Natural History

of

La Salle County, Illinois.

PART II.

GEOLOGY AND ZOOLOGY.

J. W. HUETT.
With an autograph of the author.

J. W. Brett.
AN ESSAY TOWARD

—A—

NATURAL HISTORY

—OF—

LA SALLE COUNTY, ILLINOIS,

IN TWO PARTS.

PART II—GEOLOGY AND ZOOLOGY,

By J. W. Huett.

OTTAWA, ILL.
FAIR-DEALER PRINT.
1898.
PREFACE.

This work was not written because there are not books enough. We believe there are too many, but because no one has hitherto attempted to collect and arrange what is known concerning the Natural History of this great county. We have waited, hoping to see someone, who was receiving a good salary, or one who had the time and means to enable him to take it up, come forward and give the world a worthy presentation of the subject, but we have waited in vain.

Up to the present time, the incorrect, and too often misleading articles in State Geological Report. The Catalogue of Plants by Prof. R. Williams, of Streator, published in Baldwin's History of La Salle County; the notes on the Geology and Natural History in same, pp. 486 to 541 of work, inclusive, 1877; Prof. H. L. Boltwood's Catalogue of the plants of La Salle County, published in Ottawa Republican, 1883-4; W. W. Calkin's Land and Fresh Water Shells of La Salle County, 1874; Judge Caton's article on the flow of Artesian wells, published in The Past and Present of La Salle County, 1877; Mr. C. F. Johnson's Catalogue of Plants of La Salle County, applying more particularly to Marseilles and vicinity, published privately about 1892, and fugitive notes by the author and others in the county papers, and the late Dr. Edwin Evans, "The Vermillion River Coal Fields," Streator, 1885, comprise the literature of the subject.
The author, several years ago, having collected more than 100 plants not in Prof. Boltwood’s catalogue proposed to himself a revision of that work, and was urged by friends to undertake the work. But ill health and unfortunate business adventures, prevented its immediate execution, and moreover he found the task to require an amount of labor much greater than he had contemplated, and want of health led to an abandonment of the work after much time and attention had been given to it and the manuscript for about half of it had been prepared.

The work was again taken up at the earnest solicitation of Prof. Williams, to be again abandoned as we thought definitely, but again Prof. Williams urged its completion, and under many, and not small difficulties and discouragements, the Botany was about ready for the press when we found it necessary to rearrange and revise it to make it agree with the 6th edition of Gray’s Manual. In the mean time we had enlarged our plan and had part of the matter for the other sections of the work prepared.

About this time, we opened correspondence with W. W. Calkins, attorney-at-law, of Chicago, formerly a resident of Deer Park Tp., who most unexpectedly to us, placed at our disposal his work on the Land and Fresh Water Shells of La Salle County, and a little later, offered to write the section on Lichens, and Prof. Williams kindly authorized us to use any part, and as much of Baldwin’s History of La Salle County, and Dr. Evans’ Vermillion River Coal Field, of which he is joint author, a privilege that we have found of much value.

For the Ichthyology and Entomology, we have consulted the Reports of the Indiana Geological Survey, Jorden’s Manual of Vertebrates, 4th edition, imprint: Jansen McClurg & Co., 1884; Tenney’s Natural History, imprint: Chas. Scribner & Co., 1866, as well as for other sections. Also Tryon’s Systematic Conchology; and other standard works.

The author is well aware that he has in most of this field gone over the surface, that much remains to
be done, but these little volumes form a nucleus about which the student may arrange the facts he collects and they will serve to enable one to ascertain what has been done, and instead of wasting his time in going over the same ground, threshing the old straw over, will enable him to begin where we leave off, and push on into the unknown regions which lie beyond.

We are getting old; have lived years longer than we expected to when we were 21, but at 65, one cannot have a very long time for work before him, and we have thought it wise to bring together the material we have gathered in past years, incorporate it with all we could obtain of the results arrived at by others, and thus give as complete a view of the "Natural History of La Salle County" as possible.

If we shall, through this work, impart one idea to a seeker after truth or aid some one in their studies of any part of the subject, we shall feel that we have not toiled in vain.

Nature is but God's revelation of Himself to man, hence a part of His word, the Christian can as clearly see the glory and goodness of his Heavenly Father in the stars of night, in odorous and beautiful flowers, in animals, the forest, the birds of the air, the fishes of the deep, in his own wonderful frame as the written word. Cold must be that soul and far from God who cannot feel His presence as clearly in the forest shades as in the temple made by hands, and does not hear His praise as distinctly in the ripple of the stream, the sighing of the breeze and the roar of the tempest as in the notes of the pealing organ or the song of the well-trained chorus. To the Christian all things beautiful and bright should be my Father's works, evidences of His eternal wisdom, goodness and power.

In the preface to Part I, will be found our acknowledgements to many friends, and these we reiterate here without repeating names given there, and will add to that list Thos. D. Catlin, president of National City Bank, Prof. U. J. Hoffman, County Superintendent of Schools and Pres. L. A. Vigness of Pleasant View Luther College.
This volume will be found less defaced by typographical errors than is Part I. Such as are of importance will be found corrected in the Errata at the close of the volume. Also some Addenda, facts which came to our knowledge too late to be given in their proper place. We shall be pleased to receive notice of errors or omission of any kind.

J. W. HUETT.

February 22, 1898.
EXPLANATION OF PLATES.

PLATE I—
Fig. 1. Horizontal strata.
2. Inclined strata.
3. Unconformable strata.
4. Synclinal.
5. Synclinal and anticlinals.
7. Synclinal in St. Peters N. of Millington.
8. Section across Ill. Valley, through Buffalo Rock.
10. Section strata of La Salle Co. E. to W.
11. Section strata of La Salle Co. perpendicular.

PLATE II—
Fig. 1, 2. Sandstone bluffs.
5. La Salle Limestone a and c hard rock; b shale weathering out when a falls over as at Bailey Falls.
13. Cracks in shale sections.
7-8. See page 59.
11. Markings on exterior of fossil tree trunks.
12, 14, 15, 16, page 57, for 17 read 12.
18. See page 10; for Fig. 9 read 19.
Plate of shells is from W. W. Calkins' Land and Freshwater Shells of La Salle county.
Natural History of La Salle County

PART II.

THE GEOLOGY OF LA SALLE COUNTY.

Geology has for its object a description of the structure of our earth, of the character and arrangement of the materials of which it is composed and the explanation of the phenomena observed. This embraces a description of the rocks forming its outside or surface, of the fossil remains of plants and animals which they contain, such as bones, shells, teeth, stems, leaves, etc.

We must also observe the order in which the different beds occur, how they differ from each other, and the fossils characteristic of each. And as far as possible we must account for the formation and present condition of each stratum. We must also observe what minerals and ores characterize each, the mode of their occurrence, and, if possible, discover their origin.

The field of geology is, therefore, a vast one, and many of its problems are of a most perplexing nature. But we may feel sure that the laws of nature have always been the same, that a given cause has always produced the same effect, and that the causes which today are producing certain results, produced the similar results which we find registered in the rock-sculptured annals of past eternity.
In the language of geology all of the material of the globe is termed rock, whether hard and unyielding like granite and limestone, or soft and pliable like clay, or loose and incoherent like sand. All rocks are divided into two great classes—stratified, arranged in layers, strata or beds; and unstratified, showing no layers or beds. Another division is into igneous, the result of volcanic action, and sedimentary, deposited by water. The sedimentary are divided into fossiliferous, those containing more or less of animal and vegetable remains, and nonfossiliferous, containing no remains of plants or animals. Sedimentary rocks are, of course, stratified, and all fossiliferous rocks belong to that class, but all stratified rocks are not fossiliferous.

The rocks of the Central Plain are, with few and not important exceptions, stratified, and most of them more or less fossiliferous.

While large bodies of unstratified rocks have been produced by volcanic action, others are evidently only sedimentary beds changed by heat and pressure, so that they have assumed a new form, for we may in some cases trace stratified beds to where they lose all evidence of stratification. It is now believed that by far the largest part of all known rocks is of sedimentary origin. Rocks differ much in composition, character, color, hardness, weight, etc. According to composition they may be divided into calcareous or lime rocks, arenaceous or sand rock and argillaceous or clay rocks. A rock is often made up of two or more kinds of material. Hence we have calcareo arenaceous, calcareo-argillaceous, areno-argillaceous, etc., rocks. In general, unless there are special reasons for a more careful designation of character, we shall call those rocks of which sand, though not the only, is the principal component, arenaceous; those of which lime
is the chief ingredient, calcareous; and those of which clay is the largest factor, argillaceous rocks.

Slates are rocks splitting into thin, smooth plates; shales, those which split in very thin, irregular pieces. Shales are generally argillaceous, but arenaceous shales are not uncommon. Limestones sometimes assume this form, but generally are coarse and rough in comparison to the sandstones.

Rocks are divided into formations or groups which are distinguished from each other by the fossils they contain. These groups are called ages, and are subdivided into eras, these into periods, and these into epochs. The following table, founded on that given in Dana's Manual of Geology, IVth Ed., copyright 1894, imprint American Book Company, 1895, pp. 410–11, will give the reader a better idea of the relative position and relations of these groups than would many pages of description.

Table on pages 6 and 7.
An inspection of this table shows that the geological series is not the same in all places, that some members are often wanting, and that the same beds vary greatly in thickness at points but a few miles apart, and that strata may utterly disappear in the course of a few miles. There is probably no place in the whole world where all the formations are found, and but few where any one of the eras is completely represented.

The greatest thickness of the stratified rocks is variously estimated, for they nowhere are so exposed as to admit of direct measurement, and even where measurements are possible they are usually inclined, so that it is not the actual thickness that we measure, but a diagonal to it—the hypotenuse of a right-angled triangle, the height of which is the distance we seek. These calculations give a greatest thickness for the sedimentary rocks of not less than 120,000 feet, or more than 22 3-5 miles, and a least thickness of eight to nine miles.

We observe from the above table that many entire eras are not represented in Illinois, and that some of which portions are found in it do not appear in La Salle county, that really from the carboniferous to the glacial epoch there was little or no addition to the strata of this part of the earth. This means that it was no longer a sea shore region or an area of shallow lagoons or lakes, but dry land. Changes there undoubtedly were, it may be great ones, but they did not result in building up great accumulations of sediments in which were entombed the remains of the strange inhabitants of those lands. For long ages the sun looked down on, it may be, a great forest region or grassy plains, over which roamed strange, weird forms, to our minds uncouth and frightful, the then lord's
of creation, the masters of a world that the most powerful imagination can scarcely picture to the mind. We have used the words time, age, period, epoch, as the names of divisions of the geological scale; a word as to their meaning. A time is a division embracing all those rocks, the fossils of which have a common character in their relation to the life of the present. An era is a division of a time, the fossils of which have many features in common. A period is a smaller group of strata of which the fossils have a very close similarity, and an epoch is a division distinguished from others by the presence of certain fossils not found in other beds. If we survey the strata of the United States we shall find that the Cambrian is well represented about Lake Superior and in Northern New York; the Silurian in Central and Western New York and along the Appalachian Mountains; the Carboniferous on both sides of the Appalachians, but especially on the western side; the Triassic, Jurassic, Cretaceous and Tertiary along the Atlantic and Gulf coasts and about the Rocky Mountains; and the Glacial in the northeastern and northern part of the country, almost entirely confined to the section north of the Ohio and Missouri rivers.

By strata we mean beds or layers. It is very probable that these strata were originally nearly horizontal—there were, no doubt, slight slopes, it may be, of 10° to 12°—but there could have been no very steep inclines. As all sedimentary beds were deposited from water they were laid down on the sea shore or in lakes. As a consequence, we may infer that the area over which any beds may be wanting was at the time they were being formed dry land, unless their absence can be satisfactorily accounted for in some other way. The strata are not usually found in a horizontal posi-
<table>
<thead>
<tr>
<th>AGE</th>
<th>PERIOD.</th>
<th>EPOCH ENG.</th>
<th>ILLINOIS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cenozoic</td>
<td></td>
<td>Quaternary</td>
<td>Recent. Champlain, Glacial.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Miocone. Miocone ft. in Upper, N. J., Eocene ft. in Rocky Mt. S.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occurs in Southern Indiana, Illinois.</td>
</tr>
<tr>
<td>Mesozoic</td>
<td></td>
<td></td>
<td>Upper Cretaceous, 800-2,000 ft. in Texas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Often Wanting.</td>
</tr>
<tr>
<td>Triassic</td>
<td></td>
<td></td>
<td>Triassic, 2,000-3,000 ft. in Richland, V. A., 2,000-15,000 ft. in W. of Rocky Mt.</td>
</tr>
<tr>
<td>Permian</td>
<td></td>
<td></td>
<td>In some localities, noted for remains of fishes; 3 to 10 ft. thick.</td>
</tr>
</tbody>
</table>

TABLE OF THE GEOLOGICAL AGES, FORMATIONS, PERIODS, AND EPOCHS OF THE WORLD AND THOSE OF ILLINOIS AND LA SALLE COUNTY, WITH REMARKS, THICKNESS, & C.
<table>
<thead>
<tr>
<th>Era</th>
<th>Age</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonic</td>
<td>10 to 15,000 ft.</td>
<td>Carboniferous, 20 to 2,000 ft. Illinois; 31,000 and more in Penn.</td>
</tr>
<tr>
<td>Palaeozoic</td>
<td></td>
<td>Sub-Carboniferous, 5,000 ft. Pennsylvania.</td>
</tr>
<tr>
<td>Devonian</td>
<td>31,000 ft.</td>
<td>Lower Helderberg, Onondaga, Niagara.</td>
</tr>
<tr>
<td>Devonian</td>
<td>13,000 ft.</td>
<td>Lower Helderberg, Salina and Waterline, Niagara, Clinton, Medina.</td>
</tr>
<tr>
<td>Upper Silurian</td>
<td>2,500 ft.</td>
<td>Trenton, Canadian.</td>
</tr>
<tr>
<td>Upper Silurian</td>
<td>2,250 ft.</td>
<td>Potsdam, Acadian, and Georgian.</td>
</tr>
<tr>
<td>Lower Silurian</td>
<td>7,800 ft.</td>
<td>Cambrian, 12,000 ft. in Wales.</td>
</tr>
<tr>
<td>Archean</td>
<td>10,000 to 40,000 ft.</td>
<td>Huronian, Laurentian.</td>
</tr>
<tr>
<td>Archean</td>
<td>10,000 to 40,000 ft.</td>
<td>Huronian, Laurentian.</td>
</tr>
<tr>
<td>Upper Carboniferous, 5,000 ft. Pennsylvania.</td>
<td>Upper Carb. Lower Carb. Millstone Grit, Upper or Mauch Chunk, Lower or Pocono.</td>
<td></td>
</tr>
<tr>
<td>Hamilton beds are found along the Mississippi S. of Rock Island.</td>
<td>Hamilton. Fortuno &amp; Genesee. Hamilton.</td>
<td></td>
</tr>
<tr>
<td>These beds cover more than one-half the area of the State</td>
<td>Old Red Sandstone, Devonian.</td>
<td></td>
</tr>
<tr>
<td>Trenton–Hudson 750 ft at Cal. O. Galena, 250, Iowa. Trenton, 350, 5 to 40 ft., 203 at Streator.</td>
<td>St. Peter's Sandstone, 125-275, 25 at Streator; Utica, Cambena Bed s; 225 at Streator.</td>
<td></td>
</tr>
</tbody>
</table>
tion, but have been tilted and bent until they lie at all possible angles, and are, in some cases, even over-
turned, so that the lower strata are uppermost. In this region, however, they are but slightly inclined in general, the only exception being in the country border-
ing the Big Vermillion and in the west part of the county.

Rocks whose strata are nearly parallel to each other are said to be conformable; those whose beds are at an angle one with another unconformable. Unconformability in the rocks of the Central Plain is not common. One example exists in the carboniferous sandstones, in the hill where the road ascends the bluff beyond the stone bridge over Covell creek on the river road. Along the Big Vermillion they are inclined at high angles, 30° to 45°, and much flexed and broken, but in other places depart but a little from hori-
zonality, and lie, it may be assumed, in nearly the position in which they were deposited, and others at the tunnel and near the Big Vermillion river, as we shall see farther on. Our knowledge of the rocks lying far below the surface is derived from the walls of ravines cut into them by streams, from the places where by tilting they have been brought to the surface, and from mines and borings, but the deepest mines are less than four-fifths of a mile, and the deepest borings but little more than a mile deep, and these distances are very small compared with the total thickness of the rocks at any one point, but strata are often so inclined that the edges of many thick beds are exposed, and it is from such exposures that we acquire most of our knowledge of the deeper lying beds.

We have said above that the strata were origin-
ally nearly horizontal, and also that they were depos-
ited along coast lines or in inland seas or lakes. They
then must have had a slope or inclination equal to that of the shore on which they were deposited, and were, probably, thinnest on the shore side, in the case of narrow seas, the thickest beds being probably in the middle, or, at least, at a distance from the shore, or in the neighborhood of the mouths of great rivers, just as today vast masses of material are being piled up near the mouths of the Mississippi and other great streams.

On an ocean beach, exposed to the full sweep of the waves, we find few perfect shells, the constant movement of the restless waters keeping them in motion, and in a short time reducing even thick and heavy ones to fragments, so that it is only in sheltered nooks, under the lee of islands, or in well protected bays, that we may hope to find the strand strewn with the treasures of the deep. But more than this, shell fish usually live in colonies as the oyster, mussel and clam, or in places where they can most easily procure their food, and although to anything that can swim the whole realm of ocean seems open, yet we find even fast swimming fishes restricted to certain parts of the sea, and their bounds as fixed and changeless as the great mountain chains which form the barriers between nations. Thus ocean currents, the temperature of the water, the material for food, all these are factors in the distribution of marine life. Then some creatures cannot endure mud-laden water; others flourish in it; some fatten on decaying vegetation, some shun it as if it were destruction to them, so that the remains that may be entombed in the deposits of a coast will depend upon many elements of which we may be able to ascertain but two or three, but we may rest assured that extensive deposits of shells and other organic remains are certain indices of quiet waters except in the case of coral reefs and an abundant, regular supply of food,
suited to the needs of the beings, whose tomb these rocks are. We are sometimes astonished at the rapid thickening or sudden thinning out of a particular layer, but we must remember that then, as now, the shore line was not always the same, the land oscillating, sinking here, rising there, so that formations would be shortened in one direction and lengthened in another. Thus let aa, plate 2, fig. 9, be the level of sea, bb shore, cc a layer of sediment. Then if the land sink so that ee is the level of the sea, the sediments will extend to that height, and the beds at all points below aa be much thickened.

Changes of level are not usually rapid, as far as we know, except in a few cases, a foot to three feet in a century, but there may be periods in our planet’s history when the forces causing these curious phenomena are more active than at others, and when there may be in certain areas a rapid rise or settling of the land, and a consequent change in the area covered by water. We must not forget that all our strata were deposited in water, that the dry land is not built upon, and that the remains of its inhabitants are not preserved except the bones, and these rarely, unless they happen to be swept into the ocean or a swamp where they happen to be covered by mud, and thus sealed up in a casket of nature’s own manufacture and embalmed in a manner that mocks at art’s efforts to imitate it.

The rocks are but the catacombs, hoary with the dust of ages, from which the geologist by patient research brings forth the mummies of races that perished, and whose tombs were gray with age ere man had laid the first stone of the first pyramid, or the tribes that lived between the rivers had made the first brick for the most ancient of Nineveh’s palaces. These are truly Nature’s medals of creation, a mighty
gallery of statues, each of which is a perfect representation of the original, a fac simile of the individual, not a copy of a type or of a conventionalized figure, but a true cast, or the thing itself that once lived and moved and had a being either on the land or in the seas of a world, that with all our research and efforts the most powerful imagination can but dimly or fragmentarily reproduce.

From the rocks we may gather much concerning the conditions under which they were laid down, whether in deep or shoal water, on the sea shore, in quiet bays or in swamps swept by tides and subject to inundations from some great river and much else, while from the shells and bones we can, in a measure, reconstruct the life of the sea, and in part of the land and from leaves and stems restore in part at best the vegetation of worlds gone by, of ages that we may not count a past eternity.

In our region at least the limestones are richest in fossils, and these are generally in good condition. Some of the sandstones contain a considerable number of fossils, but these are often poorly preserved and much less satisfactory than those of the limestones. The shales and clay slates are in places richly fossiliferous, and among the remains entombed in them are a multitude of ferns beautifully preserved.

The geology of La Salle county, while simple in outline, presents some problems of no little interest. The rocks of the western part have been greatly disturbed, and this convulsion has made its effects felt at a considerable distance. Again, the connection of the various areas of coal has been much discussed, and very different opinions have been held by parties well qualified to judge.
The actual correlation of the St. Peters sandstone and the Chazy of New York is not yet proven, and the exact equivalence of the Utica cement beds and the calciferous of New York may yet be questioned, and we need not wonder that it is so when a well informed writer tell us that so far as he knows these rocks contain no fossils, when a not very exhaustive search has given the writer one trilobite, several bivalves, and two or three univalves, in all not less than a dozen species of mollusks and many fragments of seaweed.

The rocks of La Salle county embrace some of the very old strata, running back into the Cambrian period, at one time thought to be the theatre of the first life, the morning of the world’s childhood. But we now know that back of this there was life, and while the Cambrian may have been one of the morning hours as marked on Eternity’s dial, it was not the first, probably not the second, but the third or fourth in order of those eras of primeval time.

While we have representatives of ancient time, we have none of recent until we reach the very last period. Scattered here and there over the first half of the geologic records, whose vast volumes are the rock-ribbed hills and its leaves the fossil entombing strata, a few chapters have been taken at random and quite fully presented and bountifully illustrated with miniatures and portraits of the tribes that have lived and vanished, while all between is a mighty blank, and, as far as any clue can be obtained from what is given to us, trackless void. Were the record everywhere as brief as it is here we should know very little of the strange and wonderful tribes that have lived and reigned for a time, only to dwindle to nothingness and vanish from sight forever like the meteor that for a moment blazes with a brightness that eclipses the orbs of night, and
dazzles and astonishes man, to be veiled the next moment in eternal gloom.

A look at the table of strata shows us that the lowest formation in this county is the calciferous or Utica cement rock, the lowest member of the great Silurian era. It consists of thin bedded, blue rather hard limestones with layers of very porous calcareous sandstone and some beds of a hard, coarse sandstone nearly a foot thick. It forms the floor of the Illinois Valley from a half mile east of Utica to near the tunnel west of that village, and the north bluff from Utica to a fourth mile east of the tunnel, but does not appear in the south bluff.

The upper beds of this formation contain many large (18-inch to 3-feet diameter) chert nodules, made up of concentric layers, often variously colored. These are well shown in the bed of a small stream in the northwest part of Utica village, on the west side of the road leading by the cemetery up the bluff, just south of where the road to the west leaves it. Below this nodular bed thirty strata are found varying in color, thickness and composition in a total thickness of 83 feet 8 inches. The section begins in St. Peter's sandstone and descends less than half way through the calciferous. It was taken at a point about three-fourths of a mile west of Utica station:
Sections of Part of Calciferous Strata of La Salle County.

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Thin</th>
<th>Thick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>St. Peters sandstone</td>
<td></td>
<td>2-3</td>
</tr>
<tr>
<td>2</td>
<td>Cherty (flinty) limestone</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Cherty, round grained limestone</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Limestone, magnesian</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Sandstone with lime</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>Limestone</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Limestone with chert</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Calcareous sandstone</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Cement rock (limestone) good</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Sandstone</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Shaly limestone and clay</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>Cement rock, impure</td>
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<td>10</td>
</tr>
<tr>
<td>13</td>
<td>Sandstone stands heat well</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cement rock, poor</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Chert, impure flint</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>Cement rock, impure</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>Sandy limestone</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>Cement rock, impure</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>&quot;          &quot; good</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>19</td>
<td>Limestone; building stone</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>20</td>
<td>Calcareous sandstone</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Limestone breccia</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Cement rock</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>23</td>
<td>Limestone; sandy</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>24</td>
<td>Cement rock; impure</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Limestone</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>26</td>
<td>Cement rock; good</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>27</td>
<td>Calcareous sandstone</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Limestone</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>29</td>
<td>Cement rock; fair</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>30</td>
<td>Limestone, upper part cherty</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Cement rock, good</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>Quartzite</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>Cement rock</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
This section is substantially the same as that given in "Geological Survey of Illinois, Vol. III," p. 281, and in the "Economical Geology of Illinois," Vol. II., p. 230. Nos. 32 and 33 have been added, and the phraseology of the list somewhat changed.

Hydraulic limestone was formerly quarried in a low ridge in the valley or bottom about a mile southwest of the railroad station at Utica. This was No. 22 of the above section, and to get it 20 and 21 were removed, 20 furnishing a very good building stone, while 21, has the appearance of being made up of irregular masses and fragments of older rocks, for the pieces are of different shades, and vary in hardness, and as the angles are sharp cannot have been carried far from the place of origin; is traversed by many cracks and breaks very irregularly, and is adapted to coarse, rough work only. It also contains many small, irregular cavities, some of which are filled with delicate aggregations of milk-colored crystals of no great beauty, while others are nearly empty.

With time these quarries have been pushed toward the village, and the cement rock is now mined instead of removing the overlying material, as was formerly the practice. The same plan is pursued at the works two miles west of Utica station, where Nos. 31, 32 and 33 are mined. These beds come to the surface nowhere else in the State.

In the Illinois Reports, as well as in W. W. Calkins' article in Baldwin's History of La Salle county, it is stated that these beds yield no fossils. This is incorrect, for the writer has obtained, generally in poor condition, from Nos. 20 and 21 alone a species of murchisonia very abundant; a small trilobite one-third inch across; two brachiapods, and eight or nine other species of shells. In the water lime or cement rock
but one fossil besides algæ was found. It resembles a murchisonia. Fragments of algæ are plenty, but not well preserved. Besides these there are vertical holes, perhaps the work of worms, and many markings which have been too little studied to enable one to give an intelligent opinion of their character. These beds will, we believe, well repay the patient, earnest investigator for his time and labor. They seem to speak of shallow seas, of rapid deposits, of sudden changes in the character of the sediments and of a comparatively limited fauna; and our beds seem to have been deposited on an open shore, exposed to a heavy surf, which accounts for the absence of well preserved fossils, but not for the absence of corals. The waters must have been turbid, too heavily charged with sediment to permit those lovers of clear water and wild breakers to flourish in it.

These beds have for many years furnished water, lime or hydraulic cement, the manufacture having been begun by James Clark at Utica. There are now two large manufactories, one at Utica, the other two miles west of the station at the crossing of Pequemsauggin creek.

The calciferous rocks are overlaid without break or disturbance by the Chazy or St. Peters sandstone. If the identification be correct, we have here one of the most widely extending formations in the world, for it extends more than half across the continent, and how far north and south is wholly unknown; certainly some 400 miles; in all probability twice that distance.

The St. Peters sandstone is a vast deposit of silicious matter about 200 feet thick, obscurely strati- fied, varying to some extent in composition from pure silica to a rock nearly half clay, from very coarse to fine grains and in color from white to creamy white
reddish, reddish brown, bluish and silvery white, and in hardness from a very soft pulverulent mass to very hard rock. Much of it is composed of almost perfect quartz crystals, clear as the clearest water, and without speck or flaw. While the planes of stratification are but faintly marked, the rock is often laminated, and the planes of lamination are as distinct as are the former, and may, unless carefully observed, be mistaken for them. Plate II, fig. 10, aa, are planes of stratification, bb the planes of lamination which vary in inclination not only in the different beds, but in different parts of the same bed, and are sometimes wholly wanting.

The St. Peters, as far as we have examined it, is utterly destitute of fossils, or any traces of either animal or vegetable remains, and is in general character one of the most homogenous of rocks. It forms the floor of the Illinois Valley from Ottawa to a point about a mile east of Utica, the north bluff from a mile west of Ottawa to Utica, and the south bluff from a point four miles west of Ottawa to Little Rock. It also forms the bluffs of Fox river to beyond Sheridan, and again appears in the bluffs near Millington, and to the northeast of that place. It is the rock into which all the deep ravines opening into the Illinois valley are cut from one-fourth to one-half mile before reaching the valley. On the north side of the river, in the ravine of Clark's Run, it is exposed for more than a mile from the bluff. It is generally inclined to the south and southwest, the slope being very moderate, but at Millington it appears in great arch-like rolls as shown by plate II, fig. 11. While along the Big Vermillion, it is often inclined at an angle of $45^\circ$, as is also the case at the tunnel, near the La Salle-Utica line. Some of the strata are, in places, rich in bisul-
phide of iron (pyrite), and much harder than the adjacent beds, but the decomposition of the pyrite leads to the rapid disintegration of these hard beds, and they give way before the attacks of moisture and frost almost as rapidly, sometimes faster, than the softer and apparently less stable rocks.

