Maps and Charts for Kentucky Geological Survey Publications, Series 2, Miscellaneous Reports, Volume 5

Map of Spencer and Nelson Counties is filmed after p. 59 of William Linney's *Report on the Geology of Spencer and Nelson Counties.*

"Birds of Nelson County" is filmed after the Map of Spencer and Nelson Counties following p.59 of William Linney's *Report on the Geology of Spencer and Nelson Counties.*

Map of Montgomery and Clark Counties is filmed at the end of William Linney's *Report on the Geology of Clark and Montgomery Counties.*

GEOLOGICAL SURVEY OF KENTUCKY.

JOHN R. PROCTER, DIRECTOR.

REPORT

ON THE

GEOLOGY OF SPENCER COUNTY.

WITH MAP.

BY W. M. LINNEY.

STEREOTYPED FOR THE SURVEY

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INTRODUCTORY LETTER.

HON. JOHN R. PROCTER,

Director of the Kentucky Geological Survey:

DEAR SIR: I herewith transmit to you my Reports on the Geology of Spencer and Nelson Counties. I would suggest that the two counties be exhibited on one map, and that the two Reports be printed under one cover.

I have continued the divisions of the Hudson River Epoch by colors on this map, and am happy to say that Mr. J. B. Hoeing's careful and beautiful work has been very much appreciated by all who have examined it.

I am, very truly, yours,

W. M. LINNEY.

FRANKFORT, KY., January, 1884.

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GEOLOGY OF SPENCER COUNTY.

Spencer county is situated in the north central portion of Kentucky, and was formed in 1824 from parts of Bullitt, Shelby, and Nelson. Unlike the majority of counties in the State, its territory has remained unchanged since its first formation. It has Jefferson and Shelby on the north, Anderson on the east, Nelson on the south, and Bullitt on the west. Its area is comprised in about one hundred and sixteen thousand acres of surface, and in 1880 its population was 7,040. The county seat is Taylorsville, a neat little town of about 500 inhabitants. It is romantically situated on Salt river, in an angle made by that stream and Brashears creek. The various civil divisions have a small village or post-office and store conveniently situated.

Salt river flows irregularly east and west through the county, receiving Ash, Little Beech, Big Beech, Brashears, Simpson, Elk, and Plum creeks as its larger affluents, while into these and into the river innumerable rills carry the surface water from the whole county. The Cumberland and Ohio Railroad, operated by the Louisville and Nashville system, passes through the county, giving needed facilities for travel and shipping. Five turnpikes have been constructed, but these are only a small portion of this class of roads which the people should construct. Material for turnpikes is so convenient throughout the county that their cost of construction should be at the minimum, and the whole county should have a net-work of them, giving every citizen facilities of good, substantial roads to every portion of the county.

Taylorsville has a high school of which her citizens are proud, but the general schools of the county need better houses and more money to make them as continuous and

valuable as is required. The county has a fine moral, social, and economic record, and with more good roads and better schools, it would be amongst the most desirable counties in the State for health, plenty, and happiness.

The general surface of the county is what is usually termed hilly, but in fact there are no hills which rise above the general level of the country. It is nearly a plane, through which water has chiseled the many lines of drainage. Often these reach a depth of two to nearly three hundred feet. From the higher portions one may usually look over a large part of the county, and even see the higher points in the counties lying to the north, east, and south. Many of these views are beautiful, and all of them are interesting, as from them one obtains some idea of the vast erosion of material which has taken place from over the present surface of this region.

With the countless hollows which mark this county the number of good springs is comparatively few, and the potable water of the county is largely drawn from wells, which are comparatively easy of construction. Artificial ponds have been largely made, the conformation of the surface and the clay beds being very favorable for their construction.

GENERAL GEOLOGY.

Spencer county lies entirely within the so-called blue limestone area of the State, and its bedded rocks are comprised entirely within the limits of the Hudson River Group of the Lower Silurian age, consequently the lower rocks, as seen in the State, have not here been reached in the channels of the streams; neither do the higher series now occupy their places on the tops of the higher points. So in this county we may not look for those massive building-stones which are exposed to view where the Kentucky and her tributaries have cut into them, nor to the higher series where the coals and iron ores of the State are to be found. But here the elements of wealth must be expected from the vegetable productions by a wise system of farming, by cultivation and grazing, and a particular care in the preservation of the soils.

GENERAL SECTION OF THE ROCKS OF KENTUCKY.

		Feet.	Feet.
Quaternary (20)			
Carboniferous —			
Coal Measures (14*b*)			
Conglomerate or Millstone Grit (14*a*)			
Sub-carboniferous—			
Upper or Limestone (13*b*)		300	600
Lower or Silicious (13*a*)		300	
Devonian—			
Hamilton Period (10)	Black Slate	60	76
Corniferous Period (9*c*)	Corniferous	16	
Upper Silurian—			
Niagara Period (5*c*)	Niagara		100
——— (5*b*)	Clinton		
——— (5*a*)	Medina		
Lower Silurian—			
Trenton Period (4*b* and 4*c*)	Hudson River	650	940
——— (4*a*)	Trenton	160	
	Birdseye	130	
Canadian Period			
Chazy (3*c*)			350

The above table exhibits a sectional view of the relations which the rocks of Kentucky bear to each other and the position occupied by the Hudson River Group, upon which is based the soils and other features of Spencer county.

