of those beds in the horizon of the Marshall group, whose geological age has been the subject of so much discussion.

On studying the matrix in which these fossils are imbedded, I find that those marked "c," are from a rock almost identical with the yellowish-brown, calcarea-argillaceous beds of Rockford, Ind., (not the limestone in which the Goniatites are imbedded,) while those marked "b," are from calcarea-siliceous shales extremely similar to those of the Kinderhook group in southern Illinois, and finally, those marked "a," are from dark bituminous shales identical with those embraced in the Waverly of Ohio, at various places, and at Vanceburg, Ky.

The siliceous shales of the Kinderhook group of Illinois, reach to the southern extremity of the State. It is not at all improbable that they should extend along the western border of the Carboniferous area across the narrow end of Kentucky, into Tennessee. It may be pronounced probable that some representation of this formation will yet be traced from the eastern border of the Carboniferous area in Indiana, southward into central and southern Kentucky.

I append a more particular notice of the fossils embraced in these investigations, including diagnoses of four, which seem to be undescribed species:

NOTES ON THE SPECIES.

1. *Fossils from near Manchester, Cannon County, Tennessee, "immediately above the Black Shale."*

1. SPIRIFERA LOGANI? * Hall, Io. Geol. Rep., p. 647, pl. xx, fig. 7, and xxi, figs 1.a, b, and 2.

The collection embraces eight *silicified* specimens of a large Spirifera, which nearly agrees with specimen of this species from above Alton, Ill., and above St. Genevieve, Mo. They are, however, of smaller size—the largest measuring three inches along the hinge line.

2. PRODUCTA SEMIRETICULATA, Martin, sp.

Four specimens of a Producta agreeing in all respects with forms usually referred, in this country, to the above species. I have collected this species throughout the north-western States, in the horizon of the Marshall group, and thence through the Mountain Limestone, into the Coal Measures.

3. ZAPHRENTIS CANNONENSIS, n. sp.

Coral strongly curved, having the diameter of the cup, to the length along the outside of the curvature, as 1 to 3. Exterior somewhat smooth, impressed by numerous medium-sized wrinkles of growth. Fossette narrow and deep. Number of lamellæ, 28, in seven groups—besides the three in the fossette. The group on each side of the fossette contains 5 lamellæ; next is a pair of groups, each with 3 lamellæ, then a pair, each with 4 lamellæ, and lastly an azygos group, with 3 or 4 lamellæ. The lamellæ are not perceptibly twisted toward the center.

This species approaches nearest to an undescribed Zaphrentis from the Keokuk Limestone, near Burlington, Io.; but the latter species, besides being somewhat larger, is much more tapering below, less strongly curved, and has a deeper cup. It agrees nearly as well with *Z. elliptica*, white, which has an elliptic transverse section instead of a circular one.

II. *A Fossil from White's Creek, Davidson County, Tennessee, found three feet above the Black Shale.*

4. ORTHIS MICHELINI, L'Eveille.

This Orthis is absolutely identical with forms from the Carboniferous rocks of the north-west, which have been generally referred to *O. Michelinii*—though, sometimes to *O. Vanuxemi*, Hall, a closely related species. It is said by Prof. Safford to occur in the "Knobs," near Louisville, Ky.

III. *Fossils from "shales just above the Black Shale, in Hickman County, and the adjoining edge of Maury County, Tennessee."*

5. SPIRIFERA HIRTA? White and Whitefield, Proc. Bos., Soc. Nat. Hist. [Labeled 4.b.]

The single specimen referred to this species, is considerably larger than

*See Note on page 440.

specimens from Burlington, Iowa, the typical locality; and perhaps, the area is a little more extended latterly, but I can scarcely doubt that the species is the same.

Types from the "Yellow Sandstone," Burlington, Iowa.

6. *RHYNCHONELLA SAGERIANA*, Win., Proc. Acad. Nat. Sci., Phil., Sep., 1862, p. 407. [Labeled 1, and 1a, and 6a.]

Six specimens, showing both valves, and agreeing well with this species.

R. Sageriana has a wide geographical distribution, being hitherto known by me in remote parts of Michigan, and from Medina, Trumbull, Cuyahoga, Summit, Knox and Licking Counties, Ohio.

Types from the "Marshall Group," Michigan.