In some places this rock forms perpendicular cliffs 90 to 130 feet high; in others the lower strata have decayed, leaving the upper overhanging for many feet—70 to 80—and forming what are locally called caves, a noted one of which is Atwood’s, Clark’s or Delbridge’s cave, about seven and a half miles southwest of Ottawa, on the road to Deer Park. Others quite as fine exist along the Illinois at various points, especially between the old slaughter house and Mayo’s ravine and ferry on the south bank of the river. The canons also furnish several fine examples of such recesses or rock shelters, some of which would furnish very comfortable quarters for twenty-five or thirty persons. See plate II, Figs. 1, 2, 3. The Trenton is overlaid conformably, as far as is known, by the carboniferous or coal measures, a great collection of clays clay shales, sandstones and limestones. There seems to have some time intervened between the close of the St. Peters era and the beginning of the carboniferous, for the surface of the former, where uncovered by the removal of the coal and clays, is seldom smooth, but generally pitted with bowl-shaped cavities and dome-shaped hillocks, with here and there a cut as if it had been the bed of a stream mentioned above seven or eight feet deep, and the time, geologically speaking, may not have been very long.

At Ottawa, on the bottom east of the Fox river, as in Fig. 1: Thin bedded clays, 7 to 8 feet; hard clay, 6 to 7 feet; coal, 22 inch; gypsum, 1 to 1½ inch; fire clay, 3 to 10 feet; St. Peters sandstone.
At Marseilles the same coal is 40 feet below the surface, and two miles west of Fox river it is resting on the St. Peter's sandstone, and 75 feet above the surface of the Fox river bottom, or not less than 88 feet above its level in the bottom, and 113 feet above its horizon at Marseilles. West of the tunnel, lying on the St. Peters, we find a limestone which the fossils found in it prove to be the Trenton. It is usually a hard, semi-crystalline, somewhat silicious, gray to buff gray rock, the upper strata thin, the lower thicker and more blue than gray. It is generally traversed by veins of calcite, very white, sometimes translucent, and contains some cavities in part filled with very handsome crystals of that mineral. On the south side of the Illinois river, in the valley of the Big Vermillion river, it appears in several places, first about a mile above Lowell, where the river has cut across a ridge of it which extends to a point west of the bridge at Lowell, next about the entrance to Deer Park. The Economical Geology of Illinois, Vol. II, p. 233, near the bottom, says: "The entrance to Deer Park is through the Trenton limestone, which forms portals on both sides, until it abruptly terminates against the St. Peter's sandstone," etc. The Trenton does not there or anywhere else in La Salle county terminate abruptly against anything. The St. Peters sinks beneath it just as it does at the tunnel. There is no fault, not even unconformability. A great part of the Trenton has been swept away, otherwise it would add a hundred feet or more to the height of the park walls. Its next appearance is about 200 rods southwest of Starved Rock, where it is very silicious. Here it covers several acres. To the northeast of this, and about eighty rods southwest of Starved Rock, on the edge of the bluff, are a few small mounds of it, and
then it is seen no more until we reach Covell creek. Here it is found lying conformably on the St. Peters, at the stone bridge over that stream, on the river road. It extends from the bridge about a half mile up the stream, where it disappears beneath the coal measures, has a breadth of about a half mile, and a thickness of sixty feet or more. On the north side of the Illinois it extends to just beyond the C., R.I & P.R.R. tracks, not reaching the bluff. Here, as about Deer Park and near Starved Rock, it appears to have been much disturbed, and does not lie smoothly on the St. Peters, but forms a series of little troughs and ridges, as if it had been subjected to enormous pressure and forced into folds. It also seems to fill a channel or trough in the St. Peters, which on either side of it rises, like banks, even with or above its surface. It appears nowhere else in the Illinois valley in La Salle county. On Fox river, however, there are several exposures, the first in the southwest part of Mission township, Section 31, and again in Section 18. The next locality known is Section 36, Township 36, Range 5 East, and the next is in Kendall county, Section 19, Township 36, Range 6, East, known as Brady’s Quarry, where it is said to dip 65° north, a steeper inclination than any along the Big Vermillion.

The last and the most noted exposure of the Trenton occurs on the Little Vermillion in Troy Grove Township, near the village of that name. The extent of the outcrop is not great. It can be traced a little over a half mile one way, along the stream, and about half as far at right angles to it, and the beds are about twenty feet thick. It has been noted for the number, size and fine condition of its fossils, in these respects surpassing by far any other exposure in the county.
The Trenton as a surface rock covers but a small area in the county, and nowhere shows beds more than seventy-five feet thick, perhaps as thick as this at the entrance to Deer Park, but at Streator a carefully made boring shows it to be no less than 203 feet. A boring made many years ago at Lowell reports it at that place as 170 feet, and there are thirty feet of strata still before the St. Peters is reached. We have not seen a single place where these rocks are exposed where there is anything between them, and we do not believe there is at Lowell, and we therefore consider the whole 200 feet as Trenton, for there has been little denudation of this rock at that place.

The scattered exposures, as we have remarked, that on Covell creek and west of Ottawa—that on the north side of the river, seem to lie in troughs or channels cut in the St. Peters, and seem to be in most cases the upper beds of the area, but that at Troy Grove—formerly Homer—cannot be of that character. The beds there dip to the northeast, and we venture to say are only one of several ridges, one of which is seen to the northeast of Millington, bringing the St. Peters to the surface at that point, and now the site of a great sand quarrying and washing industry.

It seems to us that the explanation is a very simple one. Whoever has observed the calciferous between Utica and the Pequamsauggin must have noticed that it lies in rolls, or constitutes a series of small synclinals and anticlinals. We believe the whole rock mass from the tunnel east to be made up of such rolls, but perhaps larger ones, the tops of which have been removed by glacial action, and the Troy Grove Trenton is a part of what was once a continuous sheet of Trenton strata, that on the top of the rolls having been broken up and carried away.
The Trenton is eminently a fossiliferous rock, containing the remains of many species of the animals of that time, all marine, with some of algae or seaweed, for land plants do not seem to have existed in that age. The animals are all what we should call shell-fish or mollusks—crustaceans, resembling the crab and lobster—celenterates or corals, and others of the lower forms of life. The Covell creek locality has furnished several species, as have the quarries west of Ottawa, but the Troy Grove quarries were long famous for the variety, size and excellence of their specimens. These beds are truly a "city of the dead." Here multitudes of the then lords of the sea, the giant orthoceros and the yet more huge endoceros were entombed to be preserved for countless ages, and then brought forth from their mausoleum to astonish and puzzle man.

The following list is believed to give all the fossils thus far known from the Trenton beds of La Salle county:

Blumenbachii, Calymene Trochonema umbilicata, Raphistoma lenticularis, trilobite, Clark's Run, southwest Lowell, Deer Park.

From the Big Vermillion and Covell Creek we have the following: All cephalopods or resembling the nautilus of today Cyrtolites and Maclures coiled Orthoceros straight, the shell divided into chambers, the animal living in the outer and larger one.

Cyrtolites trentonensis, Orthoceras anellum; O. junceum; O. vertebrale; O. titan; Cyrtoceros macrostomum, Cyrtoceros constrictostriatum Maclarea; Conularia trentonensis; and R.; near Lowell; Streptelasma corniculum; Septena sericea, abundant; Orthis, Rhynchonella, Strophomera, Buthotrephis suculens and B. gracilis, Fucoids, abundant at Lowell and several other species; also abundant two miles west of court house,
Ottawa. At Troy Grove, formerly Homer, are found Lituites undatus, Gonioceras anceps, Ormoceros bacekii, Orthoceras fusiforme, Endoceras Annulatum, E. protiforme, Petaria corniculum, Ctenodonta, Leptena sericea, Strophomena alternata, Asaphus canalis, a trilobite, Pentamerus, etc.

The Trenton west of Ottawa and on Covell creek contains many silicious nodules and irregular masses, some of them a fine chert, which are undoubtedly the remains of sponges, many species of which have been identified and published by Dr. E. Everett.

Corals; Halysites, two species; Favistella stellata and a few good specimens of Archimedes reversa — screw coral found by A. C. Baldwin, of Deer Park, are all which have been identified. The absence of fossils in the St. Peters and their imperfect condition in the calciferous have been noted. We venture, however, to name as certain Conocephalus minutus the tail shield, a trilobite; Ophileta levata, Murchisonia, Lin-gula, from the calciferous.

Lying on the Trenton, where it is present, in places where it is wanting, on the sandstone, we find the rocks of the carbonic age — the coal measures, a vast collection of sandstones, limesstone, shales, clays and beds of coal. In La Salle county this formation is about fifty feet thick at Marseilles, twenty-five to thirty feet just northeast of Ottawa, is wanting about Utica, over 600 feet thick at La Salle and 211 at Streator, while in the central part of the State its thickness exceeds 1,000 feet.

On the eastern side of the county we have in the Illinois at Crotty or Seneca shales or clays about fifty feet thick; coal, two feet; fire clay, four to ten feet. At Marseilles the bluff shows a heavy bed of sandstone some fifteen feet thick, and below this traces of
a coal seam, then clays and shales. coal, and below it fire clay, the coal being about forty-five feet below the sandstone.

As we go west the strata rise, the sandstone disappears, the clays and shales thin out—that is, rise, and the upper part has been carried away, so that in the valley the coal comes nearer the surface, and about a mile and a half northeast of Ottawa is not more than fifteen to sixteen feet below the surface, and a little farther to the west is not to be found.

In the south bluff it rises much less rapidly, not attaining this elevation until near the South Ottawa Deer Park line, the general make-up of the strata being the same. About a mile east of Utica station the coal disappears in the north bluff, and is not found there again until a little west of the Utica-La Salle line, just west of the tunnel. At Streator the formation is 211 feet thick, while two miles west of Grand Ridge no coal was found in a boring 300 feet deep, and in places along the Big Vermillion river the Trenton limestone comes to the surface. West of the tunnel and the Big Vermillion river the coal measures thicken rapidly, and a depth of 525 feet has been measured at La Salle, and the strata reported with thickness and character as may be seen, Economical Geology of Illinois, Vol. II., pp. 210, 211 and 212. Yet the bottom of the formation was not reached, while in the southeast part of the county it is reported to be 400 feet to coal No. 2.

In that part of the county north of the Illinois river coal is found as far north as Dayton, in the Fox river bottom, and as far as the north line of La Salle Township, on the Illinois Central railway, about two and three-quarter miles from the La Salle station. In Utica Township coal has been dug in the north part of
Section 3, and undoubtedly extends into Waltham Township. In Economical Geology of Illinois it is stated that coal has been found in the valley of the Little Vermillion in Section 35, Troy Grove Township, and also in Section 25, one and one-fourth miles farther up the stream, in each case about four inches thick.

But for all practical purposes a line starting at the west line of Dimmick Township, one mile north of its south line and running directly east across the county, is the northern boundary of coal beds, although spurs and thin strata of coal may be found farther north. In this connection it is well to remember that within the last twenty years many reports of the discovery of coal at points farther north have appeared, but to this time the evidence for their existence is so small that no effort has been made to develop them, and we may feel very sure in the face of this fact that no one feels confidence enough in the knowledge and judgment of those making these statements to lead him to venture anything in an attempt to open a mine, or even to test the truth of the reports. It may be safely assumed that the coal measures extend to near the north line of the county; it may be at one time extended farther, and that coal beds may have reached some miles farther north than they do now. The fact that we have found fragments of coal in drift near the middle of Whiteside county, and that the same is reported from near Millington would seem to indicate that this was the case.

At Seneca, or Crotty, Marseilles, Ottawa, and along the bluffs of the Illinois, but one bed of coal is found east of the tunnel, on the north side of the river, and on the south, except near the Big Vermillion. At Streator there are two workable beds and four beds of
coal. At La Salle there are three workable beds and seven beds, one very thin. A little south of the entrance to Deer Park canon there are three, all workable.

If now we study the Vermillion region carefully we shall observe five strata that are very persistent, and retain certain features through the whole area wherever they are found. One of these is a peculiar limestone, hard, gray, nodular, rough and readily yielding to frost and moisture, and abounding in a small spinous shell, Naticapsis; two sandstones, the higher called by Dr. E. Evans, deceased, of Streator, whose report on this section we follow. The Newton sandstone is compact, hard, bluish, and in rhomboidal or rectangular blocks; the second, lying about sixty feet below it, is softer, buff brown, not in blocks and breaks irregularly, is more porous and the upper layers shaly, the whole containing much more pyrite than the former, in some places surcharged with this salt from top to bottom, in others containing immense nodules, three to five feet in diameter, hard as hardened steel and striking fire with steel like flint; and two black slates, upper and lower, which split into very thin, even sheets, three to four feet square. Observing these landmarks there is no difficulty in proving that the geological survey of Illinois made most remarkable work of the Vermillion coal field. In Economical Geology of Illinois, p. 213, we find the following statement:

"The lower La Salle coal, No. 65 of the section, has been traced with its associated strata to the vicinity of Morris, in Grundy county. It is undoubtedly coal No. 2 of the Illinois river section," etc., and "the middle La Salle coal, No. 46, in the section, is coal No. 5 of the Illinois section, according to Prof. Worthen's general section of the coal measures in Central
and Northern Illinois, and the upper La Salle coal, No. 42, in the section, is No. 7 of the Illinois section.” On page 42, Vol. VII., of the Geological Report, we read; “On Section 24, Township 32, Range 2 east, the section observed was similar to that at Lowell. * * The section here is as follows: (1) Sandstone, ten to twelve feet; (2) shale, six to twelve feet; (3) black slate, two feet; (4) shale and limestone, four feet; (5) black slate, six feet; (6) clay slates, fifteen to twenty feet; (7) covered space (slope), four to five feet; (8) coal in river bed, one and one-half to two feet. This coal he calls No. 4, while he would call the first black slate coal 5, and has apparently no use for the lower black slate, No. 5, above. But the most striking argument is the following, same page as above: “Forty-seven feet below the base of the foregoing section (the bed of the river) another seam of coal, thirty inches thick, was found by boring at this point, which I have no doubt is coal No. 2 of the general section and the lowest seam in the shafts at La Salle and Peru.” To the last conclusion we assent, but we deny that a bed of coal was found forty-seven feet below the coal found in the river. The boring was some distance from that place, and that any one who has spent a day on the Big Vermillion should for a moment pretend to identify coal seams by the depth at which he finds them, when he can follow a seam and see it seventy-five feet above the water, and within forty rods see it sink beneath the river to reappear again farther south. This difference in elevation does not prove that the seam at one point is not the same as at another; in fact, the level at which a seam lies has nothing to do with what it is, especially in a disturbed region like the Big Vermillion valley. It is not by the levels at which they occur, but by their relation to other strata that we must decide the question as to the identity or dif-
ference of beds of coal or other material, and in this case we have the Craddock limestone, the Newton sandstone, the Streator sandstone, the upper black shale and the lower black shale, all of them extending throughout the basin, in patches, at least, and always in the same order for our guides, and they lead us to but one conclusion, and that is that no one ever saw coal No. 4 in the Vermillion region, or ever will. Had Prof. Worthen spent two or three days on the Vermillion unencumbered by a theory or general section to which, like travelers to the bed of Procrustes, the poor facts must accommodate themselves, and studied the rocks as they lie there and let them tell their own story by tracing out the relations of the various coal seams to the sandstones and of the black shale beds to the coal seams, he might have learned that they always occupy the same positions with regard to each other, and are certain guides to the sequence of the strata, and he would have found neither No. 4 nor No. 5 coals in this region. We conclude, then, that the coals at La Salle are Nos. 2, 7 and 8, that coal No. 3 is a thin, double bed at Streator, but becomes a black shale north of Kirkpatrick's, and is the lower black slate in Prof. W.'s section's section, that No. 4 is coal at Streator, but black slate farther north, that No. 5 is a black slate, that No. 6 is not found, that No. 7 is the Streator, Kirkpatrick and Middle La Salle bed, always having a thick sandstone or thick beds of sandy shales a few feet below it, another harder and divided into rectangular blocks some feet above it, and a few feet above this a hard, nodular limestone—the Craddock of Dr. Evans, a little above which we find coal No. 8, the upper Deer Park and La Salle bed, that No. 9 lies a little below the La Salle limestone, and No. 10 above it. We also conclude that the lower and the upper
black slates, the sandstone below No. 7—the Streator sandstone, the one above it, the Newton sandstone and the hard, gray, nodular Craddock limestone are the most uniform and extensively distributed strata, and reliable guides to the place of the coal beds in the series.

The coal at Ottawa, Marseilles and Seneca is No. 2. At Marseilles No. 7 has been found in patches near the base of the bluff. It is probably the same bed of which some traces have been found at two or three places in South Ottawa. But that this bed does not exist in most of the region between Ottawa and Streator is very certain, borings 280 to 300 feet deep having failed to find it, or any other coal. About Grand Ridge we presume that No. 2 is at least 330 feet below the surface, and to the southeast still deeper, and it is the only bed that exists there, No. 7 being confined to the vicinity of the Big Vermillion and its tributaries. Some eighty rods south of the entrance to Deer Park glen, in a bluff on the east side of the river, three beds of coal are seen rising out of the water to a height, the upper one of eighty feet or more, all three of which have been worked, and which, by reference to our land marks, are at once seen to be Nos. 2, 7 and 8, not 2, 5 and 7, as the State report calls them.

In the shaft at Wenona, Marshall county, coals Nos. 2, 3, 4, 5, 7 and 8 appear, the first being thirty-two inches thick, the second, four inches; the third, fourteen inches; the fourth, fourteen inches; the fifth, forty inches; and the sixth, six inches. No. 6 is represented by four inches of black shales.

The Caledonia shaft in the north part of LaSalle Township is 550 feet deep, shows four beds of coal, one near the top thin, the others, No. 2, 46; No. 7, 42; No. 8, 48 inches thick, and two black slates, each
24 inches thick, no doubt the equivalent of coals Nos. 4 and 5. This shaft is remarkable for the immense bed of shales above coal No. 8, no less than 215 feet in thickness.

In the north part of Utica Township coal has been dug by removing the soil and a thin covering of hard clay. The coal is about eighteen inches thick, and perhaps extends a short distance into Waltham Township. Coal has also been dug just south of Dayton, in the Fox river bottoms.

At Ottawa, to the northeast of the city, the superincumbent earth, soil, slaty clay and indurated clay, being removed, and the coal, twenty-two inches thick and underlaid by one-half to one inch of fibrous gypsum, and this by three to eight feet of fire clay, is quarried like rock.

The clay is usually removed by blasting, being too tough and hard to be broken up by the plough. When wet it has a soapy feel, and has received the common but erroneous name of soapstone, and it is this or a similar clay that figures in our sections as soapstone.

We have spoken of the strata of La Salle county as lying in a nearly horizontal position, but have mentioned some facts that imply at least that there are exceptions to this rule.

If we travel from Ottawa to La Salle we shall find that the St. Peters sandstone rises in the north bluff until at Utica station it is about 100 feet above the level of the station, and in the northwest part of Utica village (North Utica is its corporate title) we see in a ravine the St. Peters resting on a thin bedded limestone. As we go farther west we observe that this limestone rises in the same manner, and at last, about two miles west of Utica station, forms the entire bluff. But scarcely has it reached this elevation, equivalent to an uplifting of not less than 400 feet between this point and Ottawa, when it begins to descend toward
the west, and for about a half mile sinks gently in that direction, and then suddenly plunges down at an angle of 40° with the horizon, beneath the St. Peters. On the west side of the ridge thus formed we find the Trenton resting on the St. Peters, and the coal measures, at first very thin, but thickening very rapidly toward the west, lying on the Trenton.

If now we look across the Illinois river toward the south we shall see a point of rock similar to that through which the tunnel is cut, and we may, if we will, follow the line of this sudden drop of the strata to the south, finding that the entrance to Deer Park canon is a point in it, Lowell another, and that it pursues a south, southeast, north, northwest course, and that here once existed a considerable ridge, perhaps a range of low mountains. It is not easy to decide whether the coal measures covered this ridge in all its parts or not. We, however, believe that they did not cover that part of it north of the Illinois valley and between the tunnel and Utica station, and extending north as far as the coal measures exist. This ridge is distinguished by the moderate dip to the east or southeast of the strata on the east side of it, and for the steep inclination to the west of those on its west side. Along the axis the rocks are much broken up, and traces of the disturbance exist miles to the east; but all the inequalities which we find in the various strata must not be charged to the disturbance caused by the formation of this fold. The movement was certainly long continued and produced very considerable effects. A part of it involved the coal measures, and it would seem that the principal part of the change occurred after all of our coal beds were formed. It would not be easy to explain the phenomena on the Vermillion on any other theory. The wrinkling of the
coal beds, which is very clearly shown at Ottawa, and still more so at other places, must be attributed to this cause.

The distribution of the Trenton is not easily accounted for. It may have been, most unquestionably has been removed over extensive areas, but why at Streator we should have a thickness of 203 feet of this rock and only isolated patches of it in the Illinois valley, and on or in the adjacent bluffs, is not easily explained. But such are the facts. It is also somewhat puzzling to find a strip of Trenton limestone extending nearly across the Illinois valley, about two miles west of the court house at Ottawa, resting conformably on the St. Peters, while the north bluff shows St. Peters at a higher level, covered by conformable coal measures and the Trenton wanting, and, to make the puzzle greater, Buffalo Rock, a vast, isolated mass of St. Peters, capped with coal measures, rises some sixty-five feet higher, and is but a mile farther west. But the difficulty vanishes if we suppose the eastern slope of the ridge to be near the west side of the Trenton area, and it is possible the latter may cross the low land north of the C., R. I. & P. tracks, and may be found near the bluff in that direction. We have, at least, a curiously warped surface for the eastern boundary of the ridge, which then becomes a low plateau with its crest near the western border.

The limestones of the calciferous are not pure carbonate of lime, or lime and magnesia, but contain a considerable percentage of alumina or clay. An ideal combination is lime, 56 parts, alumina, 36 parts, and oxide of iron, 8 parts, or 61 parts lime to 39 parts alumina. Specimens from Rondout, N. Y., give carbonic acid 34.2, lime, 25.5, magnesia, 12.35, silica,
15.37, alumina, 9.13, sesquioxide of iron, 2.25. They do not seem to have been formed by the entombment of vast masses of organic remains, for of these there are few traces in them, and corals and corallines are most conspicuously absent. Were they formed from the debris of pre-existing limestones? If so they were ground to powder. Or is a part of our calcareous rock a chemical product, the result of the action of carbonic acid gas on waters charged with sediments? It seems to us that this may have been the source of a part of these rocks, and we believe was. That all calcareous rocks have been formed through organic agencies we do not think a necessary corollary from our knowledge of the processes now in operation, and it seems to us an unnecessary and unreasonable conclusion. That there was much clay and other impurities mixed with it is self-evident, and this would seem to imply an off-shore deposit and the almost total absence of fossils, either an open and surf-washed coast, or a sea deficient in material to supply food to a varied and numerous population.

The St. Peters bears in places traces of strong and opposing currents, and an uneven bottom with slopes of 15° to 25°, as if the bed in some places had been formed at the mouths of strong flowing but medium-sized streams. The absence of fossils may be explained in several ways. The streams bearing the sand to the sea may have been cold, turbid and destitute of food material, the sand may have been furnished by the wear of a shore washed by a cold and stormy sea; or it may have been swept by cold currents which kept the temperature too low to make it the favorite haunt of the tribes peopling the deep.

The Trenton limestone was evidently deposited under conditions very favorable to the development of
both animal and vegetable (marine forms) of life, and the same is true of a part of the coal measures.

We must not forget, however, to observe another fact relating to these strata. The formation of the Trenton beds did not begin as soon as that of the St. Peters ended. The evidence is conclusive that the St. Peters was for a time the surface, the dry land, and was worn and channeled by the action of air and water, and the Trenton was laid down on this roughened surface, sometimes very rough.

Farther north the Trenton is composed of two members, if not three, the Galena limestone, the lead-bearing rock of Northwest Illinois, a thick bedded, rather hard, buff magnesian limestone or dolomite, and lying above it a shaly limestone, rich in fossils, the Hudson River or Cincinnati shales. This last seems to be wanting here, as are also many of the fossils which characterize it.

The carbonic area was evidently one of constant changes. The fossils are, except the vegetable, largely marine; hence, we are sure that much of it was at times beneath the sea, or was covered by broad, perhaps shallow lagoons, to which the sea had easy access. There was an exuberance of molluscan life, a considerable number of species and a multitude of individuals, such a host that often great masses of rock are almost made up of the remains of a single species.

The plants were of few families but many genera, and the number of individuals great. But the indications are that it was, when at its best, no such exuberant growth as today clothes the deltas of the Ganges, and the higher parts of the Amazon basin in robes of glory and beauty. Large trees there were, 80 to 100 feet in height and two to three feet in diameter, but they did not branch widely, and these Goliaths of
the forest were not numerous. The Deer Park beds—northeast part of Deer Park Township—prove beyond cavil that much of the land at one time at least was covered with a growth of shrubs less than twenty feet in height and rarely exceeding five inches in diameter. That density of vegetation of which we hear so much in most works on coal is a figment of the imagination, scarcely more than the baseless fabric of a vision, the child of a theory to which the facts must be fitted, the theory that our coal beds are the product of vast masses of vegetation, covered by sediments, and in time by heat, pressure and the chemical changes these agents produced, changed to coal. Hence we read of "stored sunbeams," "stored up energy," and other fanciful and taking appellations, to which it is time for science to say good-bye. The theory rests on very slender foundations, if it has a foundation, and serves to distort facts, misdirect observation and mislead observers. Let us look at a lump of coal. We see that it is made up of layers, varying in thickness and color, some being of a shining jet black, others of a dull hue, and some almost gray, and some of them look as if composed of many very thin plates closely pressed together, often thin as thin paper. Here we find scales of golden and brass-colored pyrite, or snowy or tinted calcite, there a hard mass which examination shows to be pyrite in another form, and on the faces of these masses we often find marks almost like the impressions of a seal, others of squares and rhomboids, and now and then a very leaf-like looking figure. But these, while in the coal, and, we feel sure, are of vegetable origin, are not coal. We find also in the shales and slates long narrow figures much like the leaves of corn, and jointed stems like those of some rushes, and many other things which we are sure were once grow-
ing plants, but they are not coal. Then we find what we are sure can be nothing but the trunks of large trees, but they are hard, blue limestone, yet there are the roots, the trunk, the branches as perfect as they were myriads of ages ago. We find them in abundance both in connection with the coal and in the slates and shales, always stone or pyrite, never coal. The question then arises, is coal a vegetable product? Certain it is that the sigillaria, the lepidodendron, the calamite, cordaites and the ferns did not contribute to the formation of coal, and if plants did, under any circumstances, become coal, they were mosses similar in some respects to sphagnum and hypnum, and were first transformed into peat. Prof. James D. Dana, lately of Yale University, than whom a higher authority and a more conservative student cannot be quoted, tells us in his Manual of Geology, p. 712-14, that not less than eight cubic feet of vegetable matter would be required to make a cubic foot of coal, and he would be inclined to say more than that, probably ten cubic feet for one of coal! At the least of these figures a ten-foot bed of coal requires a layer of vegetation not less than eighty feet thick, and the mammoth bed at Pottsville a layer not less than 576 feet thick! Whence could such a mass of vegetable matter come?

We said above that the vegetation of the carboniferous period in our region was not dense. Everything goes to prove this, and we are decidedly of the opinion that such a vegetation as today encumbers the delta of the Ganges and that of the Niger, the valleys of the Irrawady and Amazon, and the western declivities of the Cascade range in Oregon was unknown to this age. The theory is that there was more carbonic acid gas in the atmos-
phere, and that, therefore, vegetation was ranker. But those who reasoned thus did not ask themselves if the atmosphere of the valley of the Amazon, of the delta of the Niger and of the west part of Oregon were richer in this gas than the deserts of Arabia, the arid wastes of the Utah basin, or the cold and cheerless highlands of Peru and Bolivia. They assumed a cause and reasoned as if the facts were in accordance with their assumptions. In fact, the amount of carbonic acid gas—CO₂ of the chemist—in our atmosphere is greatest in our cities! But are the trees larger, the grass thicker and stronger, the flowers brighter and finer there than in the country? But remember that there is just the same reason for expecting this to be the case that there is for believing that the carbonic age was one of exuberant vegetation—of vast and heavy forests and impenetrable thickets.

Again, the densest vegetable growth known to man in some parts of the Amazon valley and the Isthmus of Darien would furnish material, were it cut and scattered evenly over the land, scarcely enough to cover it to a depth of ten feet, or for little more than one foot of coal. But such a forest does not grow in a day—we cannot place the time required for its maturity at less than 100 years—and thus the production of a six-foot bed of coal would require not less than 500 years! But the first growth must be covered by soil, or must decay to furnish support for the second, and would not be available as coal-making matter. This argument may be carried much farther, but we have said enough to show the absurdity of the common theory of the formation of coal, and the necessity of a theory that accords with the facts as we meet them every day.
But how, says one, do you account for the formation of coal?

We believe that a large part of our coal was once petroleum or pitch, lakes of oil or swamps of pitch like the Pitch lake of Trinidad, and that on to or into these were carried trunks of trees, leaves, fruits, plants of many kinds and much sediment, and that then all were buried beneath thick beds of clay and sand, and that this process by changes of level was repeated more than once on the same ground. Hence the name mineral coal is a very appropriate one. But where did the petroleum come from? We believe it to be formed in the recesses of the earth by the direct combination of carbon and hydrogen in several proportions, forming several distinct substances, which are mingled as we obtain them, but are easily separated by distillation. It was once an argument against this view that we could not cause these elements to unite and form petroleum, but we believe this has been accomplished by Mendelieff, and thus our inability to form it is no longer, if it ever was, a valid objection to our theory. There is no evidence that the source of these oils is animal and vegetable remains. Rocks, which are a vast burying-ground of extinct tribes of marine life, the monument of races that have ceased to be, whose every particle has at some distant past been instinct with life, shrow not a trace of oil or anything resembling it. This is just as true of vegetable as of animal remains, the necropoli of one being as destitute of oil as the other.