The Hudson River Group in Kentucky occupies the larger portion of the Blue Grass area of the State, and has been divided for convenience of description into three almost natural parts: the Lower, the Middle, and the Upper beds. In each of these divisions there is a general similarity in the larger part of the rocks; in the soils as derived from them; in the general aspect of the surface, as well as in the distribution of the trees which constitute the forest over them.

These divisions are of unequal thickness, as will be seen from the following table, which gives their approximate thicknesses in this part of the State:

HUDSON RIVER GROUP.

Upper Hudson River beds	300 feet.
Middle Hudson River beds	150 feet.
Lower Hudson River beds	200 feet.
	650 feet.

LOWER HUDSON RIVER GROUP.

These, the lowest rocks exposed in Spencer county, are seen along Salt river and the other streams in the eastern part of the county, showing at their deepest cut points about one hundred and sixty feet of their upper portion. They do not, therefore, rise to the upper part of the county and make any considerable area of soils. It is here and there that portions, or sometimes the whole, of small fields are based on this series. Here they are of the same character as described in the reports of other counties which contain them. Their general characteristics are to be seen in many places—layers of compact, often half crystalized, limestones, usually rough bedded, from an inch to a foot in thickness, separated by beds of shale, often thin but sometimes several feet in thickness. The limestones often contain nodules of hardened clay, and sometimes iron pyrites. The shales are often a blue clay with few marks of stratification, and in this county remarkably destitute of organic remains. Some of these layers make tolerably fair building-stones, and have been used, to some extent, for that purpose. The layers of great wave-marks have lost none of their characters through a half dozen counties, but are seen wherever their horizons are exposed.

In all the stream beds where this division is seen the broken blocks of limestone are exposed in great quantities. The shales are torn out and dissolved by water, and the ledges of stone break off by their own weight, where not originally fractured, and drop down. Roads along those branches are therefore often almost impassable from their roughness. The same cause has often produced the same effects on the hill-sides where the loose blocks cover the ground; and where no care has been taken to preserve them the fields, or part of

them, become barren, rocky places, from which all the soil has been washed away. Those places have usually been turned out as worthless, and are enlarging each year. With the removal of those stones and a part of the ledges, those places could readily be brought back to grass or timber lands, while the stones could be built into fences, and thus preserve in part the timber, which is becoming much scarcer than the interest of these lands require.

The soils on this series of rocks were of good quality, and, where taken good care of, are very lasting, the destruction of the shales and limestones being a continual source of renewal.

White oak was the great prevailing timber which covered these soils, and even to-day, when the forests have been so largely destroyed, its well-known character is exhibited in the remaining woodlands. Sugar maple, red oak, sassafras, black hickory, perhaps, were the most prevailing trees which grew with the white oak.

Over some of the exhausted soils, and in some of the remaining woodlands, young trees are coming up rapidly, and, with care, in time would be very valuable; but, with the exception of the black walnut, none of them have received any care or protection. Among the young timber there are places where the white oak is in fair numbers, and apparently of vigorous growth.

This series of rocks, by a dip to the north and west, are carried beneath all the drainage lines, and are hid everywhere over the general surface by the rocks which compose the next member of the Hudson River Group. The fossil forms which they contain are very numerous, and are those species which mark the same series in all the counties to the south and east.

Trinucleus concentricus, *Calymene senaria*, *Asaphus gigas*, *Conularia trentonensis*, *Graptolites gracilis*, *Bellerophon bilobatus*, *Leptæna sericea*, *Orthis multisecta*, and other forms peculiar or general to this horizon, are often seen, but rarely in good condition. The shales are barren, and the limestones are so hard that they give few specimens worth collecting. Some particles of sulphate of lime, and a little iron pyrites, are often

included in the shales or rocks, and in one instance a weak brine spring was known to exist in them. So alike are all the features of the Lower Hudson in Spencer, as compared with the same division in Madison and all the intervening counties, that one almost feels sure, in many places, that he has been at the same point in other counties. The layers of rock, the character of shales, the peculiarities of soils, the distribution of trees and other plants, the variety of slopes, and the condition of the fossils, all are so analogous that they seem like well remembered places.

MIDDLE HUDSON RIVER BEDS.

This division of the rocks makes the upper surface in the eastern portion of the county, and, like the former beds, pass beneath the country in going to the north and west. The map which accompanies this report shows well the relation existing between the three divisions included in Spencer.

The Middle beds, which were described in the old series of the Kentucky Geological Reports, by Dr. David Dale Owen, under the name of the Silicious Mudstone, have, through a number of counties, a nearly uniform thickness of about one hundred and fifty feet. Their general character is very much alike through the belt of counties studied so far; but some changes have been noticed in their northwest extension.

As has been stated in the reports on other counties, these beds are made up of mud-like sandstones and shales, with a number of limestone layers included in them. To the southeast some of the sandy layers are quite heavy bedded, and have a concretionary character. I was not able to find either of these layers in Spencer county, though, with one other exception, there is a general resemblance in the more common features. Within the lower third of the series there is a layer of limestone which is marked with the great wave-like character so common to the lower beds, and from some slight analogies it seems as if the origin of the two phases were the same.