7. *CHONETES MULTICOSTA*, Win., Proc. Acad. Nat. Sci., Phil., Jan., 1863, p. 5. [Labeled 3.c and 3 a.]

The two dorsal valves in the collection agree in all respects with this species, except that the striæ are considerably more obscure than even in the typical specimens, and the exterior surface is minutely granulated.

Types from the base of the "Yellow Sandstones" at Burlington, Io., and into the base of the "Burlington Limestone,"

8. *CHONETES PULCHELLA?* Win., Proc. Acad. Nat. Sci., Phil., Sep., 1862. [Labeled 5. c.]

The single ventral valve of this species, shows only the inside, and hence, the number of ribs cannot be satisfactorily ascertained. There is a slightly divergent spine at each extremity of the hinge-line.

Types from the Marshall Group, of Michigan. This species occurs, also, in the Waverly, of Ohio.

9. *PRODUCTA CONCENTRICA*, Hall, Io. Geo. Rep., p. 517, pl. vii, fig. 3; Rep. N. Y. Regents, p.180. See also, Winchell Proc. Acad. Nat. Sci., Phil., July, 1865, p. 115. [Labeled 2.c and 2.b.]

The agreement in this case is all that could be desired. The collection contains one specimen showing both valves, one showing the ventral, and one, both sides of the dorsal valve.

Types from the "Yellow Sandstone," Iowa. This species occurs also in the same horizon, in Indiana, and in northern and southern Michigan.

10. Another specimen, marked 2.a, exhibits the exterior of a ventral valve resembling the forms named *P. Shumardiana*, by Prof. Hall, but this species is probably only a form of *P. concentrica*.

11. *CHONETES FISCHERI*, Norwood and Pratten, Jour. Acad. Nat. Sci., Phil., [2] Vol. III, p 25, pl. ii, fig. 3. [Labeled 2 a.]

A single exterior of a ventral valve. The inner surface is less finely pustulose than in the Burlington specimens, and the exterior is a little more distinctly striate.

Types from the "Yellow Sandstones," of Burlington, Iowa.

12. *DISCINA SAFFORDI*, n.sp. [Labeled 6,a.]

Shell rather small, outline nearly circular, but generally a little flattened, posteriorly, and also on each of the postero-lateral boundaries.

Upper valve rather depressed-conical, with the beak midway between the centre and the posterior side; under surface presenting a faint, but distinct linear ridge, extending anteriorly from the beak, one-fourth the diameter of the shell. Lower valve very depressed convex, with an apical pyriform indentation, having a blunt spur projecting from its broad anterior end. *No perforation visible*. Exterior of both valves ornamented with numerous fine, unequal, concentric striae; interiors smooth, except the faint vascular markings near the borders.

This curious species most resembles in general appearance, *Discina Lodensis*, Hall, from the Genesee Shale; but the pyriform indentation of the ventral valve, the finer exterior striae, and the unobscured foramen, will serve to distinguish it.

13. LINGULA SUBSPATULATA? Meek and Worthen, Ill. Geol. Rep., Vol. III, p. 437, pl. xiii, fig. 1. [Labeled 5.c.]

The single specimen, showing inside of (apparently) the ventral valve, is not over one-third the length of the specimen figured in the Illinois Report; but it otherwise agrees with the description in outline, markings, position of the beak, and faint, radiating lines along the middle.

L. subspatulata was described from the "Black Slate," of Union County, Illinois. At Vanceburg, Kentucky, and other localities near the Ohio River, and also in northern Ohio, is a black shale, embraced within the Waverly series, which contains a small *Lingula* closely resembling this specimen from Tennessee. If the Kentucky and Tennessee specimens are really *L. subspatulata*, it is singular that this species should be found in Illinois, in a shale occupying a position so much lower.

14. *Zaphrentis Ida*? Win., Proc. Acad. Nat. Sci., Phil., July, 1865. [Labeled 12.b, 12.c.]

The three specimens in the collection are all without epitheca, and lack the profound wrinkles of growth, which belong to the types of this species, from Rockford, Indiana. They also enlarge, upward, somewhat more rapidly.

15. CONULARIA BYBLIS, White, Proc. Bos. Soc. Nat. Hist., Feb. 1862, p. 22. [Labeled 8.a.]

I feel no doubt of the identity of this species. It possesses the small, isolated eminences or granulations ranged in a line along the crests of the ridges, which characterize well preserved specimens from Burlington, Iowa.* From 60 to 75 of these eminences may be counted in the space of an inch.