Natural gas is also a product not of slow distillation, but of the natural combination of the two constituent gases within the earth, and its forma-
tion is in progress now, and is going on as rapidly as it ever was, as many facts conclusively prove. Indeed, high authorities now concede this point, and this granted the contest is decided.

We believe that there is nothing so subversive of true progress in any department of science as a plausible working theory, and the more plausible the more dangerous. Once give it the support of an eminent scholar and it goes forth to warp facts, distort relations, blind observers and mislead students for years, and from such hypotheses geology has suffered long and deeply, and will, we presume, continue to for years to come.

Covering the coal measures we have beds of sand, clay, gravel and loam, very irregularly distributed and seemingly mingled in great confusion. Scattered among these are blocks of stone of various sizes, colors and composition, and the gravels are of different characters, a part of them granite, a part calcareous, the latter exceeding in quantity the former. This heterogenous material differs much in thickness at different points; at some, almost wanting, at others, more than 120 feet.

If we examine the clays we shall find them very dissimilar in color and character, sometimes exhibiting some traces of stratification, often forming great lenticular masses, and often interstratified with thin beds of sand and gravel. The material of which they are composed has been ground to a very fine powder, but here and there they contain pieces of hard rock usually smoothed and rounded, and sometimes by some agency that must have acted on them for a long time, or have acted very energetically, for we find it difficult to grind them smooth when broken. Moreover, there are no ledges or
beds of such rock in this part of our country, and to find such we must travel from 150 to 400 miles to the north, where we find in southern Wisconsin some beds similar to some of these fragments, and on the south shore of lake Superior the ledges from which others must have come. The limestone blocks found in the same position are all of one kind, the ruins of the Niagara beds which once extended farther south, but a considerable section of which along the southern margin has been broken up and crushed and a part ground to powder. Hence our drift clays contain more or less lime. These clays, sands, gravels and smoothed and rounded rocks have been so deposited as to form great ridges, long hills, resembling a boat turned bottom up, and round hills with funnel-shaped basins between them, and to their arrangement is due the present face of the country, in large part the scenery of our county. How was this material prepared, transported and deposited where we find it?

It is evident that the movement of this great mass of matter was due in part to the action of water, but the transportation for long distances of heavy blocks of stone and the smoothing and shaping them cannot be ascribed to its action, for we find no such effects produced, where we can be sure that water is the only agent concerned in the work. Water moves rock of considerable weight, for they can be lifted much more easily in water than when out of it; it smooths by rubbing against other rocks or sand, or by rolling these over rocks which are fixed; it wears sinuous channels in rocks, but does not cut straight and regular grooves; it may smooth a surface, but does not re-
duce it to a level and polish it as we find has been
done again and again.

Now wherever we have a surface of hard rock,
that is covered with a foot or more of earth, we
generally find the face of the rock, where uncov-
ered to be smooth, more or less polished and trav-
ersed by striae or scratches, with an occasional
groove straight as a line can be drawn, and run-
ingen in general from some point between northwest
and northeast to some point between southeast and
southwest. These grooves may be a foot or more
wide and are often more than six inches wide and
four inches deep, and the causes which produced
the drift must have formed these.

Various theories have been advanced to account
for these widely different phenomena. In all of them
water and ice are the important agents, and we believe
these causes to be amply sufficient to produce the
really wonderful effects which we find graven in
the rocks and testified to by beds of sand, gravel
and clay.

This is not wholly theoretical. A study of
glaciers has shown us that these immense masses
of slowly moving ice are today producing just such
results as we find everywhere recorded in the drift.
They are doing the same work, smoothing and pol-
ishing hard rocks, scratching their surfaces with
multitudes of fine lines or striae, transporting large
blocks of stone, grinding and crushing much rock,
and forming sand and a mud which becomes clay,
and more than this the deposits formed by glacial
streams, streams which flow from a glacier, are in
every respect like those we find in the drift.

Moreover, these deposits are not found every-
where. There are no such strata in the southern
part of our State, and all through the country
south of the Potomac—they nowhere reach this stream, nor do they approach within several miles of it—the Ohio and Lower Missouri.

A glacier is a vast body of ice filling mountain valleys and covering plateaus, which by the pressure of its thickest and central portion tends to flow toward lower levels, for we must not look on ice as a solid like limestone, but rather as a viscous body like pitch. As these arms of the glacier—true ice rivers—descend through the valleys they plane down the rocks over which they slide, scratching and grooving them, and forming a large amount of fine material which the water that forms a stream under the ice bears on down the valley to be deposited in pools and lakes according to its fineness and the force of the current. Besides, it bears on its surface masses of rock and earth which fall from the sides of the valley upon it, and other pieces sink into and become buried in its substance. The point to which the glacier descends is determined by the temperature and moisture. It usually presents a precipitous face to the country below—a veritable wall of ice in cold seasons, advancing, it may be, many rods in warm ones retreating. In front is a vast, rugged wall composed of blocks of stone of all forms and sizes, some smooth and scratched, others angular and rough. This wall is called the terminal moraine, while the piles of material lying on its face, forming, usually, three lines, one on each side and one near the middle, are called the lateral or side, and medial or middle moraines.

It is not uncommon to find several terminal moraines, one behind the other, and when the glacier advances one or more of these may be pushed
forward so as to mix with those in front of them.

Stretching across the United States, as has been proved by the labors of Profs. G. Fred Wright, of Oberlin, Ohio, H. C. Lewis, of Pennsylvania, T. C. Chamberlain and Roland D. Salisbury and others, there is a line of such deposits as we should expect to find near the lower end of a glacier—a moraine, generally not one but several of them running through Northern New Jersey, Central Pennsylvania, Southern Ohio, south part of Indiana and across Southern Illinois, reaching as far south in the middle of the State as the north part of Johnson county, thence taking a nearly northwest course to the Mississippi, and beyond for a long distance. See Bulletin United States Geological Survey, No. 58.

Now, how shall we account for these phenomena? As we have said before, running water is not adequate to the production of such effects, water and floating ice cannot build moraines, although they may and do transport large pieces of rock, but they do not grind and groove them, and the masses moved by the drift producing agents seem utterly beyond the power of water to even move. There are blocks of hornblendyte just west of this city 12x10x8 feet in dimensions, or containing at least 960 cubic feet, and weighing not less than seventy-six tons, and many measuring from ten to twenty cubic feet, and several of a volume of 50 to 100 cubic feet are scattered there. In Whiteside county we measured one 18x16x12 feet, a part of it yet covered by earth, thus containing over 3,400 cubic feet, and weighing not less than 272 tons, and these are small compared with some others.
The glacier—moving ice—seems to be the only agent adequate to the transportation of such enormous masses, for that they have been carried long distances there is no doubt. There are no beds of granite nearer than central Wisconsin, none of hornblende, iron-jasper and copper-bearing rocks nearer than northern Wisconsin and the upper peninsula of Michigan. There are distances of from 100 to 400 miles, some of it rather rough country to be passed over, and the carriage of a block of 100 tons weight over it would today be attended with some difficulty.

But if we suppose a great glacier, or rather mer de glace, to have covered that part of Canada lying west of Hudson's bay, extending to the Rocky mountains on the west and on the south to lake Winnipeg and the north shore of lake Superior, and having a thickness of 2,500 to 3,000 feet or more at the central part, we shall have an adequate cause of the very strange phenomena connected with the drift.

A depth of ice of 2,500 feet may seem preposterous, but we have masses of ice in the Alps as thick as this, and probably much thicker, and the great glaciers of Alaska from the sea with cliffs of ice more than 300 feet high, and as the surface slopes upward as we go inland they are probably at a distance from the coast much thicker than on the sea face. Besides, the conditions being favorable, the formation of beds of snow and ice 2,500 to 3,000 feet thick might occupy a comparatively short time, and even much thicker deposits might be laid down. As the thickness increased the pressure would become greater, and the ice about the margin be pushed out, always moving through the valleys, but able in time to surmount low hills, partly
by cutting them away, partly by piling up against and overtopping them, and thus in time long fingers of glittering crystal streaked the country, and expanded and crept on until they coalesced and covered all the land for from 100 to 300 miles south of the St. Lawrence and the great lakes, except an island in Wisconsin, for there we find a tract which presents no traces of glacial action.

But the southern limits to which the ice extended are not easily determined. When the temperature rose, or for other reasons the ice began to retreat, its melting must have given rise to a great flood, and it is probable that to these we owe the great beds of gravel everywhere found in this deposit. As the moraines would be very irregular, and often several one behind the other, and these connecting one with another, ponds or lakes would be formed, the waters of which would be comparatively tranquil, and in these deposits of clay would be laid down. The surface would be left very uneven, diversified by long low ridges, rounded-topped ridges, hills and roundish hollows to be modified and changed by various agencies, water and time the chief, into the surface as we see it today.

In central and eastern Deer Park Township we have an almost ideal glacial surface, one for some reason, but little changed from what it was when the ice vanished and the dry land appeared from beneath it. The great ridge, roughly paralleling the Big Vermilion, and forming the highest land in Deer Park and Farm Ridge Townships, and the great gravel beds of South Ottawa are a part of the drift.

Such, then, is the ANCIENT history of La Salle county. First, the bed of the sea or ocean during the Calciferous area; second, an area of shallow waters in which vast beds of sand, the St. Peters, was depos-
ited; third, a part of the ocean, the Trenton period; fourth, for a long period dry land; fifth, a region of forests, swamps and lagoons, with many sudden and extensive changes, the Carbonic age; sixth, dry land for ages; seventh, a desolate waste of ice and snow, a polar desolation; eighth, the country much as we know it today.

The vast collection of granitic and hornblendyte rocks in the west part of this city are also products of glacial times. These rocks, it will be observed, form a train running from about north, northeast to south, southwest. It is formed of a great variety of material, consequently the fragments of which it is composed came from different localities, some of them from the south shore of lake Superior, and were, no doubt, either frozen into the glacier or borne as morainic material upon its surface. Their presence indicates that there a fragment of the glacier melted and discharged its burden, wrote its autograph indelibly on the face of our country. Other such trains are found in various places, and all have the same lineage and history—a romantic story could we but read it aright, a wonderful tale, more strange than the wildest vision that a feverish imagination has ever dreamed.
ECONOMICAL GEOLOGY.

Some strata of the calciferous furnish excellent material for foundations and rough stone work, and there is plenty of it, and it is cheap. The Trenton and La Salle limestones make good building stone, and some of the beds rock that dresses well and wears at least as well as Joliet stone. None of the rocks are hard enough to polish well, and it is a sad misuse of terms to call them marbles. They are good limestones; that is all. Both make strong lime, but when used for plastering it needs careful treatment or the walls blister. The Trenton is reported by a high authority to contain 95 per cent. of pure carbonates.

The calciferous, as is generally known, furnishes a large amount of material for the manufacture of water lime, hydraulic lime or cement. There are extensive works for this purpose at Utica and also at Pequamsauggin creek, two miles west of Utica.

The St. Peters sandstone forms excellent material for the manufacture of glass, when washed, being free from any admixture of other matter, and it is largely used for this purpose, producing an article of superior quality. It is also used for sanding railway tracks on grades and in rolling mills and for other purposes, and is extensively quarried, washed and shipped.
But the great mineral wealth of La Salle county lies in her clays and coals. The clays are of several kinds. First, glacial or drift clays lying near the surface, and containing streaks or veins of sand, rounded pebbles, and smoothed and scratched pieces of rock from the size of a goose’s egg to those weighing many pounds. These vary considerably in composition, and usually contain some silica, sand, lime and iron, a combination which gives them a low melting point and unfit them for withstanding a great degree of heat. These make common brick. Second, clays overlaying the coal seams, generally containing much pyrite, but less lime than the former. They are stratified, while the first are seldom or but obscurely bedded. They make fair brick, but are apt to pit in burning.

Third, underclays or clays lying immediately below the coal. These are the fire clays so valuable for making brick for furnaces and other work where a high temperature is employed. They differ in quality that beneath coal No. 2 being one of, if not, the best. It is largely mined and quarried about Ottawa, has been dug on Covell creek and at various points along the Big Vermillion river. It is adapted to making fire-brick, drain tiles, sewer pipe, fire-proofing for lining buildings, paving brick and tiles, roofing tiles and many other things, and some of it makes very good pottery. There are in the Vermillion region clays which can be worked into ware which burns of a creamy white, and even when unglazed presents a smooth surface. The location of this deposit is unknown to us. Some years since, in the course of a conversation, Mr. Murray Kirkpatrick informed us that he knew at that time of forty-two varieties of clay in the Vermillion valley, and it is safe to say that for the county this number may be much increased, certainly to not less than sixty varieties.
Fourth, ocher clays, really as we have them, low grade ores of iron. A bed of red clay, or clay slate, is found west of the Big Vermillion, near Bailey's Falls, which may be turned to account as a paint. There is an immense supply of it; it is very accessible and the color a pleasing brown.

The clays of La Salle county also are important from another point of view. Some of them are rich in aluminum, carrying 30 to 35 per cent., or more, of this valuable metal. All that is needed to create a demand for them in this direction is the discovery of a process for obtaining the metal directly from the clay. We presume this will be accomplished at no distant day, and then these clay banks will be important as mines of a valuable ore. All in all, the clays are of immense value, of more worth to the world than all the gold of California—a surer and more regular source of wealth than it, and much more necessary to the comfort and convenience of mankind. These clays are not only extensively manufactured, but are also shipped in large quantities to Chicago and other places to be used in making brick, tile, etc.

Coal.==The coals of the county differ in quality as well as the horizon of the bed. No. 2, covering the greatest area, is a good steam coal and most extensively mined, it being easily accessible at many points. No. 7, covering a smaller portion of the county, is thicker and yields in proportion to territory covered a larger amount of fuel, and this coal makes less soot than that of No. 2. No. 8 is hard, burns slowly, and is not generally liked for any purpose for which it has been used, and is little mined at the present time. But the same bed differs considerably in quality in different places, sometimes containing much more pyrite or other impurity than at others, so that the character of
a coal at one point may differ greatly from that of the same bed at another place.

A seam of coal one foot thick yields about 1,120 tons of coal if all is removed; one two feet thick, 2,240; one three feet thick, 3,360 tons, but if pillars are left to support the roof these will take about one-fourth of the whole and the yield will be but three-fourths of these figures. The county has fuel sufficient for another century at least unless the demand increases much faster than it has done for the last twenty years.

**Petroleum.** It is useless to look for petroleum in La Salle county. There are no indications of its presence, and the rocks in which it is generally found, Upper Devonian or lower carboniferous, Niagara or Trenton-Cincinnati shales do not occur here.

**Natural Gas.** Gas was used for fuel and light in the southeast part of the county as early as 1877 or 1878. It was always found proceeding from some of the beds of the thick deposits of clay which form the coal measures in that part of the county. Most of these discoveries were made in Allen Township. Later it was found near Mendota, but in small quantity. The source of this must have been below the coal area. It is found in connection with coal No. 2 at Streator, and, we presume, at other places, and at Streator in a stratum about ten feet above No. 2 in considerable quantity. But the supply is limited. The Cincinnati shales, the great source are entirely, or almost entirely, wanting, and while gas may be found from time to time, we may feel pretty sure that time and money spent in searching for it are wasted.

Salt water exists, but not of sufficient strength—saltiness—to warrant an attempt at manufacturing salt. The salt marsh six miles southwest of Ottawa furnished a considerable quantity of weakly salt water, and a well bored farther west a greater volume.
Metals—Iron exists in small quantities as pyrite (bisulphide), hematite (red oxide), limonite yellow oxide and iron stone or carbonate.

Copper has been found in the drift, especially in the Fox river valley, near Dayton, evidently brought from the lake Superior region during the glacial period.

Lead has been found in the form of Galenite (sulphide) in the Trenton, through which rock it seems sparingly disseminated, but no one need expect to find lead mines in La Salle county.

Mineral Waters—The county contains numerous mineral springs, the most widely known the Ottawa mineral spring and the sulphur spring or springs situated about six miles west of Ottawa, on the river road, on the north side of the Illinois. The Ottawa spring is the only one whose waters have been analyzed. Its composition is given in the appendix.

The sulphur springs, three in number, carry considerable quantities of sulphur and sulphuretted hydrogen gas, but as no analysis of these waters has been made little can be said of their therapeutic value. Many years since a large building for a hotel was erected near them and an effort made to bring them into notice, but it did not immediately pay and the attempt was abandoned. The Ottawa spring has had nearly the same fate, but its water is in some demand, and seems to possess, and we presume the same is true of the other, considerable medicinal value.

A water very similar, if not precisely the same, is found on the east side of the creek, about a half mile south of the Covell creek bridge, on the river road; also in the second canon east of Starved Rock.
Chalybeate or iron springs are found in many places issuing from the coal measures. Some of these are heavily charged with sulphate of iron, and are clear as crystal, and of a temperature of 50° or less. We have found them about Streator, along the Big Vermillion, and east of Utica, along the north bluff.

A remarkable nest of springs exists about two miles southwest of Ottawa, on the south side of the Illinois, flowing out of a vast mass of tufa, or as it is generally called petrified moss, true in that moss had probably had something to do with its formation, but wide of the mark in that there is nothing petrified. In fact, petrifactions are rather scarce. We have casts and incrustations, but seldom the thing itself, changed to stone. These springs furnish a large volume of clear, cool water, and do not now seem to carry any considerable quantity of lime in solution. It is from these that the water is obtained to supply the water trough by the roadside.

Water holding much lime in solution, coming to the air usually parts with most of the lime. This is especially the case when it flows over a moss covered surface or in quantities sufficient to keep a surface moist, or drops from a greater or less heighth. In all these cases much of the water evaporates, leaving the lime behind either incrusting mosses, grasses, twigs, etc., or forming thin layers one upon another. When it falls in drops we have a growth resembling an icicle, and formed in the same way, while from below if any of the water drops off a little, column grows upward. The icicle like growths, are called stalactites, the upward growths from the bottom stalagmites. They are generally found in caves, but sometimes in crevices of the rock. Some such growths
are found at La Salle. Calcareous tufa or limestone formed as described above is found in large quantities in Clark's Run in the northwest part of Utica village and up that ravine; also in other ravines on both sides of the river. At Utica a mass of it has lost all traces of its former open structure, all the pores having been filled, and is very hard and beautifully banded.

Sometimes the water of such springs flows through sand or gravel, and the lime being deposited forms a cement binding the mass together, and forming a rather coarse grained, porous rock. In other cases iron-bearing waters produce the same effect, but the mass in this case is usually yellow or red, not white or buff, as in the former. Examples of both are to be found in many gravel beds, some on a large scale, especially in an old railway gravel pit east of Marseilles, and in some cuttings on the C., B. & Q. railway, between Wedron and Blake. In these last examples the material cemented is a comparatively fine sand.

Debolt's spring, situated about nine miles northeast of Ottawa, on the east side of the Fox river, is a sulphur spring, yielding a large quantity of water and a favorite resort for picnic parties. It rises from the St. Peters sandstone, and was formerly a place of much beauty, but the scenery has been greatly damaged by some rattle-headed blasting. We are not burdened with scenery, and it is to be regretted that many people do not know a beautiful thing when the Creator places one in their hands.

Most of the well water contains some mineral matter, and that of some wells carries a considerable percentage of lime, others of lime and magnesia. People have much to say about "pure water," but very few know what pure water is, for it is seldom found.
Artesian Wells.—All through the Illinois and Fox river valleys, water that will rise above the surface may be obtained by boring from 100 to 400 feet, but on the prairies the rocks must be penetrated to a much greater depth. About Ottawa, at Utica and at Marseilles there are many of these wells, some obtaining their supply of water from the Coal Measures, some from the St. Peters, while the larger number pass through the Calciferous into the Potsdam sandstone from thirty to eighty feet. The water is generally of excellent quality, but sometimes slightly charged with iron or sulphur, and occasionally a little salt. These wells are of less depth at Utica than at Ottawa, as the strata rise in that direction, but beyond Utica they again descend, and the borings must be deeper after we pass the tunnel, indeed, much deeper.

On the prairies wells must be sunk 2,000 or more feet, Peddicord's, 2,180 feet deep, situated north of Marseilles, being one of the few that have been bored. It yields about three barrels of slightly salt water per hour, the water rising about three feet above the surface.

The deepest boring in the county is that at Streator, 2,496 feet deep. The record of this well is given in the appendix, as well as that of a couple of deep coal shafts and a general section of the strata on the Big Vermillion. The water of this well is too salt for culinary purposes, very clear, and rises about four feet above the surface, which at that place is forty feet above lake Michigan. It has a temperature of about 85 ° Feh.; that of the wells about Ottawa is about 52 °, winter and summer the same.
LIST OF FOSSILS FROM COAL MEASURES AND CALCIFEROUS.

We have been shown a curious specimen said to be from the St. Peters, resembling the inner side of a spare-rib, three ribs being represented. It was a fragment only, and one might guess over it to the end of time. Some day some one will stumble on a larger and more perfect specimen, and then its relations may become manifest. We occasionally find in it, north bluff of Illinois, two miles west of Ottawa, and river bluff, one mile southwest of same, semi-elliptical masses made up apparently of concentric layers standing erect, rounded end down, as if they had been dropped into the St. Peters when it was soft. These are not numerous, but frequent enough to lead one who sees, to ask what they are. The question awaits an answer. See Plate II., Fig. 14.

The coal measures are very prolific of fine specimens, both the limestones and the shales, especially some of the black ones. The species thus far described are as follows:

Mollusks.—Brachiopoda, shells having curious hook-like or loop-like appendages on the inside, Martinia (spirifer) plano conversa; Spirifer Kentuckensis, S. Cameratus, S. Carbonaria, Terabratula bovidenis, Athyris subtilis, Athyris Royisii, Chonetes Millepunettate, C. Mesoloba, C. Flemingii, C. Granulifera, Discina nitida, D. Subtrijonalis, D. Capuliformis; Productus Nebrascensis, P. punctatus, P. symmetricus, P. inflatus, P. longispinus, Lamellibranchs; in structure resembling the mussel or clam; P. costatus, P. La Sallensis, P. Milberanus; Orthis (Hemipronitis) La Sallensis, Orthis H. Crasus, Orthis H. Carbonaria, Orthis Pecasi; Retzia punculyeraa, Rhynchonetta

VEGETABLE REMAINS

Calciferous. — Algae or sea weeds, plants growing in water salt, brackish or fresh, usually attached to rocks or the bottom, destitute of flowers, leaves and stems of various colors.

Trenton Algae. — Buthotrephis has been already mentioned. They are not the only ones to be found there.

Coal Measures. — Pecapteris villosa, Pecopteris unita, Neuropteris hirsuta, Neuropteris tennifolia,
Alethopteris, Asterophyllites, Cordaites, Botryconus, Calamites, Annularia, Lepidodendra, Sigillaria.

The localities for Lepidodendra and Sigillaria are very numerous—west of Lowell; ravines in northeast part of Deer Park Township; Marseilles in Streator sandstone, about four miles west of Marseilles, on south side of Illinois river, furnish good specimens. Most of the ravines in Deer Park Township furnish trunks of trees and huge, anomalous petrifactions which deserve more attention than they have yet received. See plate II., Figs. 14, 15, 16. The original of 17 is more than 10 in. in least diameter. Nearly south of Hon. Urbin Ellsworth's residence in Deer Park Township, a fourth of a mile from the Big Vermillion, we saw a trunk, represented in Fig. 14, over thirty feet in length and twelve inches in diameter, and the appearance as it lay, the north side covered by black slate, suggested the idea that it sent off a branch at each curve; ab., Fig. 15, is a section at right angles to a. Fig. 14, 1, 1, being the enclosing slates. Another specimen in a ravine on the land of Mr. Henry Dimmick is sixteen feet long, about a foot in diameter, comes to a point at the south end, but for twelve feet is about uniform in thickness, except a nearly spherical enlargement about three feet from where the north end runs into the bluff as shown in Fig. 16.

A remarkable locality for fossil ferns exists on Covell creek, about sixty rods east of the C., B. & Q. bridge. Here in the clay shales at about the water's level is a layer about a foot thick, containing many species of ferns, cordaites, lepidodendra, fossil fruits and many other things. There seems to be three fossil bearing beds in the bluffs bordering this creek, but we have explored but one of them, and that only partially. We believe that these beds will prove almost,
if not quite, equal to the Mazon locality in the number and beauty of their specimens. The shale is underlaid by a hard, blue limestone, which, where exposed weathers to buff, the surface of which lies in regular waves, the distance between crests being about a rod. It is usually divided into blocks by almost imperceptible seams or cracks. It is from fifteen to eighteen inches thick. A stratum of cone in cone from four to eight inches thick is found in the coal measures almost everywhere. It occurs in the north bluff west of Ottawa, on Brewery Hill, and elsewhere, and at about the same level.

For coal measure fossils exclusive of ferns La Salle and vicinity is the best collecting ground. For several species of small but finely preserved shells the black slate in a ravine back of the old Caton Deer Park is one of the best localities we have tried. The same slate is found in several ravines east of the Caton place, but not far to the west of it. Several localities on Covell creek, several on the Big Vermillion, near the south end of the bridge, Marseilles, are all rich in fossils.

Mr. W. W. Calkins suggests a careful examination of the strata about Bailey's falls. We would also direct attention to the shales bordering most of the streams in Deer Park and Farm Ridge Townships in their lower courses as worthy of much more careful study than they have yet received. We found in these, on the premises of Hon. Urbin Ellsworth, a fine shark's tooth, when not looking for fossils. A systematic search ought to find others.

**Additional Notes.**—On the north bluff opposite Buffalo Rock, where the road descends the bluff the surface of the St. Peters is traversed by many veins
GEOLGY OF LA SALLE COUNTY. 59

of a much harder stone. They are from three to five inches wide, and project from two to six inches above the general surface, and are in two sets, one following a northwest-southeast course, the other a northeast-southwest direction, the lines being made up of many curves. They descend four to five feet into the rock, some being very straight, others curved and have the appearance of being made up of layers, the planes being perpendicular to the surface. A similar structure is seen in some green shales on Covell creek, and also in shale in Brewery Hill, two and a half miles northwest of Ottawa, and in several other places. In the shale they are evidently cracks in mud made by drying and afterward filled with sediment; but sand beds do not crack from exposure to the sun, and hence this does not explain the St. Peters case. A curious limestone covering, as far as exposed, covers a small area on the upper road leading to La Salle about three miles northwest of Ottawa, in the first ravine crossed after ascending the bluff, fifty rods west of the crossing. It appears to be made up of fragments of older rock, somewhat water-worn but not rounded, and forms a bed of hard rock eight to eighteen inches thick.

A few rods up this ravine is a bed of blue shaly clay, traversed by veins of red ocher clay. In these clays are imbedded many hard limestone nodules from four to sixteen inches in diameter.

In the east part of Utica Township, on the land of C. W. Esmond, on a low ridge about fifty-five rods south of his residence, there is a bed of limestone gravel of a remarkable character. The pebbles look like short pieces, one-half inch to two inches long and one-fourth inch diameter of worm-gnawed twigs. It was free from sand or earth. We saw a similar gravel
deposit in the ditch on the north side of railway—C., R. I. & P.—tracks between Ottawa and Marseilles.

Among the great springs of the county we should name one on the south side of the Illinois, a half mile west of the Horseshoe canon, or one and one-half miles east of Starved Rock. Here a large volume of clear, cold water gushes up through a fissure in the St. Peters, while three feet from it water coming out of the St. Peters is quite salt. This spring is known to many who camp out near the canons. It is covered by the river when it is half flood.

Very fine and copious springs are found in the first ravine south of Deer Park, where the St. Peters appears in the bottom and sides of the ravine and forms two ridges across it, in each of which the rock is cracked along the crest, and out of these cracks fine springs flow. One of these springs is now utilized for furnishing water to the Park hotel.

In 1892, in the northeast part of Deer Park Township, Township 33 north, Range 2 east, Section 35, northeast quarter of northeast quarter, in boring in the bottom of an old well, the water in which had failed, at a depth of seventy-three feet, a stratum of a black, soft, tenacious substance six or eight inches thick was passed through. It had much the appearance in color and texture of the material for asphalt paving. Thrown into the fire it gave off considerable carburetted hydrogen gas and left a white residuum, which seemed to be a fine clay. We have heard it stated that a similar substance occurs in the banks of some of the ravines along Covell creek.

**Extent of Coal Seams.**—Some may ask where shall we look for coal, and deem what has been already said as too indefinite. We will, therefore, give a more precise statement of the boundaries of the several
GEOLOGY OF LA SALLE COUNTY.

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beds. No. 8, the upper La Salle bed about La Salle and north as far as the north line of La Salle Township, and east to near the tunnel or axis, and south on the east side of the Big Vermillion, covering a small area just south of Deer Park glen; west of the Big Vermillion generally, but thinning out to south and west of Oglesby.