There are many places where partial sections of these rocks can be seen and studied, and they show, that while the heavier layers of sandstones have disappeared, the general mass of shales retain their characters very well, but that there has been introduced a larger proportion of limestone.

Generally the soils derived from these rocks are naturally very good. Their decomposition is rapid, and they give considerable depth to the soils. Their porosity allows the infiltration of water through them, and the sandy layers hold a good deal of moisture. This is a very favorable condition, as they are well drained, and soon dry out on the surface in wet seasons, and in dry ones the amount of moisture stored beneath, by its evaporation, brings not only plant food from below, but moisture to sustain the growing crops.

Over the larger part of the county covered by this series the surface lies in narrow ridges, with steep slopes on each side. These ridges and slopes are cultivated year after year without much apparent injury; yet their destruction is rapid from the continual washing away of the surface. The decomposition is so deep that a continual renewal of the soil on the surface is produced by the exposure of the shales from beneath. There are no other soils in the State which could stand half the rough, careless treatment much of this land has received without being permanently ruined. Year after year of corn-growing on slopes of twenty to forty degrees is usually very destructive to our lands; but in many cases these do not seem to be much injured by such treatment.

There are some conditions where these soils, or a part of them, have been badly worn. It is where some hard, sandy shales come in; these break up into fragments, and produce, from some cause, poor patches in the fields. In the cultivation of these lands it would be better to plant in each of the hollows over a farm some shrubs or small trees, which would hold back and preserve the material which is so rapidly washed away, and then if bands of grass land were left half way from the top to the bottom, extending around the slope, a great saving of soil could thus be made.

An analysis of eleven specimens of these soils, made by Dr. Robert Peter, gives the following average composition:

AVERAGE OF ELEVEN MIDDLE HUDSON SOILS.

Organic and volatile matters	4.778
Alumina and iron and manganese oxides	7.064
Lime carbonate	.101
Magnesia	.605
Phosphoric acid (P2 O5)	.165
Potash extracted by acids	.155
Sand and insoluble silicates	86.551
Water expelled at 212° F.	not estimated
Potash in the insoluble silicates	not estimated

In his notes on these soils the Doctor says: "These soils contain average organic matters, alumina and iron oxide and phosphoric acid; more than average magnesia and sand and insoluble silicates, and less than the average of carbonate of lime."

As these soils give, on an average, a less quantity of lime than is usual, it would be interesting, and perhaps very profitable, for the farmers residing on them to institute a series of experiments lasting through several years, in which various quantities of lime were added to these soils. This would be a cheap experiment, as from nearly every drainage line cut through these soils can be procured limestone in quantity which will burn into a good quality of lime.

The original forests over this series in Spencer was, as usual in many other counties, composed largely of beech, often forming as much as seventy-five per cent. of the trees. In some places sugar maple and white oak were common species, while yellow poplar and walnuts of fine proportions were scattered in some quantity. Various other trees were sometimes seen, but always few in numbers. Over what is called Briar Ridge about 1830 a destructive tornado leveled all of the timber for some distance, and the trees now standing have grown since that time. They are largely white oak, red oak, poplar, walnut, ash, and beech.

This is not a series where fossils are well preserved or easy to collect. The casts of *Calymene senaria*, *Strophomena alternata*, &c., are not uncommon in the sandy layers, while in the

lower part of the limestones some of the forms of the Lower Hudson are seen. Towards the top *Streptorhyncus planoconvexus* is very common, and is usually associated with one or more of the common forms of chætetes corals.

In the northern part of the county I found two specimens of a *brachiospongia*, perhaps *digitata*. One of these was loose on the surface, but the other was imbedded in a layer of the mudstone. This is an interesting fact, for it is not positively known from what horizon the specimens found in Franklin county came, they having been found separated from any matrix, usually in the beds of the creeks. The one found in Mercer county came from the top of the Trenton. So we at last have two known horizons for this singular fossil.

The similarity of this series, as seen in Spencer and compared with other counties, is no less striking than that exhibited in the Lower Hudson beds. The deep-cut hollows, the narrow divides, the plant distribution, and other natural features are much alike. This division, like the former, disappears under the surface and the streams as we go northwesterly through the county. The map and section exhibit this in an interesting manner.

THE UPPER HUDSON RIVER BEDS.

This series make the last and upper division of the rocks of the county, but are not so homogeneous in their character as the other divisions. They differ much at different elevations in soil, rocks, timbers, &c., yet it is not advisable to subdivide them by further names; but some description of the unlike characters is necessary.