Types from the "Yellow Sandstones," Burlington, Iowa.

16. LEDA BELLISTRIATA? Stevens, Amer. Jour. Sci. [2] Vol. xxv, p. 261. [Labeled 10.a.]

* Dr. White does not mention these, and only says: "Spaces between the ridges finely crenulate." This condition appears on worn specimens. Compare with this, *C. Gervillei*, d'Arch. et Verneuil, Mem. Foss. Rhen. Prov. in Trans. Geol. Soc., Lond., Vol. VI, p. 351.

These five specimens are thus referred solely on account of external resemblances. The Tennessee specimens are a little over an inch in length, but do not, in this, exceed specimens from Michigan. At the same time, no indication of hinge structure has been observed; and the shell seems to have been thinner than usual, for species of this family. Should further discovery demonstrate that these specimens do not belong to Leda, they will probably fall into the genus *Sedgwickia*; but I do not consider it allowable, to propose a specific name to be based on the discoveries of some future investigator.

Types from the Marshall Group, Battle Creek, Michigan.

17. SOLEN SCALPRIFORMIS, Win. Proc. Acad. Nat. Sci., Phil., Sep 1862, p. 423. [Labeled 9.a.]

Shell, like the foregoing, unusually thin and delicate. Types from the Marshall Group, Marshall, Michigan.

18. PLEUROTOMARIA HICKMANENSIS, n. sp. [Labeled 7.a.]

Globose shells in an incomplete state of preservation, showing regularly convex whorls, ornamented with numerous delicately raised and finely beaded revolving striæ, and a well defined band without distinct carina. The striæ limiting the band are not beaded, but all the others on both sides bear 50 to 60 granulations to the inch. The striæ are quite unequal in number and distribution, since they increase by implantation, with the growth of the shell. The base of the shell is about an inch in diameter, and seems to be perforated by a small umbilicus.

I am unacquainted with any species, in any formation, which presents the above combination of characters.

19. PHILLIPSIA TENNESSEENSIS, n. sp. [Labeled 13.b, 13.c.]

Glabella prominent, indented by a small, round, depressed, postero-lateral lobe, and isolated by a deep occipital furrow, from a prominent occipital ring which extends, narrowing in width and curving backwards, entirely across the border, fading out toward the short, acute, genal angle. Border concave, bounded by a prominent ridge, outside of which is a linear groove limited peripherally by a sharply elevated, delicate linear margin. Surface of glabella, accessory lobe and neck-ring covered with fine, unequal granulations; a row of granules along the ridge of the border.

Pygidium broadly rounded, nearly twice as long as broad, apparently depressed; axis with 8 or 9 rings, tapering to the posterior end, which is somewhat abruptly rounded off, one tenth of an inch from the extremity of the pygidium; lateral lobes with 8 or 9 segments, becoming obscure posteriorly. Border about one sixteenth of an inch broad, marked on the under side by nine rigid, sharply impressed, parallel striæ. Exterior of the crust very finely and obscurely granulated. Length about three eighths—breadth five eighths of an inch.

Other characters of this species are unknown. It seems to approach nearest to *Phillipsia articulata*. Hall, sp.; (xv. Rep., N. Y. Regents.) from the Waverly of Ohio, but is destitute of the anterior and middle furrows of

the glabella. Neither does the description of that species give the surface characters, though comparison is made with *Proetus Missouriensis*, Shum., from the Lithographic Limestone of Mo., which is granulated like this. It differs from *Proetus (Phillipsia?) elliptica*, Meek and Worthen, (Ill. Geol. Rep, Vol. III, p. 460, pl. 14, fig. 8,) from the Kinderhook Group, in the characters of the cephalic border, in the absence of glabella furrows, and in the border of the pygidium.

20. Has the appearance of a minute *Spirifera peculiaris*, Shum., from the Chouteau limestone, Mo., and the Yellow Sandstones of Iowa. [Labeled 5.c]

21. Resembles *Spirifera Urei*, Fleming, (*Ambocælia gemmula*, McChesney, &c.) a carboniferous species. [Labeled 2.b.]

22. Portion of the test of a crustacean or dermal plate of a fish. Indeterminable. [Labeled 11.d.]

A. WINCHELL.

University of Michigan, Ann Arbor, 19th March, 1869.