Coal No. 7, about Streator and extending up the valleys of the streams flowing into the Big Vermillion in comparatively narrow tongues, thickest in the middle of the valley and thinning toward either side. It becomes thicker toward the north, until at Kirkpatrick's ford the bed is about eight feet thick, but one foot of this is shale. It then thins toward the north and disappears in the next two or three miles, to be seen no more on the east side of the stream until near Deer Park glen, where it covers a small area, then runs out to reappear at Oglesby and La Salle and to the southwest, being found at Wenona. At Streator it extends to but a short distance west of the Vermillion scarcely a half mile. It therefore covers but a small area, not more than 130 square miles, perhaps less in this county.

Coal No. 2 is found over an area of about forty square miles north of the Illinois river, and except in the Illinois and Vermillion valleys over all that part of the county south of the Illinois. About Grand Ridge and to the west of it the borings have not been deep enough. Here the land attains a height above or nearly equal to the level of Lake Michigan, and the coal at Ottawa is descending at the rate of more than thirty-five feet to the mile, and as the surface is 60 feet above Lake Michigan at Grand Ridge; then it must be 6x35—210 feet below its level at Ottawa, or 210 feet below the surface, supposing the surface to be at the
lake level. We are of the opinion that 320 feet is nearer the depth which must be bored at Grand Ridge for coal. At Wenona it is 576 feet to this same bed, so that if it can be found there at even 350 feet, it is not too deep to be successfully worked if twenty-four to thirty-two inches thick.

We would call the attention of those having borings made to the importance of having the material brought up carefully inspected, and the thickness of the strata passed through recorded. Too many of those who conduct such work are wholly incompetent to determine the real character of the beds passed through, as has been abundantly proven by a comparison of the records of a boring with what was found in sinking a shaft. The variations are often great, and show dense ignorance on the part of those doing the work. Black shales pass for coal and coal for dark shales. Hard sandstone for limestone and soft limestone for sandstone, and hard shales for one or the other, according to fancy. Thus much valuable knowledge is lost and the results lose half their value.

Do not imagine you are on the high road to fortune because a well driller assures you he has passed through a three-foot bed of coal on your land, unless you know him to be competent to decide what he has cut through. In borings with the diamond drill blunders are impossible, as it tells the whole story.

We would also call attention to the fact that the same bed of coal varies much in thickness in comparatively short distances. Of this we have given some instances, but a few general statements on this point will not be amiss. No. 2 varies from twenty-two inches at Ottawa to forty-six inches in the Caledonia mine; No. 7 from seven feet at Kirkpatrick’s ford to forty inches at Wenona, and No. 8 from six inches at
Wenona to forty-eight inches in the Caledonia, while Nos. 3, 4 and 5 change from coal to black shales. The thickness of a bed at one point is no index to its thickness at another, and besides its thickness the character of the roof, the quantity of water to be removed per minute and the first cost of a shaft require careful consideration. A thick bed of quicksand may double the cost of the work, and a poor roof may render the working very dangerous, if not impossible.

SCENERY OF LA SALLE COUNTY.

Scenery.—No county in the State possesses finer scenery and more of it than La Salle. The valleys of the Illinois and Big Vermillion afford splendid views at almost every point, and some of them are not often equalled, seldom surpassed.

The Illinois a little east of Ottawa begins to cut its channel into the St. Peters, and before it reaches Utica has chiseled its way through that to the calciferous; consequently, its bluffs present the full thickness of the St. Peters, which often form precipices of 100 to 140 feet in height more or less perpendicular, variously colored where the rock is naked, but often clothed with verdant robes of lichens, mosses, plants and shrubs, with an occasional pine or cedar towering up from this lofty watch tower, as if standing sentinel over the lovely valley and fair river below.

These bluffs are pierced by many openings, the portals to narrow ravines, cut deep in the soft rock, through which small streams flow to the river. These sometimes descend from the prairie by a series of rapids, sometimes by a number of cascades, occasionally by a single leap of 60 to 110 feet. These ravines are cool, damp and beautiful at all seasons, as much so
when clothed in the gorgeous mantle and glittering jewelry of arctic crystal furnished them by the Ice-king as when arrayed in emerald robes and decked in the brilliant gems of Flora's priceless treasures.

Canons.—These ravines are the canons of which many of our readers have heard, but some have probably not seen. The first counting from the east is located about two and one-half miles southwest of Ottawa on the south side of the river, and is crossed by the river road by a stone culvert of one arch. It is about twenty-five rods long and has a cascade, when the brook is running at the upper end.

From this point west for more than two miles the St. Peters is seen nowhere but in the valley of Covell creek, from the bridge to its mouth, the bluff being formed of Coal Measure strata, among which is a heavy bed of sandstone, the Streator, we think, through which three considerable ravines have been cut, but scarcely meriting the name of canons. They are simply V-shaped troughs or cuts through which the waters descend from the higher lands to the river.

As we go farther west the strata rise, and by the time the South Ottawa, Deer Park line is reached, is forty to fifty feet above the surface, and a little to the east of this line we find a canon, the walls of which are not so high as those of the ravines farther west. This canon is some sixty rods in length and very picturesque. We shall call it No. 2.

Almost on the township line we find No. 3, somewhat larger than the preceding ones, its walls sixty to sixty-five feet high. It is well worth a visit, but there is no public road leading to it, nor to No. 2. About sixty rods west of the town line, and piercing the bluff a little west of south of the salt well near Mr. Delbridge's, and not more than forty rods off the river
road is No. 4, its walls seventy-five to eighty feet high. It is more than a fourth of a mile long and generally twice as wide as either of the others, and has a small perennial stream flowing through it. About a half mile farther west and close to the road we find No. 5, the well-known Atwood’s, Clark’s or Delbridge’s canon, noted for its vast rock shelter, some ninety feet wide by eighty-five feet deep, and in front fifty feet high. The enclosing walls are 80 to 100 feet high, and it is six to eight rods wide and sixty rods long. The rock shelter or cave is near the entrance on the west side, and just beyond it a branch canon comes in from the west, narrow, straight and about ten rods long. About a half mile farther west we find a short, deep and picturesque gorge, No. 6. It is about thirty-five rods long, bounding walls 90 to 100 feet high, and is from four to ten rods wide. The stream flowing through it is not perennial, but there is usually a pool at the head of the canon. Nearly a half mile west of No. 6 we find a gorge very different from any of the foregoing. Following a small stream which has cut its bed deep into the sandstone with very symmetrical curves, we enter No. 7, which, pursuing a southerly course about eight rods, turns sharply to the west and runs parallel with the bluff for about thirty rods. It is dry, except in time of rain, or when the ground is very wet. Its walls tower up over 100 feet, and are either perpendicular or overhanging. A half mile farther west and we reach a creek or rivulet, turning up which we soon find ourselves shut in on the west by a gigantic wall of rock generally covered with moss and herbage. A few rods farther we see them on the east also, and a little farther on they seem to close around and shut us in, but a few steps farther and we see two openings, one to the southeast, the other
to the southwest. This is No. 8. The southeast branch makes a great curve to the east, sweeps around, enclosing a pool, to the south and southwest, and then to the west, and after some climbing and hard work we reach the foot of an overhanging cliff twenty-four feet in height. The only way to get past this is to go back some distance to the pool, ascend the west bluff, and walking about forty rods descend into the upper ravine which runs almost north-south, and is a beautiful one. Going back to the southwest branch we find it pursuing a more direct course, having very high, perpendicular walls and terminating in a pool surrounded by cliffs 110 feet in height. Here are some curious caves or recesses in the rock caused by the uneven disintegration of the sandstone, some of the beds giving way much more easily than others. No. 8 is one of the finest of the canons, perhaps, all in all, the finest. The east arm is sometimes called from its curvature the Horseshoe canon, the west arm, for what reason we know not, Wild-cat canon. It is about two and one-quarter miles east of Starved Rock hotel.

A little west, twenty-five rods, of No. 8 is a short canon, but a very picturesque one, No. 9.

About three-eighths of a mile beyond No. 8 is a ravine of several rods in length and of much beauty, but fifteen rods back from the river. This is No. 10.

Twenty rods west of this is a short double ravine; that is, two unite, and at their mouth is the big spring spoken of above. This is No. 11.

No. 12 is three-fourths of a mile farther west and terminates against a wall 100 feet high. It is noted for its fine springs of excellent water on the east side, at the upper end.
No. 13 is shorter than 12, is formed by two ravines uniting, but is much less imposing than 12.

No. 14 comes into the valley at the east side of Starved Rock.

No. 15 enters the valley a little west of Starved Rock, and is a very romantic and interesting canon, having the lower part of its course at a low level, then being crossed by a precipice, and the upper part, yet deep, below the surface, at a higher level.

No. 16 is shorter, about a half mile west of Starved Rock, wild and picturesque.

No. 17 is a large and handsome gorge, reaching the Utica-Lowell road at the foot of the bluff.

No. 18 is about a half mile west of the road, and is wonderfully beautiful in summer and must be very grand when there is water flowing over the precipices by which it is crossed.

On the Big Vermillion there is but one canon, Deer Park glen. It is from seventy to ninety feet from bottom to top of the encircling rocks, about ninety rods long, where it is terminated by an overhanging wall forty feet high, beyond which extends a rocky chasm more than 100 rods in length.

These ravines represent the work done by the streams flowing through them, not always on the surface but in the body of the rock, for it must be apparent to the least observant that a considerable volume of water flows through the rock and comes out in springs at various levels. This water is not a neutral agent, but is constantly effecting changes of importance, bearing particles of the rock, dissolving out of the mass the lime and iron which form the cement binding it together, and thus rendering it softer and less coherent. Thus these streams, when the country was a wilderness, less irregular in their flow than now, cut out these
vast gorges by slow almost and imperceptible steps, frost and heat being no mean assistants in the work. We doubt if one of these canons has been 3,000 years in cutting. Let any one who doubts this estimate, or wants more time for the work, visit these gorges when the frost is going out, and observe carefully the condition of the face of the rock, how soft it is, and how much of it is dropping away, and he will not believe that it has taken countless ages to cut these canons out, nor will he ever again see on these time-scarred walls records of how high the Illinois once stood! He will laugh at the idea of a mark on them being fifty years old.

Starved Rock and Lover's Leap are great masses of St. Peters sandstone almost detached from the bluff and facing the river, the first with terraced cliffs, the latter, with a nearly vertical wall. Starved Rock is 212x212 feet and about 140 feet above low water, connected with the bluff by a low isthmus. Lover's Leap is of the same height, but long and narrow, descending steeply on the side from the river.

Bailey's Falls, Todd's Ford and Bull Rush Falls all owe their wild picturesqueness to the fact that the La Salle limestone, some twenty-four feet thick, has near the middle a band of greenish, shaly rock which water and frost break up and cause to crumble away. Thus the upper layer of limestone, a bed twelve to fourteen feet thick, rather hard and with few joints, is left unsupported, and when the weight of the overhanging shelf or table becomes great enough to break it off, or a joint is reached it falls, usually taking a more or less inclined position, sometimes falling on edge, sometimes sliding several feet. Some of these masses at Bailey's Falls are of immense size, one being 51x17x12 feet, and others nearly as large are found there, and many huge
ones on either bank for a mile or more in either direction. About La Salle the same phenomena are seen, especially between La Salle and the tunnel, along the C., R.I. & P.R.R. Such is an outline of the geology of La Salle county, and a brief summary of its resources. These are great, and if they are carefully developed in an intelligent and thorough manner it cannot fail to become one of the richest and most populous counties in the State. Too little attention has been paid to these matters hitherto, and the efforts made to induce capital to invest in this work of development have been far from enlightened and very spasmodic. La Salle county could well afford to pay for a complete geological survey and to publish a report in good style. It would cost perhaps $500 per year for a couple of years, but it would repay this a hundred fold.

MINERALOGY.

The minerals of La Salle county are not numerous nor of great beauty, but they are of much greater economical value than those which would be more likely to dazzle the eye or fire the imagination. They are mostly compounds of lime, alumina, iron and coal.

Galenite, Galena; 44, sulphate of lead; sulphur, 13.4; lead, 86.6; lusture metallic; color, and where scratched lead gray; easily scratched; heavy crystallized usually in cubes. Found in Trenton limestone in small quantities.

Pyrite, 75, bisulphide of iron, sulphur, 53.3; iron, 46.7; pale brass yellow, when scratched greenish black, hard with metallic lusture, in cubes and various forms. Abundant in coal and the clays, both above and below the coal.

Marcasite, 90; composition same as pyrite; pale bronze yellow, inclined to green or gray; hard, brittle; radiated, like a coxcomb, etc.; associated with pyrite; is more liable to decompose than pyrite.
Hematite. 180; red oxide of iron; oxygen, 30; iron, 70; color dark, steel gray or iron black, with metallic lusture; when scratched or powdered, cherry red. Occurs as an ingredient of some red clays.

Limonite, 206; yellow or brown oxide of iron; oxygen, 25.68; iron, 59.92; water, 14.4; lusture, slightly metallic to earthy; color, from nearly black to brownish yellow and ochre yellow. Found in yellow clays; it also constitutes bog iron ore.

Quartz, 231; flint, chert, silica, sand, etc.; when pure, oxygen, 53.33; silicon, 46.67; massive or crystalline; of almost all colors and shades; hard; will scratch glass; in lusture, from dull to glittering; very common, as chert or flint in Trenton limestone; as sand, a part of it crystals, in St.Peters sandstone, as cherty, chalcedony, in concretions, in calciferous at Utica, and as quartzite in the same formation at the Pequamsauggin Cement Works.

Clays.—Kaolinite, 419; Kaolin, porcelain clay, silica, 46.3, alumina, 39.8; water, 13.9; has been reported as occurring in the county, but we have no evidence to support the statement, and must say that we doubt its accuracy. Saponite, 417, occurs in clays over coal No. 2 and several other forms.

Our clays may be regarded as impure kaolins, but they are not, as far as we have observed, crystalline in structure. We shall, therefore, class them as brick clays, usually from the drift; fire clays, usually from below the coal beds; pottery clays, usually from below coal No. 2.

Many other minerals are found in the drift. It would be possible to collect specimens, of half the minerals known to man from this formation, but none of them were formed here, and none of them exist in such quantity as to make them objects of interest farther than to know what they are and where they probably came from.
Gypsum, 654; sulphate of lime, plaster of paris, plaster; sulphuric acid, 46.5; lime, 32.6; water, 20.9; massive or crystallized; glistening white to dull; of various shades; granular, like loaf sugar; fibrous, as if made up of fine threads or in flat, beveled-edged crystals, generally somewhat rhomboidal, or in slender nodules. We have the crystallized form; selenite, often tinged with iron, scattered through the clays above and below the coal, also the fibrous or satin spar forming a thin bed under coal No. 2 at Ottawa and in other places.

Melanterite, 664; sulphuric acid, 28.8; iron, 25.9; water, 45.3; in powder, in stalactitic forms; greenish white to white, becoming yellow; soft; has a puckery, sweetish taste. Found on the rocks in coal diggings and on the timbers as thin crusts, small stalactites, etc. Formed by decomposition of pyrite or marcasite.

Calcite, 715; carbonate of lime, limestone; carbonic acid, 44; lime, 56; massive in thick beds or crystallized; usually gray or yellowish gray, bluish or brownish or crystallized, and white and glistening, often streaked, with black and other colors. The crystalline varieties are called marble; crystals, six-sided pyramids, flattened pyramids, rhombohedrons, or more or less close approaches to a cube, etc. The rhombohedral form is very common in the veins of crystals in the Trenton, the pyramidal in the coal measure concretions of the Big Vermillion. Stalagmite and stalactite occurs in crevices of the limestone at La Salle.

Calcareous tufa, a deposit from waters carrying much lime in solution, incrusting, not petrifying, mosses, grass, twigs, etc., and sometimes forming sheets over the face of a rock occur in Clark’s Run at Utica and farther up that stream, and in many other places.
Dolomite, 716; carbonite of lime, 54.35; carbonate of magnesia, 45.65; much like calcite; crystals, rhombohedral; often dark brown, and with curved faces; common in concretions at Covell creek and on Big Vermillion. Much of our limestone is dolomite; that is, it contains a considerable proportion of magnesia.

Calcite is readily dissolved in sulphuric acid; dolomite slowly, unless powdered and the acid warm. A drop of this acid on calcite produces a foaming or effervescence; on dolomite the effect is scarcely noticeable. Both calcite and dolomite often contain iron, earthy matter, sand, and many other substances.

Siderite, 721; carbonate of iron; carbonic acid, 37.9; iron, 69.1; often contains other elements; massive or crystalline; rhombohedral; ash gray, yellowish gray, etc.; also brown and reddish brown; when scratched, white, brittle. Often in yellow-coated concretions which seem to be made up of concentric shells. Common in Coal Measures.

Mineral coal, 831. A. Caking or coking coals, those that run together in burning. Coals No. 2 and 7.

B. Non-caking, those which burn without sticking together.

ZOOLOGY.

The animals of La Salle county. Mammalia—animals feeding their young on milk or giving them suck.

The animal life of the county has, of course, undergone considerable changes since the first settlement. Some animals have disappeared, usually the larger and fiercer or more destructive, while others which follow in the footsteps of man have come in.

Herbivores or Plant-eating Animals.—Bison or Buffalo.—Bos Americans must at one
lime have been numerous, as their skeletons were found scattered over the prairie by the early settlers, but the animal had disappeared.

DEER—Cervus Virginianus was common for many years. One was killed on the Big Vermillion in 1866, the last, it is believed, killed in the county. They were so numerous as to be very destructive in the corn fields.

CARNIVORES OR FLESH-EATING ANIMALS—The Canada Lynx—Lynx Canadensis—was occasionally seen.

The American Wild-cat—Lynx rufus—was more common but not numerous.

The Wolf—The large gray wolf—canis occidentalis—was not a common animal, although occasionally seen.

The Prairie Wolf or Cayote—Canis latrans—was abundant. They were not pleasant neighbors, not dangerous, but troublesome, as they had excellent appetites, and were not at all fastidious as to what they ate.

The Fox—Probably Vulpes macrourus is occasionally found. It much resembles the red fox V. fulvus, but is larger and has longer fur.

The Raccoon or Coon—Procyon lotor—while not common, is not unknown to many of our readers.

The Woodchuck or Ground-hog—Arctomys monax—is also found here at the present time,

The Skunk—Mephitis chinga—was scarce when the first emigrants arrived, and has become more common with time.

The Badger—Taxidea Americana—was occasionally seen in the early days of settlement, but has long been extinct.
The Gray Rabbit—Lepus sylvaticus—is very common, and has greatly increased since the advent of the white man. It may be well to remember that they are a dangerous article of food, being very often afflicted with tape worm, which, whatever eats them, is liable to take from them.

The Western Fox Squirrel—Sciurus niger var, ludovicianus—one of the largest squirrels, is occasionally seen in the timber.

The Chipmunk or Ground Squirrel—Tamias striatus—came in after the settlement of the country, but is not very numerous at present.

The Flying Squirrel—Sciuropterus volucella, is frequently seen in the woods. This animal sails, does not fly. It cannot rise from the ground like a bird.

The Striped Gopher—Spermophilus tridecemlineatus—is very common.

The Gray Gopher—S. franklini was less common than the former, when the country was new, and is now nearly extinct.

The Pouched Gopher—Geomys busarius—lives mostly under ground and on roots, and is not common.

Otter.—Lutra canadensis—was in early days common along the rivers; now extinct, or nearly so.

The Beaver—Castor fiber—was plenty when the country was first settled, and is now seldom seen.

The Muskrat—Fiber zibethicus—is found along our rivers in considerable numbers.

The Mink—Putorius vison—a slender bodied animal, chestnut brown, with a black tail, valued for its fur, is often met with.

The Small Weasel—Putorius vulgaris—a small, slender animal, the body six or seven inches
long, very destructive to poultry, is not uncommon.

**Rats**—The black rat—*Mus rattus*, was common in early days, now extinct; was brought to America in 1544; is generally exterminated by *Mus decumanus*.

**The Norway Rat**—*Mus decumanus*—appeared soon after the settlement of the country began, and is found everywhere. Brought to America in 1775. It is often called wharf rat.

**Jumping Mouse or Long-tailed Mouse**—*Zapus hudsonius*—is found in the timber; rather scarce.

**The Deer Mouse, Short-tailed Mouse, White-footed Mouse**—*Hesperomys leucopus*—is very common, and often called meadow mouse or field mouse. It is probable *H. Michiganensis* and *Arvicola Pennsylvanicus* are included in the last. The common mouse or house mouse—*Mus musculus*—was found here, and was in the early days more troublesome than at present.

**The Opossum**—*Didelphys Virginiana*—is said to have immigrated to this part of the world after its settlement. It has nearly, if not entirely, disappeared.

**The Mole**—*Scalops argentatus*—the prairie mole is very common and a very troublesome visitor in gardens. It is larger than the common mole and more silvery in color. *S. aquaticus*—the common mole, is probably an inhabitant of the county. We presume also the star-nosed mole *Condylura cristata*.

**The Bat**—The little brown bat—*Vespertilio subulatus*—a small olive brown animal is frequently seen; also probably *V. noctivagans*, larger, and hair with silvery tips. The red bat—*Atatapha noveboracensis*—is sometimes met with. It is reddish brown, three and three-fourths inches long.
BIRDS.

Birds are generally not so plentiful in a prairie as in a timbered country, consequently the number of species found within our limits is not so great as that found in an equal area in other places. But as there are here some tracts well suited to the habits of water birds, quite a number of these either make this their home, or visit it annually, and we have thus a reasonable number and variety of birds. Our list is by no means exhaustive.

Family Turdidæ—The Thrushes—Brown thrush, wood thrush—hylocichla mustelina—cinnamon brown; a fine singer; came in after settlement began.

Robin, Robin Redbreast—Turdus migratorius—came a little later than the preceding.

Cat Bird—Galeoscoptes Carolinensis—came about the same time as the first.

Family Saxicolidæ—Blue Birds—Blue bird—Sialia sialis. This is one of the first birds to arrive in spring, and it sometimes suffers severely for its temerity in venturing so far north before the weather has become warm and settled.

Family Paridæ—Titmice—Titmouse—Parus atricapillus—Black capped chickadee; black head; wings and tail grayish ash, white edged; P. hudsonicus, olive brown, with the head darker, may be found here, and it is possible that P. Carolinensis may sometimes come as far north as this.

Tufted Titmouse—Lophophanes bicolor—Forehead black, whitish below, sides somewhat reddish; head crested; notes loud and ringing; may be found here.

Family Sittadæ—Nuthatches—White-bellied Nuthatch—Sitta Carolinensis—sap sucker; seen running
up and down trees. He is ashy blue above, white below; crown and nape black; middle tail feathers blue, others black, blotched with white; female less or no black on head.

Red-bellied Nuthatch—S. Canadensis—Ashy blue above, brighter than the preceding, rusty brown below, glossy black, male; bluish, female.

Family Certhidae—Creepers—Brown creeper—

Certhia familiaris—dark brown, much barred and striped; rump tawny; tail feathers pointed, shafts stiff, much like those of the woodpecker.

Family Troglodytidae—Wrens—House wren—

Troglodytes aedon—common about houses.

Family Sylviolidae—Warblers—Blue, yellow backed warbler—Chloris Americana—clear ashy blue, with a large golden green patch on back, yellow below; belly white.

Summer Warbler—Dendroæca æstiva—back olive yellow; breast and sides golden yellow, with orange brown streaks.

Yellow Rumped Warbler, Myrtle Warbler—Dendroæca coronata—bluish ash above with black streaks; white below with large black streaks; crown, rump and sides of breast bright yellow.

Water Wagtail, Water Thrush—Siurus nevius—
dark olive brown above, yellowish beneath, thickly spotted with brown.

Family Tanagridae—Tanagers—Summer red bird—Pyranga æstiva—red wings a little dusky. Not common.

Family Herundinedæ—Swallows—Barn swallow

Chilidon erythrogastra. Common about barns.

Cliff Swallow—Petrochelidon lunifrons—a blue spot on breast, whitish below. Builds nests in cliffs along Illinois, also under eaves of barns.
Bank Swallow—Sand martin—Riparia riparia—
dark gray above, white below; breast brownish. Builds nest in holes in sand banks.

Martin, Purple Martin—Progne subis—shining blue, black; female duller, whitish below.

Family Ampelidæ — Waxwings — Cedar bird, cherry bird, Carolina wax wing, Southern wax wing—
Ampelis cedrorum—silky, ashy brown with a red tinge, chin and stripe across face, black belly, yellowish.

Family Vereonidæ—Vireus; several species visit us, but do not remain here for any length of time. They are forest not prairie residents.

Family Lanidæ—Shrikes—Great Northern Shrike, Butcher bird—Lanius borealis—clear bluish ash above; black bars on side of head, not meeting in front; rump and shoulders whitish; wings black; white below, waved with blackish. This bird sometimes winters here, making his home in evergreen groves.

Family Fringillidæ—Sparrows—Evening Gosbeak
—Hesperiphona vespertina—crown, wings, tail black; forehead yellow; bill very large; body olive.

Purple Finch—Carpodacus purpureus—purplish, streaky; male flushed with red, brightest on crown; female olive brown.

Yellow Bird, Thistle Bird—Chrysomitis tristis
—male, rich yellow; female, greenish yellow.

Snow Bunting, Snow Flake—Calcarius nivalis—
body white, clouded with brown, with black on back wings and tail; bill usually pale; feet black.

English Sparrow—Passer domesticus—Too common to need description.

Grass Sparrow, Ground Bird, Bay Winged Bunting—Poecetes gramineus—thickly streaked all over, slightly buff below.
Yellow Winged Sparrow---Ammodramus passerinus---streaked above; feathers edged with bay; breast buffy, unstreaked; wings and tail short. Fields; notes grasshopper like.

Lark Finch---Chondestor grammica---a fine songster; a prairie bird.

Song Sparrow---Melospiza fasciata---noted for its song.

Snow Bird---Junco hyemalis---common in winter.

Black-throated Bunting---Spiza Americana.

Indigo Bird --- Passerina cyanea --- indigo blue; greenish behind.

Cardinal Grosbeak, Red Bird---Cardinalis cardinalis---clear red, ashy on back; crested. Not often seen.

Towhee Buntings, Chewink, Marsh Robin---Peplo erythrophthalmus---black; belly white; sides chestnut; female, brown.

Family Icteridae---Orioles---Bobolink, Reed Bird, Rice Bird---Dolichonyx oryzivorus---male in spring black; neck light buff; shoulders and rump ashy white, back streaked; female, and in fall male yellowish brown.

Red Winged Blackbird, Swamp Blackbird---Agelaeus phoeniceus---glossy black with a red spot on each side; female duller.

Yellow-headed Blackbird---Xanthocephalus xanthocephalus---head and neck rich rich yellow.

Meadow Lark---Sturnella magna---Brownish and streaked above; chiefly yellow below; black crescent on breast.

Crow Blackbird, Purple Grackle---Quiscalus quiscula---black, head purplish, body bronzy.

Orchard Oriole—Icterus spurius—not so brightly colored as preceding and nest not suspended. The orioles came here after the settlement of the country.


Blue Jay—Cyanocitta cristata—is common and well known.

Family Tyrannidae—Fly-catchers—King Bird, Bee Martin—Tyrannus tyrannus—is not injurious to bee-keepers.

Pewee, Phoebe, Pewit.—Sayornis fuscus—brown head and tail darker.

Family Caprimulgidae—Goatsuckers.

Whippoorwills, Night Jar—Caprimulgus vociferus—grayish, much streaked; sings at night.

Night Hawk, Bull Bat—Chordeiles popeatus—flies toward night and makes a strange booming sound with its wings.

Family Cypselidae—Swifts—Chimney swallow—chætura pelasgica—sooty brown: nests in chimneys.

Family Trochilidae—Humming Birds—Ruby Throated, Humming-bird—Trochilus colubris—metallic green above; throat ruby red; tail deeply forked; female without red.

Family Alcindinidae—King-fishers—Belted King-fisher—Ceryle alcyon—head crested; blue; tail barred with white. Common along streams.

Family Cuculidae—Cuckoos—Yellow billed cuckoo—Coccygus americanus. Bill yellow below, body olive gray; wings more or less cinnamon red. This bird builds its nest and rears its own young.

Family Picidae—Woodpeckers—Picus villosus—Hairy woodpecker, big sap sucker and picus pubescens, frequent evergreen trees which they sometimes girdle. Melanerpes erythrocephalus—Red-headed woodpecker.

Family Strigidae—Owls—Long-eared Owl—*Asio otus*, and the screech owl—*Scops asio* are common; the great gray owl—*Strix cinera* and the great snowy owl—*Nyctea scandiaca* are sometimes seen in winter.

Family Falconidae—Falcons, hawks—The sharp-shinned hawk—*Accipiter fuscus* and chicken hawk—*Accipiter cooperi*, hen hawk or red-tailed buzzard—*Buteo borealis*—the sparrow hawk or rusty crowned falcon—*Falco sparverius* are common, and the ball eagle—*Haliatus leucocephalus* is sometimes seen, but does not make this region his home.

Family Cathartidae—Buzzards—Turkey buzzards—*Cathartes aura*.

Family Columbidae—Pigeons—Wild Pigeon—*Ectopistes macrura*, never lived here, but visited the country in great numbers at times; is not so frequently seen as formerly.

The Mourning Dove—*Zenædura Carolensis*—is not rare.