The lower part of these beds is tolerably pure thin limestone, containing quite a percentage of phosphate of lime. These limestones are to be seen resting on the Middle beds through the county. They are often irregularly laminated, and were evidently largely deposited in circling currents, which left their impress on them everywhere that they are exhibited to view. The grinding of the currents has left them nearly barren of fossils whose forms can be determined,

but it is the horizon of *Ptilodictya hilli*, *Orthis linneyi*, *Conchicolites corrugatus*, *Retepora angulata*, *Cyrtoceras vallandinghami*, &c. These rocks are about seventy-five feet thick, and give what are usually considered the finest lands in the county. Blue-grass undoubtedly grows better over them than on any other beds, and they lie usually in gentler slopes; but in Spencer there is not a large extent where they are at the surface. Their rich character is largely due to the amount of phosphates which they contain; so in this case the application of bone-dust and like fertilizers is of little benefit. Farmers had, as a usual thing, better experiment on their farms with a variety of fertilizers than to purchase at a large outlay those which their lands do not require. Too much time and means have been wasted from an ignorance of these subjects.

The principal distribution of timbers over these soils was like that in other counties, being largely made up of blue ash, wild cherry, chinquapin oak, hackberry, white ash, sugar maple, black walnut, and shell-bark hickory. One passing through parts of these counties of the Blue Grass Region, and seeing the dying remains of its woodlands, could hardly believe that once this region was covered with a continuous forest of splendid trees.

Overlying the last are some one hundred and thirty feet of limestones that are thin and shelly; except in a few instances, disposed to decompose readily when exposed. These layers are very full of the remains of shells and corals, and, from the vast numbers of one species, have been named the Lynx bed. Through many of these layers there is quite a percentage of clay, which assists very much in their decomposition. Phosphate of lime is present in some layers in considerable quantities.

There are two or three layers of stone in this section which are sometimes worked into very good foundation stones. The same layers, however, when followed for some distance, become unfit for use. All of this section melts down into very fair soils, and where the proper care of them is taken, they are

almost inexhaustible. Yet careless criminality or ignorance has left some sad blots on them over the county in the shape of bare places where the soils have been entirely washed away. These places, by being covered with refuse, are soon restored, and it is now common to see in this county farms which had been thought to be worn out restored to a high degree of fertility. The increase in stock raising and in the knowledge of the proper cultivation of lands and their care have sensibly increased the character and worth of many tracts of land, and it is to be hoped that this will be further extended.

A mixture of maple, red oak, white oak, white chestnut oak, walnut, hickory, black ash, mulberry, white elm, buck-eye, water beech, and red bud were the principal timbers. The forests have been largely destroyed, and there is urgent need that farmers should take some care in propagating a few acres of trees on each farm. In many places, on all the various soils, there is some little pains taken to leave a few black walnuts, but all the other species of valuable trees should be cared for, as it is evident that mixed timbers will grow better, give a better return, and be less liable to death from insects, disease, or other causes than one species. White oak, poplar, wild cherry, black walnut, ash, black locust, mulberry, and catalpa should at least be found in numbers on every farm, and these receive the same care and solicitude as is given to a well-kept orchard.

In this section of the rocks fossils are wonderfully plenty and well preserved. *Orthis lynx*, *Orthis occidentalis*, *Orthis dentata*, *Strophomena alternata*, *Ambonychia radiata*, with various species of chætetes, are especially abundant.

Two specimens of soils were collected from the farm of D. B. Wigginton, some two miles north of Fairfield. The first was taken from a field which had been cultivated for some seventy-five years, and was eight inches of top soil, based on the Lynx beds. The second was subsoil below the first, ten inches in thickness. These samples were forwarded to Dr. Peter, who has furnished me the following analyses:

COMPOSITION OF SOIL AND SUBSOIL, DRIED AT 217° F.

	1	2
Organic and volatile matters	3.550	3.205
Alumina and iron and manganese oxides	7.809	11.849
Lime carbonate	.320	.295
Magnesia	.250	.274
Phosphoric acid (P2 O5)	.236	.221
Potash (extracted by acids)	.228	.470
Soda (extracted by acids)	.192	.117
Water, expelled at 340° F.	.727	830
Sand and insoluble silicates	86.175	82 320
	99.487	99.581
Hydroscopic moisture (per cent.)	1.850	1.063
Potash in the insoluble silicates (per cent.)	1.063	1.206
Soda in the insoluble silicates	.473	.384

A portion of the time this land has been over cultivated in exhausting crops, but yet, as Dr. Peter says, "these still remain better than average soils, the subsoil being especially rich in potash;" and adds: "No doubt their fertility might be improved by an addition to the organic matter—*humus*—by stable manure, or the culture of clover or other green crops to be ploughed under."

Above these is about one hundred feet of mixed layers of limestones and shales. Near the bottom are several layers of heavy-bedded limestones, with more or less clayey matter in them, and mud shales between them. Those layers often have strings of calcite in them, giving what is called a partial Birdseye appearance. In places these layers are firm, solid, good wearing stones, of which houses have sometimes been erected, while at other places they are disposed to break and split into fragments which crumble into soil. This is perhaps largely due to the presence of iron pyrites, which, in oxidizing, rupture the layers, and assist in dissolving them. The soils derived from these and other layers near this horizon give heavy beds of clay, which make quite a good soil, and are highly prized as wheat lands. They grow very fine crops of clover, and are often sown in that plant to improve the soil, and prepare it for grain growing. These soils are

easy of improvement, seeming to possess in themselves all the elements of richness, except vegetable matter, which is given by the turning under of green crops.

The timber here was largely white oak, and these clay lands are usually here known by the name of white oak lands. Sometimes, however, on the flatter ridges, beech made quite a feature, and in this case the larger amount of moisture may have had much to do with the change of timber, and also for the preference of these lands for corn.

The fossils in these heavy layers are several forms of *murchisonias*, *lamellibranchs*, and a *leperditia;* all of them are usually poorly preserved.

At the base of this section is everywhere seen fragments of chert, which must have been at one time a continuous bed in this horizon, but giving many curious concretion-like forms. Throughout this chert, and associated with it, are numerous forms of fossils—*Orthis dentata*, *Chætetes fibrosa*, *Heterospongia subramosa*, &c., silicified. In a number of places, at the heads of drainage lines, where once were evidently marshy places, beds of bog iron ore have been deposited, the presence of the silicious chert aiding in its formation. This ore is sometimes six or eight inches thick, but is quite poor, and very limited in quantity.

Above the last the beds are quite variable. Sometimes there is thirty feet of yellowish sandy layers or blueish silicious shales, with limestones and clay shales. Again these are largely magnesian, showing that the conditions which afterward formed the heavy magnesian limestones of the Upper Silurian had begun its work. Above these, and constituting the highest layers seen in the county, and on its western and northern boundary, is sometimes the great coral bed so common in other counties at this horizon—*Streptelasma corniculum*, *Tetradium minus*, *Columnaria alveolata*, *Columnaria stellata*, *Beatricea nodulosa*, and *Beatricea undulata*. Among these are often some of the brachiopod shells and the smaller corals. These fossils are distributed in soft

earthy limestones and shales, in which indurated clay balls of many shapes are very common. These hardened clay masses resist decomposition in a remarkable degree, seeming at times to remain longer than the friable stones in which they are included.

While this ends the existing rock series of the county, it does not include what has undoubtedly been spread over its whole surface in past ages. Within a few miles from the line of the county the rocks of the Upper Silurian are seen in place on three sides, and the time must have been recent, in a geological sense, since this period had its place in the rocks of the county. All the rocky series described in the foregoing pages have, in time, stretched unbroken over the county, and when we see the great number of valleys which have been dug out of its floor by the action of the present lines of drainage, it is easy to comprehend what an immense amount of material has been removed from over the higher parts of the surface.

Occasionally in the soils are now found silicious remains of rocks and fossils which belonged to series much higher than any which now are seen. These extend up to and include the conglomerate pebbles, which are now, wherever in place, 700 or 800 feet higher than the rocks seen in this county.

The general erosion of the surface of the county is in a northwest direction, and agrees with the position of the KENTUCKY ANTICLINAL, an uplift which passes through the State to the southeast of Spencer county. This erosion has been modified most probably by an uplift in the region of the northern lakes, made subsequent to the greater denudation of the surface.

BOTTOM LANDS.

Along Salt river and some of the larger creeks there are bottom lands which are composed of mixed material brought down and deposited by the action of the streams. As Salt river has its source in Boyle county amongst the waste of the conglomerate, and flows down over the lower subcarbon-

iferous, cuts through all the Hudson River beds and into the Trenton, it may be seen that those alluvial deposits are the comminuted fragments from a great variety of rocks mixed with the vegetable remains from many soils. These bottoms are from narrow strips of sloping surfaces, where the Lower Hudson cuts through, to wide level valleys as the Upper Hudson is reached, toward the west of the county.

These bottoms have been highly prized in time as very fertile lands, receiving, when overflowed, the deposits of fine earth, leaves, and mold brought down by the river. The country above has, however, been so devastated of its timber that the leaf mold and other vegetable matter make but a small part of the present deposits. With the tearing away of the clay soils on the steeper slopes of the county, clay is becoming, in many places, the larger portion of the deposits. Thus it is evident that many of those richer bottoms which line the streams of Central Kentucky are becoming harder to work; later to become dry in the spring, and poorer in the vegetable matter which adds richness to our soils.

ARCHÆOLOGY.

I could learn of no mounds or graves of prehistoric character, yet the various implements usually associated with them have been ploughed up in many fields in different parts of the county, and especially along the line of Salt river and Brashears creek. These have been usually destroyed or removed from the county, and no record of them has been kept.

APPENDIX A.

STATISTICS OF SPENCER COUNTY, COMPILED FROM THE REPORTS OF THE 10TH CENSUS OF THE UNITED STATES, 1880, AND OTHER SOURCES.