Family Meleagridæ—Turkeys—The wild turkey—*Meleagris gallopavo* once common is extinct. *Caponia cupido*, prairie chicken, or pinnated grouse is frequently seen; the ruffled grouse or partridge—*bonassa umbellus*—is met with, the latter but seldom.

Family Perdicidæ—Quails—Quail, bob white—*Ortyx Virginianus*, it seems at present to be on the increase.

Family Charadriidae—Plovers, none live here. *Ægialitis vociferus*, the Kildeer, is often seen about wet places in the fall.

Family Scolopacidae—Woodcocks, etc. American woodcock—*Philohela minor* found in some places; sandpipers—*Tringa*; godwits—*Simosa*; tattlers—*Tolanus* are sometimes seen in wet places about ponds.
The Long-billed Curlew—Numenius longirostris is no longer found here.

Family Ardeidæ—Herons—The great blue heron—Ardea herodias is found along the rivers. The snowy egret, little white egret—Garzetta candidissima—is sometimes seen along our streams.

The Bittern, Indian Hen, Stake Driver, Pump Thunder—Botaurus lentiginosus—is less common than formerly, but its deep thunder-like notes are often heard. The green heron—Butorides virescens—and the least bittern—Ardetta exilis—inhabit wet places.

Family Gruidæ—Cranes, sandhill or brown crane—Grus canadensis—once very common, now seldom seen; sometimes heard as they pass over, going north in the spring.

Family Rallidæ—Rails are found about swamps.

Family Anatidæ—Ducks—the wild goose—Bernicla canadensis—the brent—Bernicla bernicla—and several species of ducks once made this region their home, but have ceased to do so.

The Pelican—Pelecanus trachyrhynchus—is occasionally seen.

The White-winged Gull—Larus leucopterus—visits our streams.

The Great Northern Loon or Diver—Uranator immer—is sometimes seen in the spring along the Illinois, and the swan—Cygnus buccinator—may be seen occasionally.

Other species will no doubt be found. The subject has not been carefully worked up, and much remains to be done. Moreover, many birds are migrant and some follow man, while storms, the gun and the want of sound sense which characterizes man often destroy a species in a given territory. Hence we find changes constantly in progress.
REPTILIA OR REPTILES—TURTLES, SNAKES.

The reptiles are not so numerous as the birds, and have been less carefully studied than they.

Box Turtle—Cistudo Carolina—not numerous.

Painted Turtle, Mud Turtle—Chrysemys picta—sides marked with bright red.

Snapping Turtle—Chelydra serpentina, C.

Common Soft-shelled Turtle—Aspidonectes spinifer—Illinois and canal.

Lacertilla—Lizards—Blue Tail—Eumeces fasicatus—on rocks near old fair ground.

Ophidia—Serpents—Colubridæ, having no poisonous fangs.

Spreading Adder, Blow Snake, Puffing Adder, Hog-nosed Snake—Heterodon platyrhinus—about the canons.


Garter Snake—Eutæmia sirtalis—and probably E. faireyi and E. proxima.

Black Snake—Bascaniom constrictor—blue racer—Coluber obsoletus—green snake—Cyclophis vernalis—milk snake, spotted adder, house snake—Ophibolus doliatus, var. triangulus—bull snake—Ophibolus calligaster, are found in the county, the last quite common.

Crotalidæ, having erectile, grooved, poisonous fangs.

Banded or Yellow Rattlesnake—Crotalus horridus and the prairie rattlesnake or massassauga—Caudisona catenala—both becoming very scarce.

BATRACHIA—FROGS, TOADS, ETC.

Leopard or Common Frog—Rana viresens—The bull frog—R. catesbeana, C.
Tree Frogs or Tree Toads—Hyla versicolor—are often heard, not so often seen. Their cry indicates a state of the atmosphere, not rain necessarily.

The Toad, Warty Toad—Bufo lentiginosus—is found about every garden, and is the gardener's friend and assistant.

The Large Spotted Salamander—Amblystoma punctatum—not a handsome animal, from five to eight inches long, black above, with round yellow spots on each side of back, and a slimy look; is sometimes found in cellars and other damp, cool places. It gives out a milky fluid from pores in its back if disturbed. It moves very slowly and does no harm.

The Mud Puppy—Menobranchus macculatus—also called water dog, and dog fish is found in still waters with muddy bottoms. It is known by its gills, which form tufts each side of its head. It is very active and hard to catch, and should not be taken in the hand.

FISHES—ICHTHIOLOGY.

We have made no careful study of the fishes of the county, and the list we give is made up from Jordan and United States fish commission reports. It is correct as far as it goes.


Buffalo Fish—Ichthyobus bubalus and others. Catfish—Amiurus nigricans, A. catus (nebulosus), and
the bullhead, A. Melas, the Gar—Lepidosteus osseus and platystomus. Shovel-nosed Sturgeon—Scaphirhynchops platyrhynchus.

While the reports of the Fish Commission give lists of fishes from the streams of many parts of our country, there are none from Illinois, and the above list is but an approximation to the truth.

INSECTS—ENTOMOLOGY.

The Entomology of La Salle county would be that of a vast region, and would alone fill a volume much larger than this, but the material for the full treatment of the subject does not exist, and it would be a work of much time and labor to gather it and prepare it for publication. The following notes are but the beginning of such a work.

Hymenoptera—Insects having four membranous, more or less, transparent wings, with branching veins. The males are not armed; the females are.

The Honey or Common Bee—Apis—; Humble bee—Bombus, several species; carpenter bees—Xylocopa; Leaf Cutters—Megachile; Mason bees—Osmia; the Wasp—Vespa; of which the hornet is a species; wood wasps—crabo, which burrow in wood; mud wasps—Sphegidae, which build nests of mud, and others.

The Ants—Formicariae—also belong here, as also the Ichneumonidae, noted for their long piercers or stings, called "ovipositor." They are mortal enemies of most other insects. To this section also belong many of the gall flies, all of which are injurious to vegetation. The saw flies, which are all tree borers, and whose larva live in the trunks of trees as grubs, belong here.
LEPIDOPTERA—BUTTERFLIES AND MOTHS.

The Lepidoptera are among the most common and showy of insects. They have four scale covered wings and a long bill or sucking tube, which, when not in use, is rolled up in a little coil beneath the head. In their young or larval state they are caterpillars or worms, and are often very destructive to plants. We have many species, several of them large and showy.

Family Papilio; hind wings generally extended in tail-like appendages.

Genus Papilio; Papilio asterias; black, double row of yellow dots on back, and a band of yellow dots across wings, seven blue spots on hind wings, and eye like orange spots with a black centre. The caterpillar feeds on parsnips, carrots, celery, etc., and is yellowish green, banded with black. When touched it pushes out two orange-colored, horn-like organs, which give out a strong, unpleasant smell. The female has few yellow spots. Breadth across open wings, three and a half to four inches. P. turnus, the Turnus butterfly; yellow marked, an orange-red spot in hind wings; breadth, four to five inches; larva upon leaves of apple, wild cherry, etc., green above, with rows of blue dots. Remains a chrysalis through winter. P. crespontes, B. with a triangular band of yellow; in shape resembles turnus.

Family Pieridæ—White and sulphur butterflies; hind wings rounded; colors, W. Y. O. Pieris oleracea, the well-known cabbage B. appeared here about 1876. Came from Europe. Colias philodice; the common yellow B. The caterpillars feed on clover and similar plants; are green and slightly downy.

Family Nymphalidae; fore legs but partly developed. Limenetia has knob of antennæ long and straight; edges of wings scalloped. Limenitis misip-
pus; missippus B.; tawny Y.; above paler, below with a broad B. border, spotted with white and black veins; three to three and a half inches. L. Arthemis; has a broad white curved band crossing both wings; male has O. spots on hind wings next border. Danais errippus; the archippus B’t.; knob of antennæ long and curved; tawny O. above, nankin Y. below; three and three-fourths to four and a half inches. Argynnis has edges of wings entire. A. idalia, the Idalia B’t. has pearly W. crescents beneath and seventeen W. spots under each hind wing; tawny O., spotted with B. above; three and a half inches. A. aphrodite has silvery W. spots under tip of fore wings, and more than twenty large ones under hind wing; two and three-fourths to three and a half inches. Grapta has the wings jagged and toothed on margin and finely colored. Several species are common. Vanessa has wings less jagged than græpta. Vanessa antiopia is purplish brown with a broad pale-buff border. The larva are black and spiny and dotted with very small white spots. It lives through the winter, and may be seen on warm days flying in sunny places in the woods.

We have many other butterflies, most of them smaller than those mentioned, but many of them very beautiful. Among these the Lycaenæ or Azure Bt. family, found about woods and the Hesperidæ or Skipper family, noted for their jerky, irregular movements, are most prominent. Butterflies have knobbed antennæ and wings erect when at rest, and fly by day. Moths fly by night, and the antennæ are of various forms.

The Sphingedæ or Hawk Moth family is a large and well marked section of the Lepidoptera. The wings are narrow for their length and they fly very rapidly, their movements much resembling a humming-
bird, and they are generally regarded as such by most people. They usually come out to visit flower gardens late in the afternoon, and fly into the night. The caterpillars are large, strong and ravenous, and feed on the tomato, potato, purslane and Ampelopsis Virginiana, etc. They descend into the ground, become chrysalids, and remain there until spring, when in June and July they come forth as moths. The tomato worm is too well known to need description. The tobacco worm is much like it, and there are others generally feeding on the elm, plum, grape-vine, &c. The tomato and the tobacco worms only, do much damage.

The moths, in general, fly by night or in the cool of the day. Some of them are very large, as the cecropia,—Platysamia cecropia living on the apple, the Promethus—Callosania Promethea, living on the cherry and sassafras, and the beautiful Luna—Actia Luna; wings tailed, yellowish green, with a purple band near border. It feeds on the walnut, hickory and maple. The last three are really wood moths and not found far from timber. They are the largest and handsomest of our moths. Their caterpillars are large and green, or bluish green and variously marked and ornamented. There are many genera besides the above, and a multitude of species so that on a warm, still, damp night, one may often capture 30 or 40 different species in an hour by setting a light where they can come to it and he will find that his visitors change, some coming early, others late.

Many of these creatures, and the small particularly so, do a great amount of damage—always in the larval or caterpillar stage, and too much pains cannot be taken to destroy them while they are yet worms.
DIPTERA OR TWO-WINGED INSECTS.

These are mostly small and inconspicuous creatures, but many of them very important, being in the larval stage very destructive of vegetation, as the Hessiarn fly—cecidomijia destructor and c tritici or American wheat fly; injurious to oats, barley and rye, as well as wheat.

The Horseflies—Tabanidæ contains several bloodthirsty species. The Asilici live on other insects; the Bomyliaria or Bee flies; the Æstridæ or Bot flies of several genera and more than twenty species, attacking horse, sheep and ox; the Muscidæ or Flies proper. The house fly and its allies and many others are included in the Dipteræ, as also the Pulicidæ or fleas.

The Coleoptera or Beetles, commonly called bugs, are at once known by their having their wings covered by a hard, usually lustrous cover, and look as if they were covered with horn. These covers are called elytra. Among the most common are the brilliantly colored Calasoma scrutator, a beautiful green and the no less handsome C. calidum, black with six rows of bright red, sunken spots on the back. They belong to the Cincindelidæ or Tiger Beetle family, all of which eat other insects.

The Dyticedæ or Water Beetles, Gyrinedæ and Hydrophilidæ are all inhabitants of the water, the last flying by night; the Silphidæ or Carrion beetles have the curious habit of burying dead mice, snakes, etc., and laying their eggs in them; Staphylidenidæ live on decaying matter, animal or vegetable; Dermestidæ in its larval state eats the dried skins and bodies of animals, and is very destructive to zoological collections; Lucanidæ are large, stout and handsome beetles, sometimes called Horn bugs from the appearance of their upper jaws; Scarabœidæ have their antennæ
in a knot composed of three or more leaflike pieces. Here we find the May beetle or June bug, Lachnos-terna quercina, also Cetonia, frequently seen here, and Elateridæ or spring beetles, or snapping bug—Elater oculatus is marked with two velvety, dark, eye-like spots. Our most common one is horn-brown, three-fourths of an inch long, and very plenty. Another species is light horn-brown, has a red head, and is one and one-half to two inches long. We have seen but few of these. The larva live in rotten wood. The Curculionidæ or curculio is well known from his work, if seldom seen. He is very small and very sly. They have a long snout, long for their size. The Pea Weevils belong here, as do the other weevils. The Clytus, C., flexuosus, banded with yellow and black, the locust borer is another destructive beetle.

The chrysmelidæ are usually small, longer than wide, and variously striped. Among them is the squash bug.

The coccinellidæ or lady bugs are round or oval, with convex backs, and are beautifully spotted with bright colors. They eat plant lice, and are useful. We have several species, most common, a red one with thirteen B. spots on the back.

The hemiptera have the mouth in form of a beak, which is folded back under the thorax when not in use. The most important members of this subordes are the Harvest flies, cicadas or locusts—the seventeen year—not a locust, nor even second cousin to a locust, the Treehopper—cecropidæ—of which we have several species; the Plant lice or Aphidæ; the boat flies or Notonectidæ, aquatic insects which swim on their backs and leaving the water at night fly about. The Hydrometridæ walk on the water. The corcidæ or squash bug, which attack the squash, and Cimicedæ or Bed-
bug also belong here, as well as the Pediculidae or lice.

Orthoptera, wings lying straight along the back. The Blattaria or cockroach; Phasmidae or Walking-sticks; Mantidae or mantis: Gryllidae or crickets, among them the curious Mole cricket; Locustidae or Locusts—the true locusts; Acrydii or Destructive locusts of many genera and species are included in this section. Locustidae embraces the Katydid—Cyrtophyllus concavus and many grasshoppers.

Neuroptera; wings four, membranous, net veined. Many of these are small and little noticed, as the Psocidae, found among old books and papers. Ephemerida—May flies are very numerous along the Illinois and the lake shores the last of May into June.

Odonata—Dragon flies of several species, some large. The larva live in water and come forth as flies the second year.

Sialidae or Corydalis is found in the woods along streams, the larva living in the water. It is ash gray, four or five inches long; has a large head and powerful jaws.

Arachmida or spiders have eight legs, and are divided into two parts instead of three, as are insects, the head and thorax forming the first, the abdomen the second and usually layer division. We have a large number of genera and many species of these very interesting insects, a description of which would form a volume by itself.

They deserve careful study, and will well repay the time and labor spent in the investigation.

Among the most interesting, is the large gray hairy field spider, clubione, which soon learns to come for food. The great white and black spider, whose webs so often seen in the fall, are a marvel of
workmanship. Epeira vulgaris is very common, less so, another Epeira having a salmon colored body, curiously waved and streaked with brown. We have also a small, jet black, hairy spider, with a small, green blotch in the center of its back, in the middle of which is a red spot. We have also pale yellow, white and other colored creatures of this class, some small, some large, some long and some short-legged, which we must pass over without further mention.

The Phalangeta or long legs, Daddylonglegs, Father Graybeards or Harvestmen, are common, and at once recognized by the small, roundish body and very long legs.

The Acarina or mites are small, generally parasitic insects, the cause of the itch, sheep scab, &c. A few, however, live in the ground. Among these, Trambidion, of a bright red color, often seen in the spring in the garden. The ticks, Ixodidae, are large mites. They are common in the woods, and are often found on animals and sometimes on man. The sheep tick belongs to the diptera.

The myriapods or centipedes are not numerous; the Chief or lithobius Americanus, having a flattened body and about 30 legs. It is found about cellars, under chips and about refuse heaps. It devours insects and is harmless. It is very quick in its movements. Another species with longer legs and slower in its movements, is some times found in rooms. Iulus multistriatus, the thousand-legged worm, dark purple brown; 2-4 inches long, and as large as an ordinary lead pencil, is common about the woods.

Crustaceans—Our species of these are few—The cray fish—Astacus, is well known and well illustrates the Decapods. Oniscus, a roundish, flat, purplish, 14-footed creature, one-fourth inch or less long, living under boards and in damp places, the Tetradecapods.
THE MOLLUSCA.

Mollusks are animals having soft bodies without a hard skeleton, breathing by gills, and is by far the larger number of species covered by a shell. They are of three kinds, not having a shell like the garden slug; second, shell usually coiled, of one piece, like the snail; called univalves third, shell of two parts or pieces, called valves, like the oyster and clam, called bivalves.

They are also divided into Land, Freshwater and Saltwater Mollusks.

The Mollusca of La Salle county belong to all three divisions or groups of the first arrangement and to the first and second of the second.

The land mollusks are lovers of shade and dampness, and as the country is settled, wet lands drained and forests destroyed, no doubt many species will become extinct; some are already rare, but those living in the water will probably hold their own. We observe, however, that the drainage of coal mines into the Big Vermillion, at every season of low water, kills off the unios of that stream, and at present very few are found in it.

The following notes on the mollusca of this county are largely taken from Mr. William Wirt Calkins' "Land and Fresh Water Shells of La Salle County, Illinois," published in 1874, as Proceedings of "The Ottawa Academy of Sciences," an organization that practically ceased to exist about 1881, when it placed its library and cabinet in the care of the trustees of the Ottawa Tp. High School, since which time it has held no meetings, and the members have, most of them, died or removed from the city. Cannot La Salle Co. support one Scientific Society? Is there not work in this great county for one?

Mr. Calkins is in no way responsible for the present form of this paper. It has been considerably altered from the original.
TERRESTRIAL MOLLUSKS.

ORDER PULMONATA—SUBORDER GEOPHILA.

Before describing the species common to the county, it will be necessary to give my readers a general idea of the habits, etc., of the snails. I have examined the animals in their own homes, and have domesticated them to the number of ten or twelve species on my premises in Chicago, where at the present writing, some of them are hibernating, or taking their annual sleep. I have a number in glass cases. A few have fastened themselves to the walls of my library, while I have planted some in various locations around the yard. My first observation was *Macrocyclis concava* attempting to make a comfortable meal of its inoffensive neighbor *Helix alternata*. The carnivorous propensity of the species is well known. Some of the species are more active than others in their movements. My *H. alternata* have made frequent attempts to escape. Most of those I have are generally passive and remain closely withdrawn into the shell. The snails can live a long time without food or moisture. I now have live ones that have been without food for several months, and I shall test their endurance further. Extremes of temperature are said to be fatal to snails. Most of the species are solitary in their habits, living alone, beneath logs, leaves and stones, or debris. They prefer the shade of the forest, or damp, cool places. Here they pass the major part of their lives.
They generally sally forth in the night in quest of food. On cloudy days they sometimes come out, but avoid the light and glare of the sunshine. In early spring, however, they emerge from their retreats to enjoy the invigorating effects of the sun, and are then found for a short time where its rays will fall upon them. Having regained their accustomed vigor, they retire to the first convenient shelter. I have said that the snails live alone. Helix alternata, Say, is an exception. It is gregarious, numbers of them living together, and in winter we find them collected closely as if for the purpose of imparting warmth. I have taken as many as two hundred from beneath a single log. The snails lay their eggs from May to October, depositing them under logs and leaves to the number of thirty or more. The young are soon hatched if the conditions are favorable, make their first meal on the shell they have just left, and proceed to shift for themselves. Their growth is rapid. At first the shell consists of one and one-half whirls, which increase in number during the first and second seasons. As to the average life of the snails I am uncertain. I think some of our species live at least two years. I would direct observation to this point. As to size, that depends upon the conditions of food, climate, etc. Our species are as large as any found elsewhere. The snails are vegetable feeders, but not strictly so. Several species are carnivorous. One of these I have noticed. The slowness of their movements precludes the idea of their being entirely animal feeders. They are provided with a rasp-like tongue which enables them to reduce vegetable substances with great facility. Our American snails are very plain. There are only a few banded species east of the Rocky Mountains. On the Pacific side there are a number. In this country
we have one variegated species, *H. alternata*, and three banded species, noticed hereafter. In tropical climates the shells are brilliantly colored, a fact that applies to marine forms as well.

One peculiarity of our snails is the tooth-like appendage found in the apperture of many of the species. These have been grouped as *Helicodonta* by Ferussac. The snails, having passed their summer existence, prepare, on the approach of cold weather, to go into winter quarters. These they find in the same localities where they have lived. They either burrow in the ground or attach themselves to the under side of their shelter. Having disposed themselves with the apperture of the shell upwards, they blow forth a mucous-like secretion from the collar. This is ejected so as to cover the apperture of the shell. We call this the *epiphragm*. It hardens and effectually shuts out the cold. As the season advances, the animal retiring further within builds more of these barricades in the same manner as the first. Finally, the pulsations of the heart becoming slower and slower, at last ceases entirely. The sleep is complete. They are eaten in some parts of Europe—Paris and Vienna.
LA SALLE COUNTY SPECIES.

FAMILY HELICIDÆ.—SUBFAMILY VITRININÆ.—GENUS MACROCYCLIS—BECK.

Macrocyclis Concava, Say—Shell flattened, whirls five, umbilicus broad and deep, shell striate, horn color, breadth one-half inch. They are fond of animal food, and are active; the shell resembles *M. vancouverensis*, Lea not so large and differs in other respects. C.

Genus Zonites, Montford—Zonites arboreus, say. Shell thin and depressed, whirls four and a half, lip acute, light horn color, one-fourth inch in diameter. R.


SUBFAMILY HELICINAE

Helicodiscus, Morse,—Helix lineata, Say—Shell flat, whirls four, lip acute, two pair of teeth within aperture, horn-color, breadth four mill. Very abundant.

Genus patula, Halde.—Helix alternata, Say—Shell has five whirls, peristome acute, umbilicus deep, shell not much elevated, and variegated with numerous red-
dish spots, some of them oblique, others running into lines on last whirl, diameter nearly one inch. The most abundant species in the county; live in colonies of one hundred or more in some localities. Semi-fossil in the Quaternary deposits.

*Helix alternata*, Say, variety.—A sharply carinated variety with coarse striae. resembling *H. mordax*, Shutt. I believe the true *mordax* is from Tennessee, and this differs in not having as coarse striae. A well marked variety.

*Helix solitaria*, Say.—Shell coarse and heavy in texture, has a broad umbilicus, is globose, coarsely and obliquely striate, whirls six, lip acute, has two reddish revolving bands; aperture circular, color brownish; breadth one inch. Abundant in some localities; also in the Quaternary, one of the three banded species in the county.

*Helix striatella*, Anthony.—Shell small and depressed, whirls three and one-half with distinct oblique striae; umbilicus large, lip acute, color brownish or russet, breadth one-fourth inch. Quite abundant.

**GENUS HELIX, LINN.—SUBGENUS MESODON, RAF.**

*Helix albolabris*, Say.—Shell has nearly six whirls obliquely and finely striated, horn colored; lip white inside and reflected; umbilicus covered by the peristome greatest diameter thirty-two mill; abundant.

This fine species is so distinct in its characters as to be easily recognized. Some specimens have a tooth on the parietal wall.

*Helix multilineata*, Say.—Shell depressed and sub-globose, whirls nearly six, with fine oblique striae aperture lunate, a little contracted by peristome; ornamented with numerous reddish bands and lines, per-
GEOLOGY OF LA SALLE COUNTY.

Istome reflected and of a roseate color; umbilicus covered, breadth one inch. Abundant.

The finest species we have. Say, describes the lip as white. The rosy lip is a peculiarity of our species. They live alone, slightly burrowed in the ground—and seeming to prefer a greensward opening to a shelter beneath logs, etc. Best specimens from the vicinity of Indian Creek, near Fox river.

Helix Pennsylvanica, Green.—Shell elevated, whirls six, white crowded and oblique striae, umbilicus closed, aperture triangular, somewhat contracted, lip white, reflected, a little thickened near the base, color chestnut, greatest dia. 17 mill. Abundant.

A beautiful, large species. I have always found them solitary, each in its own little burrow which is very nicely excavated to the depth of from two to three inches, and on a high blue-grass plateau near the Fox river, where there are a very few trees or debris.

Helix exoleta, Binney.—Shell large and ventricose, six whirls, which are striated, peristome wide and reflected, an oblique tooth process on the parietal wall, suture distinct, aperture rounded, breadth one inch. Abundant.

Helix thyroidus, Say.—The shell has five whirls with oblique striae, spire depressed, aperture lunate, lip white, reflected, and at the basal portion partially covering the umbilicus, tooth process on the parietal wall; horn colored, breadth nearly one inch. Very abundant.

Helix clausa, Say.—Shell has five whirls, is somewhat elevated, horn color, lip reflected, and at the basal portion partially covering the umbilicus, greatest dia. 18 mill. Very abundant.
Helix profunda, Say—Shell depressed, umbilicated, lip white, reflected, thickened, with a blunt callus on the inner side near the base, whirls six, shell horn color with two broad, revolving bands and two smaller ones. All of a reddish color, extending into the aperture; has coarse and oblique striae, umbilicus large and deep; greatest breadth one and one-fourth inches.

Another of our banded species. Some have but one band. A variety with a sort of porturberance on the outer circumference of the last whirl, one-fourth inch from the margin of the lip occurs. C.

SUBGENUS STENOTREMA, RAF.

Helix hirsuta, Say.—Shell has five rounded whirls which are covered with fine bristly hairs, resembling minute spines; aperture narrow, almost closed by an elongated tooth on the parietal wall, peristome depressed with notch near its center, umbilicus covered, breadth 8½ mill.

Some of the finest specimens I have seen were found by Mr. A. C. Baldwin and myself in the Deer Park, and in a ravine on the south side of the Vermillion River, near the Farm Ridge Bridge. The rich, deep chestnut coloring is noticeable.

HELIX MONODON, RACKETT.

Shell depressed, whirls five, hairy; umbilicus partially covered, aperture lunar, a lamelliform tooth on the parietal wall, peristome white, acute, reflected; shell horn color. breadth 10 mill.

Not so abundant as the preceding, but has been found by Mr. A. C. Baldwin and myself in the town of Deer Park. Other places near the timber. The situations were dry ones.

Helix monodon, Rackett.— Variety Leaii, Ward—A somewhat smaller shell than *H. monodon*, of which
it is a variety, undoubtedly. It differs in its size, and is only found in same situations as *H. hirsuta*.

**SUBGENUS STROBILA—MORSE.**

*Helix labyrinthica*, Say.—Shell conic, elevated, apex blunt; whirls six; aperture lunate, with teeth within; color chestnut; dia. 2½ mill; height 2½ mill; very abundant in the Fox River Valley, and may be known by its elevated conic shape.

Genus *Pupa*, Drap.—This genus, founded by Draparnaud, to include the minute species of Europe that had been classed with the *Helices*, and by some is considered superficial. The genus has, however, been adopted as a good one. The shells are so minute as to require much time, patience and skill to find. The species are semi-aquatic, being found in damp or wet places, near streams and frequently on drift wood in our rivers.

**SUBGENUS PUPILLA, LEACH.**

*Pupa pentodon*, Say.—Shell conical, ovate; whirls five, well rounded with deep suture; aperture semicircular; peristome sharp and expanded; has a callus on the inner margin of the lip, on which are from three to six denticles; on the parietal wall is one prominent denticle; horn color; length 2½ mill. Very abundant.

**SUBGENUS TEUCOCILHA, ALBERS.**

*Pupa fallax*, Say.—Shell fusiform; turrited; whirls six, smooth; suture impressed; aperture lateral, large; lip expanded but not reflected; color brown; length 6 mill. Dia. 2½ mill. Found in considerable numbers in various localities.

*Pupa armifera*, Say.—Shell subfusiform, smooth; whirls six; peristome white and reflected; aperture small, oval, with reflected lip, much thickened within,
its extremities nearly joined by a callus on parietal margin; has four teeth in the aperture, on the margin of the lip and within; length 5 mill. Dia. 2½ mill. Abundant.

Pupa corticaria, Say.—Shell subcylinrical; apex obtuse; whirls five; suture impressed; aperture small, with white, reflected lip; on parietal wall is one tooth; horn colored, length 2½ mill. Dia. 1½ mill. Abundant.

SUBFAMILY SUCCININÆ.

Genus Succinea, Drap.—Subgenus Succinea, Drap.—The animal resembles Helix, but is shorter. They live on the land near water, and on swamp grass millions may sometimes be found. For instance, in the calumet swamps. In our county around swales. I find S. obliqua, however, in situations somewhat removed from water or damp grounds. On the approach of cold weather the species imitate the habits of the Helix. The shells, oblong, three to four whirls—the last much the largest.

Succinea obliqua, Say.—Shell oblong, ovate; whirls three, the last very large and expanded; lip acute; straw colored, and moderately thick and firm; length three-fourths of an inch. Abundant.

Grows to a large size in this county. Is thicker than usual.

Succinea avara, Say.—Shell thin; whirls three; shell straw colored; length one-fourth of an inch. Abundant in meadows in Deer Park.

Succinea retusa, Lea.—Shell ovate, oblong, thin, yellowish; whirls three, aperture dilated and drawn back below, length 14 mill. Abundant.

This is longer than the species described by Dr. Lea. His description was from a single specimen. My specimen is the mature shell.
SUBORDER LIMNOPHILA—FAMILY AURICULIDÆ—GENUS CARYCHIUM, MÜLLER.