1880. Total population	7,040	Miles of turnpikes	
1870. Total "	5,956	Average cost of turn'kes per mile,	
1860. Total "	6,188	Total cost of turnpikes	
1880. White "	5,414	Number of horses	2,827
1870. White "	4,477	Number of mules and asses	601
1860. White "	3,974	Number of working oxen	4
1880. Colored "	1,626	Number of milch cows	1,827
1870. Colored "	1,479	Number of other cattle	4,338
1860. Colored "	2,214	Number of sheep	15,125
1880. Native "	6,940	Number of swine	15,892
1870. Native "	5,854	Pounds of wool	68,300
1860. Native "	6,097	Pounds of butter	120,761
1880. Foreign "	100	Pounds of cheese	1,590
1870. Foreign "	102	Gallons of milk	2,000
1860. Foreign "	91	Bushels of Indian corn	528,987
1880. Taylorsville, population	537	Bushels of wheat	116,006
1880. Mt. Eden, population	115	Bushels of oats	18,743
Number of farms	810	Bushels of rye	6,789
Acres of improved land	96,542	Bushels of Irish potatoes	7,990
Value of farms, including buildings and fences	$2,253,229	Bushels of sweet potatoes	560
Value of farming implements and machinery	$77,630	Bushels of barley	858
Value of live stock	$376,177	Bushels of buckwheat	
Cost of building and repairing fences, 1879	$30,284	Tons of hay	2,374
Cost of fertilizers, 1879	$461	Value of orchard products	$14,798
Estimated value of all farm products, 1879	$379,597	Pounds of tobacco	28,185
Assessed valuation, real estate,	$1,450,089	Manufact'ing establishments, No.,	15
Assessed valuation, per'l prop'ty,	$374,026	Capital invested in	$27,100
Assessed valuation, total	$1,824,115	Hands employed in	28
Taxation, State	$8,299	Wages paid in the year	$3,024
Taxation, county	$4,100	Cost of materials	$73,675
Taxation, town and school dist.	$335	Value of products	$89,361
Taxation, total	$12,734	Bonded debt	$245,500
Miles of railroad	7.35	Floating debt	
Valuation of railroad in county	29,400	Total debt	
		Sinking fund	
		Net debt	$245,500
		Total number acres of land, 1881,	116,017
		Av'age listed value per acre, 1881,	$11.61

GEOLOGICAL SURVEY OF KENTUCKY.

JOHN R. PROCTER, DIRECTOR.

REPORT

ON THE

GEOLOGY OF NELSON COUNTY.

BY W. M. LINNEY.

JOHN D. WOODS, PUBLIC PRINTER AND BINDER.

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GEOLOGY OF NELSON COUNTY.

GENERAL NOTES.

Nelson county was founded by the General Assembly of Virginia in 1774, being the fourth in the State—then the District of Kentucky. At that time its territory was very large, but by the successive formation of new counties its area has been reduced, until now its superficial extent is comprised within about two hundred and fifty thousand acres.

This county lies in the north-central portion of the State, and is bounded on the north by Bullitt and Spencer; on the east by Anderson, Washington and Marion; on the south by Washington, Marion and Larue, and on the west by Larue, Hardin and Bullitt counties. The population in 1880 amounted to sixteen thousand six hundred and nine.

Bardstown is the county seat and principal town. It is one of the oldest towns in the State. Its population according to the late census was one thousand eight hundred and three. Here is located St. Joseph's College, an old, well known and well established institution for the education of young men. Here also are situated two high schools, for the education of females, which have deserved reputations.

Bloomfield and Fairfield, in the northern portion of the county, and New Hope and New Haven, in the southern, are small towns, and besides these are a number of small villages and railroad stations scattered through the county. At Nazareth Station, on the Bardstown Branch of the Louisville and Nashville Railroad, is located Nazareth Academy, a female school of long and faithful standing. Southeast of Bardstown is located St. Thomas' Orphan Asylum. Several parochial, and

the regular common schools of the county, give altogether more than the average facilities for general instruction.

In the southern part of the county is a monastery under control of the Monks of La Trappe. There is a school for boys connected with this institution.

The Louisville and Nashville system of railroads has three several branches traversing different portions of the county. The Knoxville Branch along the southern border, the Bardstown Branch through the center, and the Cumberland and Ohio Division enters the northern. The location of all these are exhibited on the map.

The turnpike system is not near as good as it should be. There are a number of these in the county, and portions of the northern part are tolerably well supplied, but other portions have roads which through part of the year are almost impassable. A good system of common roads is of more general use to a larger number of persons than even railroads, and the character of the roads shows largely the character and wealth and intelligence of the people.

TOPOGRAPHY.

The surface features of Nelson are quite varied in their character. In the northeastern portion the streams have eroded deep into the surface, and the hills and hollows with steep slopes give the character of roughness to the country. A close net work of small streams make the ridges quite narrow, some of whose slopes are quite rocky. West of this the lands are not so broken, but still are quite rolling, but give comparative easy cultivation. Through the center of the county are some very level tracts unbroken for some distance with streams, which have cut but little beneath the surface. The southern part is made up of broad, flat bottoms on the streams and the so-called knobs, which rise in isolated knolls or in connected ridges at elevations of two to four hundred feet.

These hills, or knobs, add much to the variety of surface features, for on looking over the country from the common emi-

nences, the channels of the streams are not seen and a general levelness appears, but those hills are to be seen for many miles. The most of them have some local name to distinguish them, and some beautiful landscapes may be seen from some of them. Rohan's Knob is the best known and most easily recognized. The top is one thousand and fifty-three feet above the sea level, and so isolated is its character that for miles around it the whole county is more than three hundred feet below its summit. It is a well known landmark, and from its top one may see portions of a number of other counties. The semi-circle of blue hills which seem to inclose it in the distance on a clear day are perfectly outlined, and the sunshine and shadows cast pictures of beauty among the jutting rocks, the bare spots and amid the forest covering. Following them in the farther distance, they seem to melt away in the distant horizon. This should be a point for the summer tourist, be he idler or student, for beside the beauties of the landscape, there is much to interest in the species of plants which grow over the different rocks and soils.