Carychium exiguum, Say.—Shell elongated, tapering; apex obtuse; whirls five to six; suture impressed; aperture obliquely oval, white; lip thick, reflected, flattened, umbilicus perforated, a plait-like tooth on the middle of the columella, about midway between the extremities of the lip; color white, appearance shining; length one and one-half mill. Dia. 6 mill.

This minute species was described by Say as a *Pupa* in 1822, and is still known as such to many collectors. The most abundant of our minute species. Found in wet moss, leaves, bark, drift-wood, etc., along our rivers. Dr. L. N. Dimmick collected many thousands in the vicinity of Ottawa.

FAMILY LIMNÆIDÆ.

The *Limnæidea* are found all over the world, are very variable in characters, and as yet imperfectly understood. In habits they are aquatic, and are found in rivers, ponds and creeks, feed on vegetable matter or the slimy material found in rivers, and on infusorial animalculæ. Dr. Gould speaks of them eating each other's shells in the latter part of the warm season. Having kept them alive for months at a time, I am able to confirm Dr. Gould's statement as far as this. They rasp off with their tongues the confervaceous vegetation and epidermis of each others' shells in a very thorough manner. The sexes are united in the same individual. The shell is dextral, with a fold upon the columella. They come to the surface to breath free air, but are adapted to breathing through water. On the approach of cold weather they bury themselves in the mud for the winter. From my own observation they begin to disappear in the early part
of October, *Limnæa stagnalis*, L., being the last I have found at the surface, and this on the first of November.

**SUBFAMILY LIMNAEIBÆ.**

Shell spiral, spire more or less acute, last whirl large, aperture large.

**GENUS LIMNÆA, LAM—SUBGENUS LYMNOPHYSA, FITZ.**

*Limnæa reflexa*, Say.—Shell, dextral, elongated, volutions six, which are very oblique and wrinkled, spire acute and long, body whirl dilated, aperture rather narrow, shell reflected from the middle, length one and one-fourth inches. Illinois river.

*Limnæa pallida*, Adams.—Shell thin, whirls five, suture marked, horn color, body whirl not much enlarged, fold upon the columella not large. length one-half inch. Loc. Fox and Illinois rivers.


*Limnæa desidiosa*, Say.—Shell oblong, spire long as the aperture, whirls five, of a yellowish horn color, length, 10 mill. Found in same locality as the preceding species.

*Limnæa caperata*, Say.—Shell conic, whirls five, suture distinct, apex acute, whirls wrinkled, and with light-colored revolving lines on the young shell, aperture dilated somewhat, labium without much fold, color yellowish horn, with frequently bands of white, aperture reddish within, length 14 mill.

**GENUS PHYSA, DRAP.**

The Physas are the most active and hardy of all the aquatic univalves. They move rapidly through the water shell downwards. They inhabit muddy
bottoms and prefer still waters. They are tenacious of life, living much longer out of water than any other species I have taken, and emitting when removed from their native element, a peculiar snapping noise. I have seen them attack bugs as large as themselves with the greatest ferocity and quickly draw them beneath the water. The shells are sinistral.

Physa gyrina, Say.—Shell oblong, of a polished, shining appearance; color light yellowish; whirls five, suture marked; apex acute; aperture more than half the length of the shell; labrum slightly thickened on inner margin and tinged with a reddish line; length 16 mill; fine, abundant.

Physa Hildrethiana, Lea—This species is placed by Mr. W. G. Binney, in the synonomy of *P. gyrina*, Say; but I think they are distinct. The following describes my specimens, which are large and well developed. I obtained them from a pond in Deer Park. My description is fuller than that of Dr. Lea.

Shell elliptical, of a chestnut color, firmer in texture than *P. gyrina*, whirls five, spire obtusely elevated; aperture nearly two-thirds the length of the shell, and compressed; labrum sharp, with its inner margin red; and further within the aperture, a chestnut colored line showing outside a whitish color; length, 19 mill.

Dr. Lea calls this the most remarkable Physa found in this country. The pond from which I obtained my specimens has the bad habit of getting dry every season. The remarkable size of the shells as well as their shape attracted my notice. The species disappear with the water, but for several successive years have reappeared with its return; or, the ova deposited have served to perpetuate the family. The above two species are all that I can vouch for as living
in this county. In the Lake Michigan drainage around Chicago Physa gyrina attains a very large size, but is different in shape from Physa Hildrethiana.

**GENUS BULINUS, ADANSON.**

Shell fragile, slender, polished; whirls six, aperture narrow, spire tapering, color light yellowish, columnellar fold slight; length about 18 mill. Loc. stagnant ponds near Illinois river.

Differs from Physa, in being more slender and more highly polished, and in having a simple, unfringed mantle; appears of a deep black when the animal is within.

**SUBFAMILY PLANORBINÆ.**

Genus Planorbis; Guettard—One of our most abundant mollusks, is found usually in quiet waters feeding on confervaceous vegetation or decayed matter. The genus is represented by a number of species in this county. I believe that more species of Planorbis have been made than will stand. Several varieties of *P. trivolvis* are very good as varieties, and I believe as much entitled to the rank of species as some that are called such.

Planorbis glabatus, Say.—Shell has five whirls, rugose in appearance, spire regular; umbilicus large, deeply concave; exhibiting the volutions; color brownish; breadth nearly one inch. Loc. Fox River.

**SUBGENUS PLANORBELLA, HALDE.**

Planorbis campanulatus, Say.—Shell has four whirls; umbilicus deep, color yellowish horn; aperture dialated, campanulated; greatest breadth one-half inch. Abundant.
Planorbis trivolvis, Say.—Shell has four whirls, which are finely striated, two and a half whirls visible upon the right side, the ante-penultimate disappearing within the umbilical cavity, aperture large, slightly thickened within the margin, and its faces projecting beyond the planes of the shell; color chestnut: greatest breadth three-fourths of an inch. Very abundant.

Say gives the breadth as half an inch. Attains to nearly an inch in breadth in Chicago River, and resembles *P. macrostomus*, White. I have forms answering to *Plan, corpulentus*, Say, which I believe to be *trivolvis*; and also the following which are included in the synonomy of *Plan, trivolvis*: *Plan, regularis*, Lea—an immature form; *Plan, megastoma*, DeKay; *Plan, trivolvis, var; fallax*, Halde. The varieties are numerous. I believe that the differences may be accounted for by the character of the waters, chemical elements, station, climate, etc.

Planorbis bicarinatus, Say.—Shell has three whirks, carinated, color brownish; aperture large; color within reddish, with two white lines corresponding with the carina; breadth one-half inch. Abundant.

**SUBGENUS GYRAEUS. AGASSIZ.**

Planorbis deflectus, Say.—Shell dextral, depressed; whirks five, minutely wrinkled, texture thin, aperture large, color light horn; breadth five-sixteenths of an inch. Very abundant.

Planorbis parvus, Say.—Shell horn color, whirks five, minutely wrinkled; concave above and beneath; and equally showing the volutions; lip rounded; breadth one-fifth of an inch.

Ligamentina, Fleming.—Shell dextral, spire depressed; whirks few, visible on both sides, furnished internally with teeth; outer lip simple.
Segmentina armigera, Say.—Shell has four whirls, umbilicus deep, exhibiting the volutions; aperture subovate; oblique; far within the throat six teeth; color brownish; breadth one-fourth of an inch. Abundant.

SUBFAMILY ANCYLINÆ.

Resembles in shape the marine *patella*; are fragile and small. We have a species which is about two-sixteenth of an inch in length, which I presume to be *Ancylus tardus,* Say. I found numbers of them associated with a valvata-like *Phrygania,* clinging to stones in Fox River.

ORDER PECTINIBRANCHIATA—FAMILY VALVATIDÆ—GENUS VALVATA, MULLER.

Valvata tricarinata, Say.—Shell has three volutions; three revolving, carinate, prominent lines, giving to the whirls a quadrate appearance; Suture deep; umbilicus large; aperture circular; lip simple, almost surrounding the aperture; shell horn colored, breadth; one-fifth of an inch. Very abundant in ponds and other waters. Easily known by the quadrate appearance of the whirls, its round aperture, etc.

Valvata sincera, Say.—This shell differs from the former species in being smaller, and is without the carinated whirls. Same localities as the preceding species. Not so abundant.

FAMILY VIVIPARIDÆ.

Genus Vivipara, Lam.—Numerous in all our rivers. The animals are sluggish in their habits. They live
on muddy bottoms, or among the vegetation found in our waters. Their food is vegetable, but they have been found feeding on decayed animal matter. Many of the species are viviparous. I have taken *V. cinctectoides* in the fall of the year, with the ovaries full of the young, the shells showing distinctly three of the bands peculiar to this species. The foot of the animal is provided with an opercle which closes the aperture when its owner withdraws into the shell. In the spring they deposit their young in the mud. The shells are turrited.

**Vivipara cinctectoides, W. G. Binney.**

Shell large, globose, has five whirls, which are finely striated, peristome acute and continuous, tinged on the inner margin with a dark line, aperture subcircular, color brownish horn. The body whirl has four reddish bands, the last near the base, whirls very bulging. The beginning of new peristomes is marked by prominent lines or ridges. Loc. Illinois River.

Vivipara subpurpurea, Say.—Shell oblong, whirls five, wrinkled, apex obtuse, suture impressed, color greenish with a purplish tinge, spire lengthened, shell has three reddish bands, length three-fourths of an inch. Found in the Illinois river.

This species may be distinguished from any other by the unusual expansion of the last whirl, and the reddish bands, prominent in some specimens, but obscure in others.

Genus Melantho, Bowditch.—Melantho decisus, Say.—Shell elongated, ovate, whirls six, peristome acute, lines of growth plain, apex missing in full grown specimens, color green, aperture oval, oblique, bluish within, length one and one-fourth inches. Quite abundant in Fox and Illinois rivers, also in the Vermillion river.
We sometimes find a shell corresponding to *Palu-dina heterostropha*, Kirtland. The shell is sinistral, has five whirls, suture is distinct, color green, length three-fourths of an inch. Loc. Fox river. The shell has been referred by authors to various species as only a reversed variety, and I am inclined to so consider it.

Melantho subsolidus, Anthony.—Shell ovate, thick, whirls six, suture distinct, aperture ovate, spire elevated, apex entire, color green, length one and one-half inches. Abundant.

One of our most abundant species; considered by some a synonym of *M. decisus*. Very variable in its characters.

**GENUS LIOPLAX, TROSCHEL.**

Lioplax subcarinata, Say.—Shell has six carinated whirls, wrinkled, suture impressed, aperture oval, color greenish, length three-fourths of an inch. Loc. Illinois river.

Say's description of this species was of a dwarfed specimen and represents it as having but three whirls. We have *M. coarctata*, Lea, and *M. rufus*, Halde, specimens not abundant. There remains much work to be done before the true position of some species is determined.

**FAMILY RISSOIDÆ—SUBFAMILY HYDROBINÆ—GENUS AMNICOLA, G. & H.**

Amnicola porata, Say.—Shell obtuse, conic, volutions four, wrinkled, spire obtuse, labrum and labium equally rounded, umbilicus distinct, shell rather short, horn color. Very abundant in the Fox and Illinois rivers, clinging to stones, roots, etc.
SUBFAMILY POMATIOPSINÆ — GENUS POMATIOPSIS, TRXON.

Pomatiopsis lapidaria, Say.—Shell turrited, thin, smooth, volutions six, suture impressed, aperture longitudinally ovate—orbicular, operculated, rather more than one-third the length of the shell, color brown, length one-fifth of an inch. Abundant.

This species is longer than A. porata. I follow Binney in placing it in the genus Pomatiopsis. The animals are amphibious, and may be found near our rivers in moist places. They possess the power of crawling on the surface of the water in a reversed position, shell downward.

FAMILY STREPOMATIDÆ, HALDE.

This family presents in its numbers and diversified forms one of the most interesting studies in the whole range of American Conchology. There are nearly five hundred recognized species of Strepomatidæ from North America; the larger part from Southern waters, only a few being found in the Ohio river and its northern tributaries, and these are small compared with those from Tennessee and Alabama. In the East, the St. Lawrence river and its branches form the northern limit of the family; and in the West, the northern boundary of the United States, beyond which, I believe, none have been found. The Ohio river seems to form a dividing line also, both northern and southern species fading out as they approach this stream. They are not found in New England, nor in the vicinity of the Ocean. The distribution of species and the characters of the shells of the north find a parallel in marine mollusks, and leave no doubt as to species being specially adapted to the station they occupy in the first creation, though
they may be subsequently modified by change of the conditions. The family was formerly called Melaniæns from their supposed affinity to Oriental forms, but our species have a plain or entire margin to their mantle. The Oriental species have a fringed mantle. The soft parts have not, as yet, been much studied in this country, and species, genera, etc., are based upon the characters of the shell. We have four species, three of them abundant in our rivers.

GENUS PLEUROCERA, RAFINESQUE.—PLEUROCERA
SUBLUARE, LEA—(TRYPANOSTOMA.)

The following description is from American Journal of Conchology, Vol. 1: "Acutely turrited, rather thin, spire much elevated, apex acute, whirls twelve, flat, carinate at apex, body whole, angulate on the periphery. Horn color, generally light yellow and bluish ash below the suture."

In some specimens from one locality the whirls are rounded, have from one to two bands, and are of a dark horn color. From another, the whirls are eleven, the color very light, resembling *P. pallidum*, Lea. I refer to mature shells. In the young the differences are not so marked.

Pleurocera lewisi, Lea.—Sulcate, somewhat thin, conical, elevated, spire much elevated, with indistinct suture, whirls eleven, flattened, covered with sulcations, of which there are four to five on the body, which is angulate on the periphery. Horn color or dark brown, banded or without bands, white or purple within.

This species is found in the same localities as the preceding one. *P. Lewisii* is a much broader shell at the base, more pyramidal in shape, has sulcations, and is of more solid texture than *P. Subulare*. Of the
soft parts of the two I cannot speak as yet. These species are now sometimes called Trypanostoma, a Genus instituted by Dr. Lea to take the place of Pleuroceras, Raf. The latter having priority must stand.

GENUS GONIOBASIS, LEA.

Goniobasis livescens, Menke. — Ovate oblong, smooth, moderately thick, spire short, conically acute, suture slightly impressed, whirls five to six, rather flat, the last large, aperture large, elliptical. Horn color, purple within. Length one-half inch, abundant.

Goniobasis depygis, Say.—Oblong, conic ovate, whirls five, the last elliptical. Suture well impressed, aperture narrow ovate, acute above, color yellowish, two rufous bands on the whirls, shorter than G. livescens. Fox and Illinois rivers.

Of more than two hundred and fifty species of Goniobasis found in American waters, the two just described are all inhabiting this county. The latter species is not so abundant here as the former. All our Streptomalidae are very hardy, living sometime after being removed from the water, as I have had occasion to notice, and differing in this respect from the Viviparidae. They are evidently suited to our northern climate.

Note.—Valvata—— We find by thousands in the Fox and Illinois rivers, fixed to stones, etc., the larva case of an insect—Phrygania. The case is built of grains of sand, cemented together in the shape of a valvata, for which it has been mistaken.

CONCHIFERA — FAMILY CYCLADIDÆ, WOODWARD—GENUS SPHAERIUM, SCOPOLI,

Sphaerium simile, Say—(S. sulcatum, Lam.) Shell oval, truncated at the extremities in young, and
rounded in adult specimens, convex sub-equipartite, beaks slightly elevated, surface with conspicuous concentric wrinkles, epidermis brown or chestnut color. About seven-tenths of an inch long, height one-half inch, breadth two-fifths of an inch.

Abundant in Illinois river. Shells bluish within. The young shells are of a lighter color, thinner, and show the wrinkles at all ages; lines of growth prominent. Animal with simple mantle; foot tongue-shaped.

*S. sulcatum*, Lam., is the same shell.

*Sphaerium partumeium*, Say. — Shell rounded, oval, sub-equipartite, lowest anteriorly, somewhat angular behind, thin and fragile, valves very convex, minutely wrinkled by lines of growth, and obsoletely radiated, light horn color, beaks elevated. Length nine-twentieths of an inch. Abundant.

*Sphaerium occidentale*, Nam.—Shell small, oval, thin, fragile, striae fine, beaks small and rounded, color light yellow, beaks not prominent. Length one-third of an inch. Not so abundant as the preceding species.

**GENUS PISIDIUM, Pr’R.**

*Pisidium abditum*, Prime.—Shell small, rounded, oval, beak raised slightly, surface smooth, striae fine, color chestnut, beaks near the posterior side. Length three-twentieths of an inch, breadth one-tenth of an inch.

This widely distributed species is abundant, but from its small size seldom noticed. Found in mud in rivers.

*Pisidium compressum*, Prime—Shell solid, trigonal, very oblique, drawn up near the beaks which are placed posteriorly, striae distinct, epidermis chestnut. Size about the same as *P. abditum*. Abundant in swales and Illinois river.
Varies in shape, but its obliquity is constant. Its peculiarity is the apex of the beaks, which assume the appearance of wings placed on the summit of the umbones. The animal is active. Other species of this family are reported from Illinois, but I am unable to report more from this county. *Sph. striatinum*, Lam., if a distinct species should be included, as we have the shell. The *Sphaeriums* are sometimes mistaken by local observers for young *Uniones*.

The *Uniones* or *Naiades* are a genus of fresh water mollusks found in most rivers and lakes, and common to the streams of both warm and cold climates. It is a very extensive genus, containing more than 1,200 admittedly distinct species, and some of these furnishing several varieties. The shells are generally white, buff, brown, black, green, yellowish green, or variegated with these colors; they are smooth, warty or spinous, and while some are very thick and heavy, others are thin and fragile. They also differ greatly in size, some when full grown attaining a length of eight to ten inches, others not more than two and a half to three inches. The shells are smooth inside, and vary in color from pearly white through bluish white to salmon and purple.

The *Unio* belongs to the class acephala or headless mollusks, that is these animals have no well defined head, order Lamillibranchiata, having gills made up of several thin layers or *lamella*. They are called bivalves because the shell is composed of two pieces or valves united by an elastic gristle and teeth usually two on one valve, and one on the other, which interlock and are usually thick and short. One end of the shell is larger than the other, and this is called the anterior or forward end, the other the posterior or hind end.
Shell is larger than the other, and this is called the anterior or forward end, the other the posterior. The back is generally broad and somewhat swollen or inflated toward the anterior end, forming a raised space on either side, which in some cases projects back and outward beyond the line of the hinge so as to appear like horns. These are called umbones and are sometimes curved forward. Around these the shell seems to be built up in nearly concentric layers.

The shell is closed by two powerful short muscles, one near each end, by contracting which the valves are drawn together, and when they are relaxed the valves spring apart. The animal breathes by means of gills and extracts its food from water which it draws in at the anterior end through two tubes called siphons and expels at the opposite extremity. They move along the bottom of the stream or pond by expelling water with great force from their siphons. They can also extend the thick, fleshy foot, and attaching it to a stick or stone pull themselves up to it, and thus move slowly along the bottom, wherever there is anything of which they can get hold. The flesh is hard, tough, rather tasteless, and the longer they are cooked the harder and tougher they become. Some people, however, eat them. Raccoons and muskrats are fond of them, and chickens greedily devour them when divested of their shells.

These creatures, dull, senseless, helpless, as they appear to be to us, are, nevertheless, able to repair their shells when broken, and to coat the insides of them with a smooth layer of pearly nacre, if by any means they become rough. They prefer muddy bottoms, but are frequently found on sand, where the water is charged with much decayed vegetable matter.
We follow Lea in his division according to form and surface of shell.

1. Winged, the upper edge of shell extended back into a kind of wing, triangular, smooth.
   U. alatus. Three and a half to four inches long, width the same, brown without, thin, flat, white or purple within, muddy bottom.
   U. gracilis. Four to five inches long, width same, light brown, very thin, flattish, bluish white within.

2. Rectangular, longer than wide, surface ribbed or plicate, posterior margin often wrinkled, dark.
   U. plicatus. Five and a half L., four W., shell thick and heavy, with about five strong wrinkles running from the umbones to the posterior margin, dark brown or black.
   U. multiplicatus. Four and a half L., four and a half W., length and width about the same, posterior margin much wrinkled, black or dark.
   U. undulatus. Oblong, with four or five strong undulations running diagonally across the shell, length twice the breadth.

3. Warty or pustulate.
   U. pustulatus. Rectangular, two and a half L., two and a half W., thick, yellowish brown, covered with warts or nodules.
   U. dorfeuillianus. Triangular, in color and size like Pustulatus.
   U. gibbosus.—Heavy, thick, dark brown, bluish within.
   U. capax. Oval, brownish green, 3½ L., 2½ W., thick, inflated, rayed with green.
   U. cariosus. Oval, dull yellowish green, 4 L.,
3W., thicker than Capax, inflated, lines of growth strongly marked, forming concentric ridges.

U. ellipsis. Oblique, greenish, 2½ in dia., heavy.

MARGARITINA scarcely differing from Unio, generally broad and flat, Margaritina complanata. Triangular, with folds, broad, flat.

M. corfragosa.—Squarish, undulations or folds broken, giving it a rough appearance.

M. marginata.—Ovate, thin, 3L., olive green, mottled with broken lines of a darker color, bluish within, becomes thicker with age.

M. rugosa. Oval, roughened by folds.

M. deltoidea. Triangular, smooth, anadenta, shells usually thin and smooth, hinge without teeth. hence name A without and dens tooth.

A. edentula. Oval, smooth, 3L., black, polished within salmon, firm, with several undulations.

A. imbecillis. Oval, thin, bright green, fragile.

A. ovata. Oval, rather broad, flattish.

A. corpulenta. Oval, large, smooth.

U. occidens. Oval, yellowish, green rayed with brighter green, 4½ L., 4W., large ones thick.

U. nova eboraci. Oval, small, flat, yellowish, rayed with green lines running from beaks to margin, 2L., 1W.

U. spatulatus. Oval, 2½ L., greenish rayed with lines of darker green.

U. ligamentinus. Thick, heavy, 3 to 4 L., 2 to 2½ W., brownish, rayed with green, teeth prominent.

U. orbiculatus. Oval, squarish, solid, olive color, with narrow lines radiating from beaks, umbo depressed, within white, tinged with salmon color.

U. lutealus. Oval, flat to inflated, three L., one
and a half to two W., ornamented with green lines and bands radiating obliquely from um-bones, pearly, bluish white within. Abundant.

U. retusus. Oval, beaks curved, strongly retuse, brownish.

U. ebeneus. Oval, thick, black.

U. coccineus. Oval, small.

U. rectus. Long, straight, heavy, six to seven L., polished, black, pink inside.

U. anadontoides. Long, six to eight L., two and a half to three W., milky to creamy white.

U. metanerva. Three L., three W., triangular, greenish yellow, very thick, beak prominent. A sinus or hollow extends from beaks across centre of each valve, surface marked by strong concentric ridges and large, flat topped tubercles, teeth strong, white within.

U. cornutus. Triangular, two L., one and three-fourths W., yellowish green, thick, with about three large tubercules on each valve, white within, surface often striped and dotted with darker green.

U. pustulatus. Oval, three L., two and a half W., reddish brown, covered with small pus-tules.

U. verrucasus. Quadrat (squarish), three L., three W., thick, flattish, tuberculate, bluish purple within.

U. alsapus. Oblique, three and a half L., three W., thick, heavy, dark brown, with a few small projections or tubercules, white within.

U. tuberculatus. Oblique, five to eight L., three to five W., dark brown, covered with small tubercules, posterior margin notched.

U. triangularis. Triangular, smooth, small, marked
with green and black spots, anterior straight.

U. elegano. Triangular, smooth, small, green, with
darker lines and spots.

U. zigzag. Triangular, smooth, small, greenish,
with many darker zigzag lines and blotches.

U. crassidens. Triangular, light green.

U. rubiginasus. Triangular, very smooth, glossy,
two and a half L., two W., dark brown,
beaks prominent, curved forward, thick and
heavy.

U. trigonus. Triangular, smooth, thick.

U. solidus. Triangular, smooth, thick, brown
without, pink within.

U. obliquus. Triangular, smooth.
THE LICHEN—FLORA OF LA SALLE COUNTY.

BY WILLIAM W. CALKINS AND JOHN W. HUETT.

The following list containing thirty genera and 135 species and varieties indicates the richness of our county in that humble class of plants known as Lichens, yet the authors do not claim to have exhausted the field of research. La Salle county with its large area, diversity of soil and geological strata, as well as extensive natural forests, offers inducements and situations peculiarly favorable to the growth of the lower orders of plant life, hence explorers who may follow us will find many other species additional to those here enumerated.

Briefly defined, lichens are a natural order of plants, having neither stem, leaf, root or flower in the usual acceptation of the term, deriving their sustenance from the air, and stimulated or retarded in growth by the conditions of light, heat and moisture; also intermediate between Algae and Fungi, according to some learned scholars. But in the light of present knowledge we must consider them as autonomous, not being in haste to concur in the opposite conclusions of some authorities, however eminent. Neither shall we forget that as regards certain genera and species (ANGIOCAPAI), we approach the border land of FUNGI—as, for instance, SPÆR1A! While enquiry
in this direction would be interesting, the present purpose, which is mainly their classification, will be best subserved by omitting the discussion.

WHERE AND HOW THEY GROW.

Lichens will be found almost everywhere, even on the bare prairie, on boulders often. The native woods, earth and rocks, pebbles and old orchards are their favorite home, while certain species are peculiar to certain substrata and localities.

The principal parts of the plant exposed—the Thallus and Apothecium, will first attract notice on trees, old fences, etc., and are popularly called by the plain citizen—not versed in botany—Mosses! A good exhibition may be observed on the Deer Park road in the ravine on the Hogaboom place, where some oak, walnut and hickory trees and the old fence contain a number of species. One, of a bright yellow color (THELOSCHISTES), is prominent. These foliaceous kinds are attached to the substrate by fibrils of the thallus. While a vast number of species grow on trees and shrubs may inhabit only rocks, stones and the earth. A few species by means of the acids of the thallus bore into the hardest rocks, and becoming imbedded in it, show on the surface as pits of the size of a pin head or smaller. Lichens avoid cities, the smoke and gas being fatal to them. On the St. Peters sandstone at Starved Rock and along the cliffs for miles, in the ravines and on the trees many fine species can be found, among them the Reindeer moss (CLADONIA). Localities like the preceding afford the best collecting grounds, but no place should be neglected, for what suits one species may not be adapted to another. The searcher cannot go amiss, and can often spend hours within a small area. The same rules for collecting
and preserving other plants apply to these also, but the rock-borers must be taken with a piece of the rock attached, which can be accomplished with a cold chisel and hammer.

**SOME OF THE DIVISIONS AND ORGANS OF LICHENS.**

Without going into an exhaustive discussion of these—a subject for advanced students and specialists—we will only mention some prominent features. As now understood in the United States, and as elucidated by Prof. Tuckerman, the father of the science here, our lichens fall into two series—the open and closed—fruit series, known as GYMNOCARPI and ANGIOCARPI. Then, we have a division into five tribes, all represented in La Salle county. Next come families, genera and species, but the convenience or fancy of authors has again subdivided many of the genera and species, and often without reason, which has added much to the synonymy as well as to the bewilderment of succeeding authors and students. Europeans are especially noted for this, but it is easy to see how far an honest enthusiasm will carry one in the study of nature's wonderful works.

Of late new views have been announced as to the origin and relations of lichens to other orders of plants which may upset long cherished theories of some eminent Europeans and of our own Tuckerman. But science will be the gainer by whatever controversies have or may occur, whoever is hurt, and it is with some satisfaction that we mention here the name of Dr. Albert Schneider, a son of Illinois, native of Granville, Putnam county, as one not likely to be daunted by the shadows of great names in the assertion of his views.
THE THALLUS AND APOTHECIUM.

These were the only parts studied in the infancy of the science. They contain many organs—such as regards the former a cortical layer of cellules; a goni-dial layer of green cells, and below filaments (hyphae), then the hypothallus or fibrils. But as in Collema, the thallus may be wanting, or partly absent or scanty. The apothecium on examination will be found to contain gonidia and the hymenicum which bears the thekes, within which are the spores. There are also other organs of various names and relations. The different uses of these in the economy of the plant have been the cause of speculations without number. The microscope has played an important part in their study, and on the discoveries thus made have been built up the systems of authors, beginning with Townenfort about 1600, who first separated them from the true mosses. From time to time, real or fancied, improvements have been made by a number of eminent men. Among them should be mentioned for Europe Acharius, Elias Fries, Nylander. The latter has the largest knowledge of world lichens of any man now living, and may be said to be the first of lichenologists in eminence. As to classification it will be long before any system will be promulgated meeting general favor by all.

THE ECONOMIC USES OF LICHENS.

These are many, and first impress the practical man who cares nothing for their scientific value. The Iceland and Reindeer moss are best known and largely used by whole populations in Europe. The hardy Laplanders are dependent upon the latter, especially for food for their animals; also spirits are made from this Cladonia. Sticta pulmonaria was a specific
for lung troubles. In Africa another lichen, Lecanora esculenta, which grows on arid, sandy plains, is an article of food for man and beast. The Arctic travelers have often owed their lives to the rock lichen (Umbilicaria). In Japan are Endocarpon, and the same may be found on rocks at Covell creek and elsewhere, is an article of diet. Prior to the advance in chemistry thousands in Europe obtained a livelihood by collecting certain lichens for coloring dyes. Lecanora tartarea (also found in the United States) was one of these. There are several in our county, as Parmelia, containing valuable dyes, but enough has been shown to prove the usefulness of even the lowly lichen, and the greatness and goodness of their Creator.

SERIES I. GYMNOCARPI.

TRIBE I. PARMELIACEI. USNEEI.

RAMALINA. (Ach.) De Not. Thallus fruticulose, or pendulous, subcompressed, pale-greenish; apothecia scattered, or marginal, scutellæform. Spores colorless, bilocular.


R. calicaris, Fr., var. fastigiata, Fr. Lobes short, often straw-colored, crowded, branched, apothecia terminal, subfastigiate. This is the most abundant species of the genus. Occurs throughout the county on oak and hickory trees.
USNEA, (Ach.) Thallus erect or pendulous, gray-green, filamentous. Apothecia rounded, subterminal, disk open, margin ciliate. Of universal distribution in some form.

U. barbata, (L.) Fr. Occasional on trees and stones in deep woods.

U. barbata, (L.) Fr. var. florida, Fr. Thallus tufted, apothecia large, pale. Infertile often. On trees and shrubs. Deer Park, etc.

U. barbata, (L.) Fr. var. livita, Fr. On trees—Abundant.

CETRARIA, (Ach.) Fr., Mull. Thallus ascendant with compressed, turgid, or channelled branches; or may be expanded and foliaceous-membranaceous, brown, yellowish, or glaucescent; apothecia marginal or submarginal, scutelaeform, often dilate. Spores sub ellipsoid.

C. ciliaris, (Ach.) Thallus membranaceous, foliaceous, sinuate-laciniate, greenish or brownish; brownish beneath, fibrillose, lobes crowded often narrowed and cleft, lacunose, apothecia marginal, ample; disk chestnut, margin crenulate. Spores subellipsoid. On old logs and rails in various localities.


PARMELIEI.

THELOSCHISTES, Norm. (Physcia, Nyl.) Thallus foliaceous or reduced, appressed or ascendant; membranaceous, orange or yellowish, apothecia scutelaeform; disk yellow, orange or greenish-yellow. Spores ellipsoid, polar bilocular or simple.
T. concolor, (Dickson) Tuckerm. Thallus folioaceous, orbicular, greenish-yellow; divisions narrow, much dissected, beneath pale, fibrillose; apothecia small, yellow or rufous. Spores numerous. Physcia candelaria, Nyl., etc. Occasional on hickory, etc.

PARMELIA, (Ach.) De Not. Thallus imbricate—foliaceous, lobate or laciniate, appressed, membranaceous, more or less fibrillose, sometimes densely so, apothecia scutellæform, slightly pedicellate. Spores ellipsoid.

P. perlata, (L.) Ach. Thallus greenish-glaucous, or whitish; dilated, lobes rounded, often sorediate, undulate, black beneath, with brown margins; apothecia small to large, rufous, entire. Ach. L. U. 459, etc. Found throughout our county on oaks and other trees, and on boulders.

P. perforata, (Jacq.) Ach. Thallus whitish, much dilated; coriaceous, membranaceous, glaucouscent, smooth, sinuate lobed; beneath black or fuscous; fibrillose, apothecia very large, perforate, cyathiform, disk fuscous or rufous. Spores ellipsoid. Common on trees.

P. crinita, Ach. Thallus dilated; membranaceous, surface covered with minute granules and branchlets; black beneath and fibrillose, lobes ciliate; apothecia ample, cyathiform, disk chestnut. Fr., L. E., 58. On various trees.


P. tilliacea, (Hoffm) Fl. Thallus smooth, closely
adnate, much narrowed, membranaceous, margins crenate, lobes rounded, sinuate-laciniate, apothecia medium size, few, margins crenululate. Fr. L. E. 59, etc. Common on trees everywhere.

P. tiliacea, Fl., var. sulphurosa, Tuck. Medullary layer sulphur yellow, otherwise like the species. Deer Park. Rare.

P. borreri, Turner. Thallus cinereous, glaucescent, lobes large or narrow, rugulose, beset with round soredia, membranaceous, pale brown beneath, fibrillose, dense, apothecia large, badio-rufous, margin entire. Spores rounded. Turner. Linn. Tr. 148. Very common everywhere in our county, especially on oaks.


P. saxatilis, L., Fr. Thallus glaucous-cinerascent, membranaceous, more or less lacunose, ramose, isidiophorous, beneath black and densely fibrillose, lobes sinuate multifid, incised, apothecia large, disk fuscous, or spadiceous, margin sub-crenulate. Spores ellipsoid. Fr. L. E. 61. Very common west of Ottawa on trees and sandstones.

P. saxatilis, Fr., var. sulcata, Nyl. On bluff boulders and stones, and along Illinois river, below Ottawa.

P. physodes, L., Ach. Thallus loosely attached, substellate, whitish, coriaceous, glaucous, beneath fuscous-black, no fibrils, lobes many cleft, complicate, often with white soredia, apothecia

P. caperata, L., Ach. Thallus substramineous, dilated, coriaceous, undulate- plicate, often sore- diate, beneath black, fibrillose, lobes sinuately- laciniate, rounded tips, apothecia large, chest- nut, margin subcrenulate, often sorediate. Ach. S. L. 196, etc. Very common on oaks every- where, Deer Park, etc.

P. conspersa, Ehrh., Ach. Thallus straw-colored, greenish, laciniate, much divided, appressed, often isidiophorous in the centre, beneath fus- cous-black, sparingly nigro-fibrillose, lobes sinu- ate, often crenate, or pinnatified, complicate, apothecia large, chestnut, margin subcrenulate. Spores ellipsoid, simple. On boulders, trees, etc.

PHYSCIA, D. C., Fr., Th. Fr. Thallus foliaceous, variously divided, stellate, somewhat fibrillose, apothecia scutellæform. Spores ellipsoid, biloc- ular.

P. speciosa, Wulf., Nyl. Thallus greenish, glau- cous, loosely stellate, appressed, beneath corti- cate, rhizinae whitish, lobes sinuate. flat, pin- natifid. with powdery margins, apothecia me- dium size, sessile, margin crenulate, disk fus- cous. Spores bilocular. Parmelia speciosa, Ach. On various trees; Deer Park, Indian Creek, etc.

P. stellaris, L., Nyl. Thallus albo-glaucescent, stellate, appressed, orbicular, beneath pale, fibrillose, lobes linear, many-cleft, compaginate, or discrete; apothecia small, sessile, disk fus- cous-black, often grey-pruinose, margin entire or crenulate. Parmelia, Fr. L. E., 82. This,
the most common species of the genus, occurs everywhere on oaks, hickories and other trees.


P. obscura, Ehrh., Nyl. Thallus stellate, orbicular, appressed, epruinose, glaucous, fuscescent, beneath black, fibrillose, lobes many-cleft, flattish, ciliate, apothecia rather small, disk nigro-fuscos, margin entire. Spores bilocular. On trees, basswood, etc., and on mossy rocks, Bailey’s Falls. Variable.


PELTIGEREL.

STICTA, Screb., Fr. Thallus frondose-foliaceous, villous beneath, marked with cyphels or bare spots, apothecia submarginal, scutellaeform.

S. quercizans, Mx., Ach. On oak, Deer Park. Rare as yet. Infantile.

S. pulmonaria. Is probably found within our limits.

P. adglutinata, L., Nyl. Thallus often slightly olivaceous, also cinerascent and brown, adheres closely to substrate, small, lobes thin, flat, compaginate, apothecia small. disk nigro-fuscous, margin entire. On hickory. Deer Park.
PELTIGERA, Willd., Hoffm., Fee. Thallus membranaceous, lobate, frondose, foliaceous, beneath somewhat villous, marked with veins, occasionally cyphels, apothecia peltæform. Spores fusiform. Cortical layer; in some species consisting of gonidia, in others of gonimia.

P. rufescens, Neck, Hoffm. Thallus large, coriaceous, rotund, lobate, lobes elevated and crisp, ash colored to reddish brown, beneath reticulated with brown veins, fibrillose, apothecia on lobules, large, disk revolute, rufo fuscous. Spores acicular. Common on earth in many localities, in woods along streams.

P. polydactyla, Neck, Hoffm. Lobes elongated, clustered, thin, greenish or lead-colored. At Bailey’s Falls on rocks.

P. canina, L., Hoffm. Thallus large, round-lobed, cinerascent or brownish, apothecia roundish, disk reddish, brown. On rocks.

PANNARIEI.

HEPPIA, Naeg. Thallus squamose-foliaceous, monophyllous, Gonimous layer of gonimia, apothecia round, immersed. Spores ovoid.


PANNARIA, Delis. Thallus squamulose, subfoliaceous or monophyllous, the hypothallus spongy or obsolete, apothecia scutellæform, with both thalline and proper margins, frequently biatorine. Gonimous layer of both gonidia and gonimia.
P. nigra, Huds., Nyl. Thallus squamulose, minute, lead-colored, and mostly merged into a granuloid crust, apothecia small, biatorine, sessile, disk black, margin entire. On calcareous rocks at the old Lowell Mill, Bailey's Falls and elsewhere.

P. lanuginosa, Ach., Kœrb. Thallus whitish, powdery, apothecia seldom developed. Covell Creek, etc., on shaded rocks.

**COLLEMEI.**

**PYRENOPSIS, Nyl.** Thallus coralloid, apothecia globose, depressed. On rocks.

P. schærreri, Moss, Nyl. Apothecia small, disk reddish. On black slate and calcareous rock. Clark's Ravine, Baldwin Farm, Deer Park. Rare and fine.

**OMPHALARIA, Dur. & Mont.** Thallus foliaceous, attached to substrate at one point, apothecia immersed. Synalissa, Fr.


**COLLEMA, Hoffm., Fr.** Thallus greenish, cortical layer obsolete, gonimia in chains, apothecia very small to middle size, scutellæform. Spores variously shaped.


C. flaccidum, Ach. Thallus dark green, or olive-green, lobes large, expanded, bullate, entire, with concolorous granules, undulate plicate, paler beneath, apothecia small, sessile, disk rufescent, margin entire. Spores ovoid. On elm and calcareous rocks, Vermillion river.

C. tenax, Sw., Ach. Thallus thin, lobes wide, appressed, also ascendant. lead-colored, apothecia often immersed, disk rufescent, the margin entire or robose. Var. c. of C. pulposum. On limestone, Vermillion river.

C. limosum, Ach. Thallus thin, dark green, scattered, slightly crenate, pulpy when wet, apothecia rufous, immersed but becoming superficial, margin prominent, entire or somewhat crenulate. Spores in fours in the thekes. Inhabits clay soil. Rare.

C. granosum, Wulf., Schärer. Thallus small, rigid, gelatinous when wet, lead-colored, lobes ample, rounded or elongated and divided, apothecia of medium size, sessile, disk reddish, dark. C. dermatinum, Ach. L. U., 64. On Trenton rock, Covell Creek.


LEPTOGIUM, Fr., Nyl. Thallus foliaceous, or fru-
ticulose, cortical layer distinct, gonimia in chains, apothecia sub-scutellæform, lecanorine or sub-biatorine. Spores of various forms.

L. lacerum, Sw., Nyl. Thallus plumbeo-fuscescent, lacero-laciniate, ample, wrinkled, the lobes dilated above and sinuate, thin, crisped and dentate, apothecia small, pale red, sub-sessile, margin entire. Spores avoid-ellipsoid. Ach. L. U., 657. On elms and rocks, Deer Park timber,

L. chloromelum, Sw., Nyl. Thallus small to large, orbiculate, rigid, plumbeo-virescent, lobate, plicate, rugose, apothecia medium size, lecanorine, plane, rufous, the thalline margin granulate. Spores ovoid. Nyl. Syn., 128. On ash and elm and rocks.

L. myochroum, Ehrh. Schärer, Tuckerm. Thallus ample, coriaceous, membranaceous, sub-monophyllous, also loosely attached, lead colored and blackish, beneath has a whitish nap, apothecia reddish, border plicate. Spores ellipsoid. Tuck. 99. On calcareous rocks on the Big Vermillion, also on trees.

L. pulchellum, Ach., Nyl. Thallus small to large, rosulate, glaucous green, lobes plicate, papulose, wrinkled above and beneath and pitted, apothecia medium size, lecanorine, sub-pedicellate, disk fusco-rufous, finally excluding the smooth or finally rugose thalline margin. Spores ovoid-ellipsoid, sub-muriform, decolorate. Collema, Ach.

LECANORei.

PLACODIUM, D. C., Næg. & Hepp. Thallus crustaceous, lobed, suffruticulose, or uniform, apo-
thecia sub-scutellaeform, lecanorine or sub-bia-
torine, disk usually yellow or orange. Spores
ellipsoid, polar-bilocular, colorless.

P. cinnabarinum, Ach., Anzi. Thallus rimose-
areolate, more often of planatane scales, cre-
nate, and crowded into an imbricate crust,
orange, apothecia minute or small, adnate, disk
orange, margin entire. Spores ellipsoid. Le-
canora, Ach., L. U. 402. Parmelia, Fr. L. E.
165. Very common on calcareous and arenace-
ous rocks. Lowell mill dam raec.

P. microphyllum, Tuckerm. Thallus squamulose,
from greenish yellow to orange, scales adnate,
crowded and concealed by granules, apothecia
small, adnate, flat, orange, proper margin entire,
the thalline one crenulate. Spores ellipsoid.
Tuck. Syn. 174. On old fence panels and
rails on Deer Park road, also elsewhere.

P. aurantiacum, Light., Næg. & Hepp. Thallus
uneven and chinky, warded, broken; yellow or
variously colored, often bordered by a dark
hypothallus, apothecia fair size, sessile, zeorine,
flat, disk lemon, saffron or tawny colored, proper
margin thin, the thalline one crenulate, or may
be obsolete. Parmelia, Fr. L. E. 165. Lecanora,

P. ferrugineum, Huds., Hepp. Thallus chinky,
verruculose, ash-colored, upon a black hypothal-
lus, apothecia fair size, mostly biatorine, sessile,
flattish, disk opaque, rust colored, or fulvous,
bordered by a crisp proper margin, often en-
closed in a thalline one. Parmelia, Fr. L. E.
170. Caloplaca, Th. Fr. Scand. 182. On oaks,
Deer Park.

P. vitellinum, Ehrh. Thallus effuse, tartareous,

LECANORA, Ach., Tuckerm. Thallus crustaceous, mostly uniform, apothecia scutellæform, or zeorine. Spores ellipsoid, or oblong.

L. pallida, Schreb., Schærer. Thallus thin, membranaceous, smooth, cream-colored or darker, apothecia sessile, tumid, whitish buff, white pruinose, the entire margin disappearing. Spores ellipsoid. Parmelia, Schær. Spicil. 396. On oaks and hickories.

L. subfuscusca, L., Ach. Thallus whitish or cinerascant, smooth, rimulose, granulate, verrucose, soon diffract, apothecia plano-convex, disk fuscos, becoming black, often pruinose, the thalline margin entire, flexuous or crenate. Spores ellipsoid. Parmelia, Schær. Spicil. 389, etc. Very common in our territory on oaks and other trees and also on arenaceous rocks. There are several varieties.


L. hageni, Ach. Thallus cinerascen, verruculose or wanting, apothecia small or minute, crowded,
plane or tumid, pale to fusco-rufous or sometimes pruinose, margin white, commonly crenate or entire, may be excluded. Th. Fr. Scand. 250. L. umbrina, Massalong'o, Nyl. On rails and calcareous rocks.

L. varia, Ehrh. Nyl. Thallus verruculose, greenish or yellowish, apothecia small, the disk yellow to flesh-color or rufescent, thin, margin entire or crenulate, often excluded. Spores oblong-ellipsoid. Nyl. Scand. 163. On various trees.


L. calcarea, Sommerf. var. contorta, Fr. Areoles, discrete, pale lead color. L. calcarea, f. Hoffmani, Nyl. On calcareous rocks at Bailey’s Falls, etc. A very curious form.

L. cervina, Pers., Nyl. Thallus tartaceous, areolate, squamulose, scales sub-peltate, from yellowish to chestnut, apothecia medium size, impressed, becoming superficial, disk reddish brown, thalline margin obsolete. On Trenton rocks at Eton’s mill and elsewhere.

sandstone at various points.


L. erysibe, Ach. Thallus cinerous, thin, diffract, apothecia fusco-rufous, plane or convex. On calcareous rocks at Eton's and elsewhere.

PERTUSARIA, D. C. Thallus crustaceous, continuous, smooth or verrucose, apothecia globular, difform, closed, enclosed in thalline verrucæ, opening by pores (ostioles), explanate, lecanoroid. Spores generally large, ellipsoid.

P. velata, Turn., Nyl. Thallus white, glaucescent, rugose, chinky, rimose, radiate near the circumference, apothecia small, adnate, pale yellowish, white powdery, the thalline margin disappearing in the fruit. On rocks and trees.

P. communis, D. C. Thallus glaucescent, smooth, chinky or rugose-verrucose, may become zonate at the circumference, apothecia small, adnate, depressed, sub-globose, difform, closed, the numerous ostioles sunken and black. Spores generally in twos, sometimes solitary. Porina

pertusa, L., Ach. Common on oaks everywhere.


P. pustulata, Ach., Nyl. Thallus greenish or whitish, chinky, or verruculose, apothecia very small, hemispherical and diffusum, globular or confluent, ostioles black. Spores in twos. Porina, Ach. L. U. 309. On trees, general in distribution.


URCEOLARIA, Ach.. Flotow. Thallus crustaceous, uniform, apothecia urceolate. Spores ovoid-ellipsoid, muriform, plurilocular, fuscescent.

U. scruposa, L., Nyl. Thallus tartaceous, rugoseplicate, glaucous, ash-colored or white, apothecia immersed, but emerging, urceolate, large, black, disk somewhat cinereous, margin denticulate, hidden by the thalline one, if present. Nyl. Scand. 176. Found on dead cedars along the banks of the Illinois, below Ottawa.
TRIBE II. LECIDEACEI - CLADONIEI.

CLADONIA, Hoffman. Thallus squamulose, rarely granulose or deficient, apothecia variously colored, but never black, soon inflated and cephaloid, podetia fistulous, funnel or tubulose in shape, often shrub-like. Spores small.


C. fimbriata, L., Fr. Thallus squamulose, but reduced, the podetia elongated, often white-powdery, cups with erect margins, apothecia brown. Fr. L. E. 222. Found on rotten logs and earth in woods.

C. fimbriata, L., Fr., var. tubæformis, Fr. Podetia slender, elongated, tawny-brown, often with squamules, cups smaller, toothed or entire, proliferous, fimbriate, apothecia confluent. On logs and mossy rocks, Bailey’s Falls.

C. gracilis, L., Nyl., var. verticillata, Fr. Cups pro-
lierous from the centre, dilated. On earth.

C. squamosa, Hoffman. Thallus much divided,
podetia much branched, apothecia cymose, fusc-
cous. On earth and rotten logs.

C. delicata, Ehrh., Fr. Thallus reduced, more
often of crowded white granules, podetia short,
on old stumps. Very closely related to
C. squamosa, Hoffm.

C. furcata, Huds., Fr. Thallus squamulose, but
small, podetia fruticulose, elongated, corticate,
brownish green, fertile summits corymbose,
pervious, apothecia brown. Fr. L. E. 229. On
calcareous soil, Deer Park.

C. rangiferina, L., Hoffm., var. sylvatica, L. Hor-
izontal thallus wanting, the podetia two to four
inches high, cinerascent, erect, branched and
imbricate, terminal ones divaricated, corymbose.
A more delicate form than the species. On
sandstones, Starved Rock and elsewhere.

C. cristatella, Tuck. Thallus squamulose, minute,
cut and crenate, podetia fair size, often elon-
gated, cylindrical, corticate, smooth or wrinkled,
summits fastigiate, apothecia scarlet. Found
occasionally on old decaying logs and stumps,
Vermillion timber.

C. macilenta, Ehrh., Hoffm. Thallus squamulose,
minute, crenate, lobate, podetia cylindrical,
slender, granulose-pulverulent above, apothecia
terminal, confluent, scarlet. Fr. L. E., 247.
On earth and logs in woods.

C. Floerkeana, Fr. Apothecia scarlet. On old
logs, Deer Park.


MYRIANGIUM, Mont. and Berk. Thallus cellulose, orbiculate, plicate-striate at the circumference, nodulose, apothecia lecanoroid. Spores oblong-ovoid.


LECIDEI.

BIATORA, Fr. Thallus various or deficient, apothecia diverse in color, becoming soft and swollen when wet. Spores ellipsoid and simple, or assuming different forms, colorless, numerous.


B. varians, Ach. Thallus of minute granules compacted into a yellowish or greenish crust,
which is granulate or broken, apothecia very small. yellowish, rufous or blackish, disk flat, margin thin. B. exigua, Chaub. Fr. L. E. 278. On oaks and hickories.

B. rubella, Ehrh., Rabenh. Thallus yellowish or grayish green, effuse, confluent, apothecia luteorufescent, or reddish brown, scattered or congestate, becoming tumid and margin excluded, the latter often whitish. Spores pluri-locular. Lecidea, Schær. Spicil. 168. Bacidia, Th. Fr. Scand. 344. On basswood and elm along rivers.


B. suffusa, Fr. Thallus the same as in No. 91. Apothecia ample, reddish brown, suffused partially or wholly with white, disk rufescent, becoming darker, turgescent, excluding the margin, suffused with white. Tuck. Gen. Lich. 166. On elm and other trees.

B. inundata, Fr. Thallus scurfy, greenish, rimose-areolate, apothecia minute, sessile or adnate, flat or convex, tumid-brownish, black, often excluding the margin, hypothecium pale. Spores slender. Secoliga, Stizenb. Bacidia, Koeb. On rocks and pebbles, also on old mortar.


B. uliginosa, Schrad., Fr. Apothecia small to minute, rufous-brown to black, aggregated, thallus effuse. On dead wood and earth, Deer Park.

LECIDEA, Ach., Fr. Tuckerm. Thallus various, crustaceous, squamulose or evanescent, apothecia patellæform, horny. Spores colorless. Fr. L.E.

L. enteroleuca, Fr. Thallus granulose and cinerascence, often wanting, apothecia small to large, adnate, convex, often excluding margin, black. Spores ovoid-ellipsoid. This species has many forms and has been described under various names. Some of them occur on rocks and mosses, others on trees. It is found on maples.


BUELLIA, De Not., Tuckerm. Thallus mostly uniform, apothecia patellæform. Spores ellipsoid, brown or decolorate.


B. schæreri, De Not. Thallus granulose, often wanting, cinerascence, apothecia very small, black, flat, disk turgescence and margin wanting. Lecidea nigritula, Nyl. Scand. 238. Found on an old stump, also on old rails; not common. Is also found in Grundy County.

TRIBE III. GRAPHIDACEI—OPEGRAPHEI.

OPEGRAPHA, Humb., Ach. Nyl. Thallus hypophlavæous, or, if exposed, thin. apothecia normally lirellæform.
O. atra, Pers., Nyl. Thallus thin or wanting, apothecia sessile, black, simple, flexuose, disk open, canaliculate, proper margin thick, elevated wavy. Throughout our territory on oaks, hickories, cherries, etc.

O. varia, Pers., Fr. Thallus white, pulverulent, apothecia prominent, elongate, oblong, elliptical, attenuate at the ends, brownish-black, dilated in the centre, margin inflexed. On various trees.

GRAPHIS, Ach., Nyl. Thallus crustaceous, uniform, apothecia mostly lirellaeform, and branching, but in some species rounded, difform, the proper exciple colored or black. Differentiated from Opegrapha by the spores.

G. scripta, L., Ach. Thallus thin, whitish, even or rugose, sub-tartareous, apothecia immersed or half immersed, slender, width uniform, simple or branched, obtuse at ends, proper margin narrow, wavy, thalloidal margin tumid. Spores colorless. Common everywhere on oaks, hickories and other trees; apothecia variously branched.

G. dendritica, Ach. Thallus white or yellowish, thin, pulverulent, apothecia brownish black, immersed, broad, flexuose-branched, forked, disk broad, often caesio-pruinose, margin thin. On oaks and various trees within our limits. These two species seem to be the only ones of this genus in Northern Illinois. One other can be added for the southern portion of the State.

GLYPHIDEI.

ARTHONIA, Ach., Nyl. This genus, containing a great number of species mostly tropical, is one of the most perplexing. We have several spe-
cies, two so abundant as to be easily identified.


A. spectabilis, Fl. Thallus thin, white, apothecia black, diffuse, angulate, plain or convex, often bordered by the thallus. A. dispersa, Duf. A. polymorpha, of Muhl. Catal. 1818. On maples. It is also found on other trees. Synonyms numerous.

A. diffusa, Nyl. Thallus white, effuse or wanting, apothecia round or diffuse, plane or convex, pruinose. On hickories and maples.

A. radiata, Pers., Th. Fr. Thallus whitish, darkening, or obsolete, apothecia dark brown, stellate, diffuse or ramulose, erumpent. Opegrapha, Pers. (1794). Arthonia, Th. Fr. Arctic, 240. A. astroidea, Ach. Syn. 6. Has many synonyms, and until lately was known as A. astroidea, Ach. Found on oaks. The variety swartziana, Nyl. should also occur within our limits.

A. tædiosa, Nyl. Thallus indeterminate, apothecia erumpent, linear, heaped, few branched and sometimes round. On maples, also on oaks. The name is very applicable.

TRIBE IV.

CALICIUM, Pers., Ach., Fr.

C. subtile, Fr. Apothecia turbinate, stipitate. On dead wood, Baldwin farm.
SERIES II. ANGIOCARPI.

TRIBE V. VERRUCARIACEI. ENDOCARPEI.

ENDOCARPON, Hedw., Fr. Thallus foliaceous, or crustaceous, peltate, apothecia imbedded, minute. Spores colorless.

E. miniatum, L., Schær. Thallus cinereous, large, peltate, lobate-crenate, umbilically affixed, underside smooth or rugose, fulvous, apothecia numerous and minute, immersed, brownish. On calcareous rocks. The species has a wide distribution; is found in Europe and Japan, being used in the latter country as an article of diet. The thallus is often one inch or more in diameter. Abundant on Covel Creek.


E. miniatum, L., Schær., var. muhlenbergii, Ach. Occurs with the first named and is scarcely distinct.

E. hepaticum, Ach. Thallus fuscous, squamose, small, round or angular, apothecia numerous, blackish. On calcareous earth.

E. pusillum, Tuckerm. Thallus very small, greenish, thin, apothecia minute, imbedded. Very abundant throughout on various rocks and stones. The genus Endocarpon was founded upon this species.
VERRUCARIEI.

In the following genera we approach the limits marking the close relations of the lower lichens with the fungi. The absence or slight indications of a thallus have caused Lichenologists to doubt whether certain species of Verrucaria and Pyrenula should be classed under these names or as Sphaerias.

VERRUCARIA, Pers., Tuckerm. Thallus crustaceous, sub-tartarous, mostly uniform, apothecia globular, black, immersed or prominent, perithecium black.


V. nigrescens, Pers. Thallus nearly black, crustaceous, uneven, crumbling, and often raised around the apothecia, apothecia black, perithecium dimidiate. Spores 8, colorless. On limestone along streams in various localities.

V. fuscella, Fr. Thallus crustaceous, dark brown, areolate-diffract, black-limitate, smooth, apothecia minute, immersed in the areolae. Spores 8, colorless. Ach. L. U. 289. Found on calcareous rocks, Deer Park, as far as observed. A well defined and interesting species.

V. muralis, Ach. Thallus whitish, tartarous, mealy or wanting, apothecia black, semi-immersed, hemispherical, perithecium dimidiate. Found on limestone near La Salle, also elsewhere.

V. viridula, Ach. Thallus greenish olive, are-
olate-diffraot, areolae polygonal, smooth or rugose, effuse, apothecia black, numerous, semi-immersed. Spores 8, colorless. On detached calcareous rocks.

**PYRENULA**, Ach., N. & H., Tuckerm. Thallus hypophloëoid, subcortical, rarely ektophloëoid, superficial, apothecia denudate, perithecium black, ellipsoid-oblung, etc.

**P. gemmata**, Ach., Næg. Thallus whitish, thin, apothecia black, medium to large, prominent, convex, perithecium black, dimidiate. Spores colorless. Ach. Meth. Lich. 120. (1803.) On oaks and hickories.


**P. nitida**, Ach. Thallus pale yellowish or olive, waxy, smooth, apothecia black, in size medium to large, though sometimes small, invested by the thallus, globose, perithecium black. Spores fuscous. Sphæria, Weigel, Obs. 45. (1772). Verrucaria, Ach. L. U. 279. Nyl., etc. On oaks and maples. The very pale thallus will identify its location more easily.

**P. glabrata**, Ach. Thallus whitish, thin, apothecia variable in size, black, hemispherical, conoid, perithecium black. Spores fuscous.
MUSCI AND HEPALICÆ, MOSSES AND LIVERWORTS.