This county is well watered. Salt River is on the line in the northeastern corner. Beech Fork flows on the eastern boundary for a number of miles, and then through the south-central part to its union with Rolling Fork. The latter stream is the boundary on the whole of the southern border. Each of these streams were formerly used for the transportation of the products of the county, but no flat-boats have been built for this purpose for a number of years, consequently these streams have ceased to be highways of navigation, except for saw-logs, which are floated down for a few miles to some mill.

GENERAL GEOLOGY.

The following section illustrates the geology of the State, the numbers referring to Dana's table. The maximum thicknesses of all the formations have not been determined.

GENERAL SECTION OF THE ROCKS OF KENTUCKY.

Quartenary.	Quartenary.	. . . . .	. . . .	. . . .
Carboniferous.	Coal Measures	. . . . .	14*b*	
	Conglomerate	. . . . .	14*a*	
	Sub-carboniferous	Upper. . . .	13*b*	
		Lower. . . .	13*a*	
Devonian.	Hamilton Period	Black slate. .	10*b*	150
	Corniferous Period	Corniferous. .	9*c*	
Upper Silurian.	Niagara Period	Niagara . . .	5*c*	100?
		Clinton . . .	5*b*	75?
		Medina . .	5*a*	20?
Lower Silurian.	Trenton Period	Hudson . . .	4*b* & 4*c*	650
		Trenton . .	4*a*	200
		Birdseye . .		180
	Canadian Period	Chazy	3*c*	350

The rocks as seen in Nelson county extend from the Hudson River Group up to, and include, a part of the Upper Sub-carboniferous, and aggregate a total thickness of about eleven hundred feet. The lowest rocks are seen in the northeastern part of the county, where the Lower Hudson Beds are exposed in the banks of Salt River and Chaplin Fork, and the highest are seen on top of the knobs, south of New Haven. These are the

geological elevations, and differ from the geographical elevations. The lowest geographical point is at the mouth of Wilson's Creek, where the elevation is about four hundred and eight feet above the sea; while the summit of Rohan's Knob, the highest, is as before stated one thousand and fifty-three feet. There is thus a geographical difference of six hundred and forty-five feet, while the geological difference is only about three hundred feet. It must then be seen that the rocks of the county are not level, else these differences could not exist. There is a general dip to the northwest through the county, with a falling away to the southwest; or in other words the roads along the eastern part of the county are higher elevated than they are on the west and they are also higher on the northern than they are on the southern.

From this slope of the rocky floor of the county it is possible to obtain a flow of artesian water at any place in its boundary, whenever this kind of well may become desirable or necessary, and with the understanding that a water-bearing rock shall be penetrated.

Like in all the knob region surrounding the Silurian area of the State, futile attempts have been made in Nelson to find coal. It seems needless to say that there can be no coal found in any of the formations which are seen in the county. By an examination of the section on a preceding page, it is easy to understand that the highest rocks seen in the county are much too low in the geological scale, and though it is probable that at one time the coal measures extended over the whole extent of the county, they have been carried off by the same means which are now hurrying away the soils from every field.

The section of rocks of this county are exhibited in the following order and thickness:

	Feet.
Upper Sub-carboniferous	60
Lower Sub-carboniferous	300
Black Slate	60
Corniferous Limestone	67
Niagara Group	75
Clinton Group	13
Medina Group	12
Upper Hudson River Beds	300
Middle Hudson River Beds	150
Lower Hudson River Beds	100
Total	1137

In traversing the county from the northeast corner to the southern extremity, all these divisions are successively passed over. They each give a different expression to the surface, and each constitute a difference in the soils as derived from them, and to a close observer there is a well marked character in the native trees and other plants which grow over them.

DETAILED GEOLOGY.

LOWER SILURIAN.

Lower Hudson River Beds.—As has been stated, these are the lowest division of rocks exposed in Nelson county, and are only to be seen in the northeastern portion where Salt River, Beech Fork, and their smaller streams have cut down into them. At their highest point on Chaplin Fork, they rise to a little more than one hundred feet above low water, and gradually slope down with the stream until near Glenville they disappear beneath the river. As the uplands here are over two hundred feet above the valley, there are consequently no amount of soils which are derived excluively from these rocks. Their characters have been described in the Reports on Spencer and Washington counties. The same characters belong to them here; and their outcrops are marked with white oak timber where it has not been destroyed.

Middle Hudson River Beds.—These beds, like the former, are only shown in the northeastern corner of Nelson, but are more conspicuous as they make most of the surface in the Chaplin precinct, and extend to the north, east, and south of the village of that name. Over these rocks the country is much broken, and the narrow ridges with deep hollows between them remind us of the same beds in Garrard and Madison counties. Some little change has been produçed in them, for the heavy masses of concretionary sandstone have thinned down until they have almost disappeared. It seems also that a limestone with the large wave-like marks have taken the place of one of the sandstone layers.