Mosses and Liverworts are small plants, many of them growing on trees, logs, rocks, etc., and generally in damp and rather dark places. The mosses grow by the extension of the stem like a tree or other plant, and have well defined leaves, flowers often of two kinds, one a little rosette of minute greenish red leaves at the top of a leafy stem, usually short, the other looking like a small green seed at the end of a slender leafless stem. This seed, like a vessel, in time opens by the outer end dropping off and the seed or spores, minute dust like bodies, drop out. We have spoken of flowers, but the organs we have mentioned have no resemblance to a flower, nor does the microscope reveal any organs like those of a flower. The mosses differ much in form of leaves, color, size and shape of seed vessel or capsule, and on these differences the genera and species are founded.

We have identified the following species:

1. Sphagnum cymbefolium, erect, 4-6-inch, leafy, leaves soft, whitish fruit on slender, rather short pedicels at ends of stems. Wet places forming a dense mat.

14. Bastramia pomiformis, small, erect, one-fourth inch in dense clumps, pedicels reddish, one inch, fruit globular. Ground in hedges and along fences.

17. Climacium Americanum, erect, 4-6-inch, some branched, leafy at top, greenish brown. Wet woods. Looks like a little tree. Our largest moss.

11. Polytrichium commune. In dense mats, stems one inch, leaves long, one-fourth inch, acute,
pedicel 2½-3-inch, reddish, capsule large as a grain of wheat, hairy, whitish, bent at right angles to pedicel steminate flowers like little pink-eyes at end of stem. Dry woods.

15. Funaria hygrometica. Common on ground that has been burned over. Pedicils two inches bent over at top, capsule pear form.

2. Dicranum leoparium var. pallidum. In dense mosses on dry ground, greenish brown, leaves soft, narrow, curved, canons. Fruits but sparingly.


L. Minus. Dry woods.

5. Fissidens subbasilaris. Stems branched, crowded one-half to one inch, leaves oblong, obtuse, fruit ovoid, at first has a long beak. Rotten logs and trees near the ground.


7. Barbula caespitosa. About roots of trees, pale green, capsule yellow, lid or operculum red.


10. Atrichium undulatum. Moist claybanks, leaves long, narrow, wavy, toothed, margined.

12. Bryum pyriforme. Ground, burnt woods, small, less than one-half inch, leaves bright green, spreading, narrow, wavy, serrate at apex, capsule yellow brown.

13. Minium cuspidatum. Small, ½-1-inch, in close tufts about the roots of trees, leaves oval or obovate acuminate, serrate.


The careful student has here a considerable field for investigation. There is much to be done in this division, as we are aware that our work is but a beginning.

HEPATICÆ.

The Hepaticæ differ from the Musci in having no axis of growth. They are without leaves, broad stems rooting by the under surface, and spreading from the margin either by pushing the whole border forward or by sending out narrow arms. The flowering organs are not at all like those of the Musci, and the fruits are different. They are very common on the sandstone rocks, often covering the whole surface for many square rods.

Marchantia polymorpha. Frond green, spreading, forked, sterile flower peduncled, lobed or rayed above. Has many bud-like little cups on back of frond.

Fimbriaria tenella. Frond thickened in middle, purple on margin, flower or receptacle of four bell-shaped involucres. Very common.
FUNGI.

This great order of plants embraces such members of the vegetable kingdom as are without chlorophyle or green coloring matter, have no semblance of leaves and no organs producing fruit visible to the unassisted eye. They grow rapidly, perfect their fruit—spores dust-like bodies—very quickly, and many of them decay in a few hours. They are very numerous, are of many colors and forms, and differ much in structure. Here we find the mushroom, smut, rusts and molds.

The mushrooms are divided into several great groups—Agaricaceæ or Hymenomycetes, those having the under side of the pileus or caps divided in thin plates something like the gills of a fish, hence called gills; Polyperei, or those made up of little tubes placed side by side; Hydnei, or spine-bearing Fungi; Auricularina or leathery fungi, and several others. The first two are most common as individual plants.

If we take a mushroom and look at the gills with a good glass, one capable of magnifying 100 diameters or more, we shall see on the surface of the gill post-like processes, each having four branches, and at the end of each branch a little roundish body or spore. We see that they are very numerous and very small. If we cut off the stem of the mushroom and lay it on white paper, gills downward, and in five or six hours carefully take it up, we shall have a perfect printing of it on the paper in white, brown, salmon color, or black, according to the kind of mushroom we used. We shall find this colored print is formed by multitudes of spores which the gills have thrown off, and in some cases the member is so great that they form a colored spot as large as the cap, but show no trace of the gills; we let it lay too long before removing it.
In the Polyporei the spores are discharged from the tubes, but not in so great quantity as from the gill bearing, while in other orders they are developed in different ways. There is much that is wonderful and strange about these plants, and a great field for investigation exists here. But are they fit to eat? Yes; forty or more species if you know enough to select the right ones. The common mushroom white and smooth above; gills pink or purple pink, almost every one knows, but this is but one of many which may be safely eaten. The last of May and first half of June you may find about the roots of oak trees a pear-shaped, pale-yellowish brown object having a short thick stem. It is from one and one-half to three and a half inches long, one to two inches broad, and its sides are full of little pits, as if they had been scooped out or gnawed. This is the Morell—Morchilla esculenta, a highly valued mushroom, and one of the earliest to appear. The following notes may be of use to you: First, use common sense. Do not eat a mushroom of which you know nothing. Second, always taste a strange one; if it has a hot, biting taste cook it thoroughly with plenty of salt and taste it. If still hot and biting drop it; if the biting flavor has departed eat a little and see if it affects you in any way. Go slow. Do not make friends too rapidly with bright colored species. Be sure to use none but those that are fresh; never let them stand long after gathering before cooking. If when cut or broken they give out milk, be careful. We have known good mushrooms when kept to produce bad effects. The puffballs, when white and clean within, are excellent and safe. Never collect mushrooms which have grown amid filth and dirt.

Order. AGARICINI. AGARICS.
Gillbearing Fungi.
Genera. Spores of five white.
Lepiota procerus. Upper surface scaly, gills free from stem.
Armillaria melleus. Gills connected to stem. Dry eating, says Mr. Calkins.
Tricholoma gambosus. Gills notched next stem.
Clitocybe dealbatus. Gills attached to and running down stem, white.
Pleurotus ostreatus. Grows in great masses on stumps, as much as a bushel from one stump.
Ulmarius. On elm trees, spores brown.
Psalliota arvensis.
Coprinus comatus. Gills soon becoming dark and melting.
Hygrophorus Virginius, white, waxy below.
Lactarius deliciosus, Giving out milk when cut or broken.
piperatus.
voleumum.
Russula emtica. Gills rigid, not milky.
virescens.
Cantharella cibarius. Gills thick, branched.
Panus stypticus. Cap fleshy, tough.
Marasmius subvenosus. Gills thick, rough.
Lentinus Leontti, cap hard, dry, tough.
Lenzites sepearia. Corky, gills netting.
L. betulina.

TUBE-BEARING FUNGI—POLYPAREI.
BOLETUS EDULE. Made up of many squarish tubes. Tubes separable.
POLYPORUS ARCULARIUS. Tubes not easily
separable, becoming woody and hard.

P. pergamenus, sanguineus, Virgineus, hirsutus, velutinus, versicolor, molluscus, vulgaris, sentellatus. spumeus.
Merulius tumelloides. Waxy.
Hydnum repandum. Spiny below.
Sparassis crispa. Branches broad, much divided. On ground, woods.
Clavaria cinersa. Club shaped.
C. rugosa. Branches rough.
Georglossum hirsutum. Black, hairy.
G. difforme. Black, smooth.
Stereum complicatum. Leathery below.
S. acerimum.
Corticium cinereum. Soft, fleshy below.
C. incarnatum.
C. lactescens.
Reziza aurantia. Cup form, red.
Herncola aricula Judae. When damp looks like rubber, soft, gelatinous.

WATER POWER OF LA SALLE COUNTY.

When the county was first settled it was obvious that the grain produced here must either be taken East to grind or mills must be built here, and the Green's located at Dayton because the Fox river offered sufficient power and a favorable situation for the erection of a mill, and at that point a dam still spans that stream, and its waters not only drive machinery at that place, but a part of them is brought to Ottawa and furnishes the hydraulic company's power here.

Of course, the main source of power in the county is the Illinois river. This stream, formed by the junction of the Des Plaines and Kankakee
rivers in the extreme southeast part of Ausable Township, Grundy county (Section 23, Township 34 north, Range 8 east), pursues a general westerly course for about fifty-seven miles in an air line, about sixty-six miles by the course of the stream, and then strikes to the south-southwest. Of its affluents in La Salle county, water powers have been developed on the Big Vermillion, Fox and Pequamsauggin, on the Illinois itself, and on Indian creek, a branch of the Fox.

The Illinois sends down, when at its greatest height, about 65,000 cubic feet of water per second, but at its lowest stages as little as 1,070 cubic feet per second, or one sixty-fifth of its greatest flood volume. When the country was new the floods were less excessive and the stream did not fall so low as now. The whole drift of man's improvements has been to cause the river to rise more rapidly, fall more quickly, and to reach a lower stage in times of drought than it did prior to the settlement of this region; but even 1,070 cubic feet of water per second is not to be despised, as it equals 64,200 cubic feet per minute, and this with twelve feet fall equals about 1,460 horse-power; but at Ottawa 14½ feet fall can be used east of the city, and 8 or 10 feet west of it, giving at its lowest stages 1,700 horse power on one side and 980 horse power on the other, while at medium stages with a discharge of 2,500 cubic feet of water per second we have for each site 2½ times the above, or 4,200 horse power on the east and 2,400 horse power on the west, a total of 6,600 horse power, or one of the finest powers in the country. We have introduced no hypothetical figures here as to what may be some time, somehow, somewhere, but have taken the facts as they are now.

But the total power that may be developed from
the Illinois is, counting that already in use at Marseilles, much more than twice the above, as will be at once seen from the following figures. The elevation of the Kankakee river is 58.5 feet, of Utica 10.5 feet, a difference of 48 feet, which is the total fall of the Illinois from its formation to Utica, and of this fall 39.5 feet is between the foot of the Marseilles dam and Utica.

The Fox river furnishes a constant power of about 600 horses at Ottawa, and as this represents about half its power, the total is about 1,200 horse power, but the water of this stream is used again for a mill near Sheridan, and furnishes a fine power at Milford—Millington, once improved, but now in ruins—altogether not far from 2,500 horse power.

The Big Vermillion is too unreliable to demand any consideration, although formerly dammed at Lowell and at Ladd's Ford, about two miles southwest of Deer Park, and the Pequamsauggin, Little Vermillion, Tommyhawk, a branch of the last, and Indian creeks have all dwindled to insignificance. So capable is man in his unreasoning anxiety to get rich and to improve every inch of land around him, that he stops not to inquire what the result of his improvements will be, but rashly ventures to destroy the delicate balance of conditions which the Creator has instituted to secure the greatest possible good with the least waste. We have been assured by a gentleman, who knew whereof he spake, that when he was a boy he frequently went swimming in Mission creek, in a place where, at the same time of year, it is now dry every season. It must also be remembered that at one time river steamers came to Ottawa a part of the year with reasonable regularity. These facts suggest the question, Has the rainfall diminished? To this the
answer must be no. Man has no power to attract or drive away rain, and all the fine stories told of the increased rainfall in Western Kansas and Nebraska by land speculators and railway land agents are myths, as too many have found to their cost. But man drains swamps and sloughs, cuts down the forest and prepares the way for a rainfall to rush to a creek or river as fast as it falls, and, as a consequence, he has disastrous floods, low or dried up streams, and must deepen his wells year by year. "As a man soweth so shall he reap." and in nothing is this more true than when he destroys the balance of the Creator's works.

But other questions aside, we think it is clear that La Salle county is rich in the possession of unusually good and valuable water powers to the amount of not less than 10,000 horse power for the Illinois, all of which can be concentrated at Ottawa and Marseilles, and 2,500 horse power for the Fox, a power not excelled, if it is equalled by that of any other county in the State, and yet by far the most of this from sloth and want of enterprise, or from the grasping avarice of those who own the sites that must be developed, is to-day running to waste. No wonder Ottawa fails to grow. A people whose great object in life is to dance, play cards and sing, is not at all likely to lead in great and noble enterprises. Cards and songs do not build dams or run machinery, or give the mechanic or artisan much to do. We need sturdier stuff than this to push great enterprises and build cities.

ARTESIAN WELLS.

Some of the phenomena connected with artesian wells deserve notice. The late Judge J. D. Caton very conclusively proved in a paper read before the Chicago Academy of Sciences Jan. 13, 1874, and afterward published in "The Past and Present of La Salle
County," Keet & Co., Chicago, 1877, that the flow of artesian wells, at least of those about Ottawa, is irregular, that is, they deliver a greater quantity of water per hour at one time than at another. Few experiments have been made in this direction, and one hears much loose talk on the subject, but Judge Caton's experiments were carefully made and are convincing, he was unable to discover anything like regularity in the variation or to connect it with any cause.

Our friend Mr. T. D. Catlin informs us that he has a well 1,800 feet deep, which was, when first bored, capable of raising water some 160 feet above the Courthouse Square. This well is tubed 1,730 feet from the top, the remaining seventy feet being through shales which it was deemed unnecessary to tube. For a time the well worked perfectly; then it showed signs of weakness, and finally raised no water to the top of the bluff, and it was supposed that it had given out. But after a time it showed signs of recovery, and now flows, but less strongly than at first. He accounts for its failure in this way: A column of water 1,900 feet long has a pressure equal to about 58 atmospheres, or 870 pounds per square inch, more than four times the pressure carried by the strongest locomotive boilers. This immense force exerted on the shale forced the water through it into some adjacent cavities and took the water from its course through the well in some other direction. At length, this reservoir being filled, the water returns to its former course.

Another reason may be given for a part of the change. The water of artesian wells, as well as of all others, depends originally on the quantity of rain falling somewhere, which, soaking into the earth and being confined between impervious strata, is obliged to pursue a certain course, and whenever an opening is
made down to this stream or reservoir the water, in obedience to well known laws, rushes up and we have an artesian well. Now, as the supply comes from the rainfall at some point, if that source varies to any great extent, so must the quantity furnished increase or diminish. Thus a succession of dry years in the region of supply lead to a lesser flow, a series of damp to a stronger discharge.

This well proves that the source of the water must be some 200 feet above the Court House Square, or not less than 700 feet above sea level after it reaches the confining strata, which is probably not until it has descended a hundred feet or more, so that we must have heights of 850 or 900 feet. But these are reached in the northwestern part of Illinois, and considerably exceeded in Northern Wisconsin, and the source of our deep artesian wells may be there. It certainly cannot be Lake Michigan nor even Superior, for water never climbs up hill.

COAL.

About the time the pages on Coal were printing, it was announced that in a boring about a mile and a half northeast of Ransom—southwest quarter of Section 10, Township 31 north, Range 5 east—coal had been found. We find the facts to be that at 300 feet a coal seam one and one-half feet thick is believed to have been passed through, and at 350 feet a second seam three and a half feet thick and about fifty feet below the coal, 398 feet from surface, a soft bed of rock was struck, after which a considerable flow of gas was observed. The gas gave a pressure of 65 pounds per square inch on a steam gauge. The well was carried down through hard white rock to 425 feet and abandoned.
GEOLOGY OF LA SALLE COUNTY.

The one and one-half foot seam of coal at 200 feet below surface is no doubt a tongue of the Streator bed, No. 7 much thinned, as it is, at Wenona. The three and a half feet bed is No. 2, thicker than at this place, but about the same as at Wenona. The "hard white rock below it, containing the soft gas-bearing streak, is the Trenton limestone, which is probably not less than 200 feet thick at that place. Whether deeper boring would lead to the production of more gas is an interesting question. It would probably lead to flowing water, but at what depth is uncertain.

WEEDS.

In Part I the reader will find a short article on "Weeds." We give a list of what we consider the troublesome weeds, that is those which the farmer finds most difficult to get rid of. But some which are new to the county are not mentioned. Among these are Salsola kali tragus, the Russian thistle. We believe that our soil, except where very sandy, is not congenial to this plant, and that the danger of its increasing is small, but none the less should it be watched.

Iva Xanthifolia seems to be more at home, and from its resemblance to several of our common weeds, may spread widely before it is noticed. It should be looked after.

Atriplex patulum spreads slowly, but moves in solid columns—it fills the ground and should not be suffered to make a lodgement.

Acniga tuberculata, formerly known as Montelia tamariscina looks much like an Amaranth, and belongs to that family. It has spread along the river and the railways, and seems to be perfectly at home and gaining ground very fast.

Solanum Carolinense is evidently at home and
enjoys both soil and climate. It does not spread with great rapidity, but holds all that it gains, and should be kept down.

If any one wants to know these plants we will mail specimens of the five to any address for 15 cents, or furnish them at our room for 12 cents.

The whole weed family, and here we include in this term every plant growing in our fields, which has no known use, should be much more carefully looked after than they usually are, for the material which they take from the soil is so much taken from that which should go to nourish the plants which we cultivate, and slovenly farming is generally poor economy. The farmers' aim should be to grow the largest possible crop on the least possible area, instead of going over the largest possible tract and leaving the crop very much to itself. It is in this direction that we believe the salvation of agriculture lies, for this should give us the greatest product at the least expense.

The following addendae is a list of plants omitted in Part I, to which our attention has been called by Mr. C. F. Johnson and Prof. L. H. Boltwood. Descriptions are given where thought important. This list contains fifty-five species and varieties, making the whole number recorded, not counting lichens, mosses: Mosses are fungi, about 1,090; lichens, 135; mosses, 18; hepaticæ, 2; fungi, 77; total, 1,322 species and varieties.

Clematis Viorna, 42; Clematis Viorna, tails of fruit plumose of Pitcheri, hairlike.
Anemone patens var. Nutalliana, 42; sepals, 5-7: of Caroliniana, 10-20.
Dentaria laciniata, 50; stem leaves, 3 parted.
Sisymbrium sophia, 133; resembles S. canescens.
Lepidium intermedium, 134. Much like Virginicum.
Sagina decumbens. Should follow Cerastium, 53. Little matted herbs, leaves threadlike, awlshaped, flowers small at end of branches.

Hypericum Canadense, 54. Branches erect, four angled, leaves three veined, linear, flowers small, yellow.

Rhamnus Alnifolia, 56. Calyx lobes and stamens, 5; leaves oval, acute, serrate, nearly straight; a small shrub.

R. lanceolata. Calyx lobes, etc., four; leaves oblong.

Polygala Senega var. Latifolia, 62. Plant larger than true P. senega, and leaves ovate.

Erysmium cheiranthoides, 133. Comes before Sisymbrium. Roughish, branching, slender, leaves lanceolate, flowers small, four petals, yellow.

Desmodium Canadense, 65. Hairy, 3-6 feet, leaflets oblong-lanceolate, obtuse.

D. paniculatum. Nearly smooth, slender, flowers paniculate.

D. Illinoense. Rough with short hairs, leaves ovate-oblong, obtuse.

Agrimonia Eupatoria, 72. Root leaves interruptedly pinnate, flowers yellow in thick spikes.

Tiedemania rigida, 80. Before Hercleum. Aquatic plant, leaflets narrow or none, leaflets 3-9, linear. Poisonous.

Zizia aura, 81. After Sium. Lower leaves 2-3 ternate, of root very long, flowers early, yellow.


Houstonia angustifolia, 85. Leaves narrowly linear.

Eclipta alba, 94. After Xanthium. A. slender, rough, leaves opposite, lanceolate, acute at each end, sessile, some serrate.

Rudbeckia laciniata, 94. Smooth, branching, 2-7 feet, leaves smooth or not, lower pinnate with 5 to 7 cut or three-lobed leaflets, upper irregularly 3 to 5 lobed.

Chrysanthemum leucanthemum, 97. Before Tanacetum. Flowers 1½ to 2 inches across, rays white, disc yellow, leaves dark green cut into narrow segments.

Erecttites hieracifolia, 97. After Cacalia. A. Erect, coarse, juicy stemmed and strong smelling, leaves long, narrow, coarsely toothed, light green.

Cnicus lanceolata, 98. Common thistle.


Lysimachia thyrsiflora, 102. Smooth, 1-2 feet, flowers light yellow, in spikes, in axils of 1 or 2, of middle pairs of leaves.

B. Acerates lanuginosa, 104. Hairy, 5-12 inches, leaves lanceolate, flowers small.

A. longifolia. Erect, 1-3 feet, very leafy, leaves linear.


Lophanthus scrophulariæfolius, 114. Obtusely four angled, leaves below short, hairy.

Solanum elæginifolium, 108. More or less prickly, with small, slender prickles. Along railways.

Rumex verticillate, 117. Tall, 3-5 feet, leaves lanceolate, obtuse, pale green. Wet places.
Rolygonum erectum, 117. Erect, 1-2 feet, yellowish, leaves oblong.

P. Virginianum. Smooth, 3-4 feet, sheaths hairy and fringed, leaves ovate or ovate lanceolate, acute, rounded at base, petioled.

Saururus cernuus, 118. After Asarum.

P. Marsh herbs, leaves cordate petioled, flower white, fragrant in nodding spikes.

Sassafras officinale, 118. Before Thymelaceae. Tree 15-25 feet, twigs yellow green, leaves ovate or 2 or 3 lobed, flowers green yellow, aromatic. Both sides of Illinois, west of Lover's Leap.

Smilax rotundifolium, 122. Leaves ovate or round-ovate, cordate short, pointed, thickish, green both sides, stem more or less beset with black prickles.

S. glauca. Prickles stout, leaves ovate.

S. pseudo china. Smooth or few prickles, leaves ovate cordate.

Acorus calamus, 124. Sweet flag, calamus, Flowers on a spadix, yellow green, no proper leaf, very different from blue flag, aromatic.

Carex tribulædes var. Cristata, 127. Spikes almost globular.

Elecharis ovata, 125. Nearly round, 8-14 inches, high.

C. laxiflora var. latifolia, 127. Leaves ½ inch broad or more, staminate spike nearly or quite sessile.

Panicum commulatus, 128.

P. scoparius, pubescens.

Phalaris aurundinacea, 129.

Sporobolos minas, 129.

Agrostis personans, 130.


Eatonia Pennsylvanica, 130.

ELEVATIONS.

In Part I, page 19, there is a table of elevations of the railway stations in the county. We add a few heightths above sea level.

The highest point in the county is in Township 36 north, Range 1 east, 3d P. M., Sections 2 and 3, 931 feet, or the northeast part of Mendota Township. On the centre line of this township, from west to east, beginning on the west line at mile and half mile stations, half mile in parenthesis, we have 875, 852, 831, 838, (824), 790, 798, (781), 751 feet.

Township 32 north, Range 1 east, west to east on south line of fourth tier of sections we have, beginning a mile east of west line, 600, 650, 658,—655, 647, 666 feet.

Three miles farther south 681, 670, 678, 669, 674,—672, 661 feet.

One and a fourth miles south of the 674 point, or 3¾ miles south of Tonica, there is a point 704 feet high.

Osage and Groveland both have small areas above 700 feet high. On the north side of Section 31, Groveland, a hillock reaches 730 feet; Section 26, Otter creek, rises to 710 feet; Ransom Station, in Allen Township, is 703 feet to top of rail in front of station house. Land to the west, south and north is 25 or 30 feet higher, and cannot be less than 730 or 740 feet above sea level. In the southwest corner of Brookfield a point reaches 738 feet.

In West Farm Ridge and Deer Park are points over 700 feet above the sea, not much less than 750 feet in height. The highest points in South Ottawa must
reach an elevation of 640 to 650 feet.

The north half of Meriden Township ranges between 730 and 850 feet.

Here is a broad field for investigation. It is to be regretted that while the State was engaged in a hypsometrical survey in 1892, an appropriation sufficient to do the work thoroughly was not made. It was at best but a rough reconnaissance with the aneroid, and leaves much to be desired.

**COAL PRODUCTION OF LA SALLE COUNTY.**

For the year 1894, 1,134,087 tons; 1895, 1,084,552 tons; 1896, 1,409,085 tons.

In 1895 La Salle was sixth county in the State in quantity produced; in 1896 it ranked fifth. Mine Inspector's Report.

The Peddicord Artesian Well Drift, etc., 269 feet; shale, 65; limestone, 25; St. Peters, 290; calciferous, 617; white sandstone, 262; limestone, 52; shale, 115; slate, 112; shale, 9; limestone, 29; sandstone, 298. The water comes from this. Limestone, 46 feet. Total, 2,189. It is 618 feet above sea and 40 feet above Lake Michigan.

The calciferous beds, it is suggested in State Geological Report, Vol. VII., probably embrace the *Potsdam*. We cannot assent to this. We think the sandstone 298 feet thick, from which the water comes, is the *Potsdam*.

The Blood-sucker or Leach—*Hirudo Sanguisuga*—is found in the Illinois river, especially about rotten floodwood and about rocks, in warm weather attaching itself to the stone a little below the surface of the water. We have found a species of this genus attached to a land turtle. The young are a hundred or more in number, and are for a time covered or brooded.
by the mother. It is sometimes four inches long.

The earthworm Lumbricus terrestris—is found almost everywhere, and is too well known to need description.

ERRATA.

Page 18, line 20, at end for Trenton read St. Peters.

Page 31, line 9 from top, after See read Little Rock.

Page 39, last line second paragraph, add This is the Drift.

Page 60, line 21, read “one and one-fourth miles for two,” etc.

Page 118, MARGARITINA should follow U. obliquus, page 120.

M. deltoida, put a period after smooth and read ANADONTA, not anadenta.

J. solea concolor, 136, after Viola. Green violet, leaves oblong, pointed both ends, entire, smooth; G.W.; 1-2 feet, Long’s Run, west of Marseilles.

Corallorhiza multiflora, 121, before spiranthes. Coralroot; stem stout, purplish, leaves, a few brown scales; flowers in a loose spike, pinkish, spotted with purple, small, spurred. Woods west of Starved Rock.
GEOLOGY OF LA SALLE COUNTY.

A. Coal Run's Shaft, Streator; B. Boring, Munster; C. Boring near Ransom.—Records of Artesian Wells.

<table>
<thead>
<tr>
<th>STRATA</th>
<th>Thickness (in.)</th>
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<tbody>
<tr>
<td>Drift</td>
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<tr>
<td>Coal Measures</td>
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<td>Trenton Limestone</td>
<td>203</td>
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<td>St. Peters Limestone</td>
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<td>Calciferous Limestone</td>
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<td><strong>Total</strong></td>
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Records of Shafts and Bearings.

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<td>Fire Clay</td>
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<td>Trenton Limestone</td>
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<td><strong>Total</strong></td>
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### Analysis of Mineral Waters; Grains in One Gallon: 231 Cubic Inches.

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<th>Congress Springs, Saratoga</th>
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# ANALYSES OF COALS.

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<th>A.</th>
<th>B.</th>
<th>C.</th>
<th>D.</th>
<th>E.</th>
<th>F.</th>
<th>G.</th>
<th>H.</th>
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| CLAYS                    | ADAMS CO. | ILL. | BIR. ENGLAND. | HOLES CREEK, O. | MILWAUKEE. | BUCYRUS | FT. SMITH. | FLOYD CO. | CARTERSVILLE | BAUXITE | |
|--------------------------|-----------|------|---------------|----------------|------------|---------|------------|-----------|---------------|---------|
| Peroxyde of Iron         | 4.57      | 1.00 | 3.00          | 2.33          | 6.18      | 8.35    | 1.44       | 1.83      | 7.51          | 5.00    |
| Protoxyde of Iron        | 1.37      | 0.65 | 20.18         | 24.08         | 0.72      | 1.16    | 1.14       | 0.71      | 6.18          | 3.20    |
| Lime                     | 7.06      | 7.04 | 4.77          | 44.83         | 66.66     | 58.43   | 40.40      | 15.43     | 60.63         | 3.20    |
| Magnesia                 | 44.57     | 75.03| 35.56         | 44.93         | 66.66     | 58.43   | 40.40      | 15.43     | 60.63         | 3.20    |
| Silica                   | 38.07     | 16.08| 19.64         | 18.37         | 26.44     | 32.30   | 28.60      | 15.43     | 60.63         | 31.00   |
| Aluminia                 | 10.82     | 6.09 | 8.80          | 1.30          | 8.10      | 1.18    | 1.95       | 1.74      | 3.00          | 4.76    |
| Water                    | 10.82     | 6.09 | 8.80          | 1.30          | 8.10      | 1.18    | 1.95       | 1.74      | 3.00          | 4.76    |
| Carbonic Acid            | 10.82     | 6.09 | 8.80          | 1.30          | 8.10      | 1.18    | 1.95       | 1.74      | 3.00          | 4.76    |

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**Note to Table:** Coals, Column B. Volatile matter, per cent.; C. fixed carbon or coke; D. moisture; E. ash; F. sulphur; G. heating effect of 2.2 pounds; I. water evaporated by one pound of coal. Clays—Localities, etc.: Adams County, Ill.; Birmingham, England; Fire Brick: Holes Creek, Ohio; Brick: Milwaukee, Wisconsin; Pressed Brick: Bucyrus, Ohio and Ft. Smith, Arkansas; Paving Brick Clay: Floyd County, Northern Georgia; White Clay or Kaolin: Cartersville, Ga.; Good Brick Clay, Bauxite, the most important ore of Aluminum, Floyd County, Ga. Sl. sulphur; P. Potash; S. Soda, T. Titanic acid; Authorities, Geological survey of Illinois, Indiana, Ohio and Georgia.
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