These large wave-like marks are very persistent, as they are seen in several horizons in every county that I have had a chance to study, while their origin seems to be very obscure. I have only seen one condition any way analagous to them, and that only on a small scale. Some of our creeks contain a great deal of fine gravel, which is moved by every freshet which takes place in them. Several times after a high, rapid rise in some of them I have seen the gravel left in ridges, extending with the force of the waters nearly in sizes and curves as in the ridges in the rocks. It thus seems to me that however long and wide an area is covered with this feature, that the floor of the old ocean as covered with the shifting sands must have been lifted suddenly and the waters rushing down the slope have left the fine particles just as the rush of water in those little streams to-day leave them as if they were great wave marks.

The silicious soils of this division have been badly treated in this county. The timber has been largely destroyed, and an incessant cultivation of the lands in corn has been the rule. Hogs were the principal export for a long time, and as much of the corn was eaten by them in the fields at a time of the year when the heavy fall rains fell, their rooting up the soil left it in the condition in which it was rapidly washed away from the steep slopes.

Some of these lands are in a deplorable condition, and but few of them have received much care. The great prevailing timber, as is usual on the silicious mudstone, was beech, with some other timbers, as walnut and poplar, but these have been largely destroyed. Young trees are growing over some of the exhausted lands, and give promise for the future, if taken care of.

From all the observations which I have made over eleven counties where these beds are exposed, I know of no soils so well adapted to the rapid growth of timber as are these. The most of our valuable timber trees which are indigenous to Central Kentucky seem well adapted to these soils. Their deep decomposition give the roots ample conditions to reach far

beneath for their food. The mixture of lime and silica gives the elements necessary to make a good quality of wood, and their permeability to water gives the requisite drainage, as well as a sufficient supply of water at all seasons for the maintenance of their growth.

All of these steep slopes should be in forests and grasses. A forest culture here, conducted in an intelligent manner, would be a heritage of wealth for the future. When it is known that much of this land has produced, year after year, without extra culture or the use of fertilizers, eighty and ninety bushels of corn to the acre, its natural quality may be understood. No careful attempts have been made to have paying orchards or vineyards, yet these would undoubtedly succeed well.

With the good quality of these soils, and their susceptibility to great improvement by the proper rotation of crops and grasses without the aid of foreign fertilizers, a population that has learned the proper care of lands would make these steep hillsides as fertile as the most vaunted lands in the State.

Upper Hudson River Beds.—This division of the Hudson River Group is the largest in area, and the most important in some respects in the county. As will be seen by the map it is confined to the northern portion, except where it has been cut into by the streams, more to the south. As has been stated, it has a thickness of about three hundred feet, and as the rocks have been described in the reports on Garrard, Lincoln and Washington, but little need be added here.

The lower portion, which is everywhere the richer in all the elements which make the best of soils,* are seen from Chaplin to Bloomfield, and for some distance around the latter place. Here they are of that gently rolling character which give good drainage without being disposed to wash badly, and everywhere present a pleasing landscape. Rich bluegrass pastures lie between well cultivated fields, which are more highly prized than any lands in the county. The grains grow to perfection, and at one time quite an acreage of hemp was produced. The

*See Analyses of Soils, Appendix A.

trees common to this class of soils are seen here where they have not been too largely destroyed. Blue ash, chinquapin oak (*Quercus muhlenbergi*), wild cherry, hackberry, mulberry, and other species were common and still exist in variable numbers. In very dry seasons these lands in many situations are disposed to burn, and then the crops and grasses are not so good as those on soils which hold more water beneath.

Several layers of phosphatic limestone come into this strata, and its natural decomposition adds perhaps enough phosphates to the soil, so that the purchasing of bonedust as a fertilizer add no perceptible percentage to the crops grown over them.

Stretching in a half circle around the Bloomfield soils, and based on somewhat higher rocks, is another class of soils which have been derived from the decomposition of the one hundred or more feet of rocks which have been termed the Lynx Beds. The rocks as a general rule lie deeper beneath the surface of the soil, while the shales which come between the layers of limestone give a more clayey character to the soil.

These soils have always been considered as excellent wheat soils, and many of the fields have been injured by too large a cultivation in this grain. The lands are more rolling than around Bloomfield, and were they of the same character of soils would wash very badly, but the clay is of that character that it does not require extraordinary care to prevent their wasting away. These soils which are seen around Fairfield in every direction seem to have every element in them to keep them as very desirable lands. But there is too little application of barnyard manure, and much too little of the sowing of clover and other green crops to be turned under by the plough. The humus has been cleared from the lands by years of cultivation and too little replaced. The turning under of green crops have a chemical effect upon the mineral constituents of the soil, preparing them as proper food for succeeding crops, aud also correct these clay soils in warming and making them lighter and more easy to cultivate.

Above the rocks holding the *Orthis lynx* is another set of

soils which differ to some extent from either of the others of the Upper Hudson River Beds. These have at the base several thick-bedded limestones, which are more indestructible than the thinner layers which underlie and overlie them. This is so perceptible that they are nearly always seen outcropping around and on top of the hills. These rocks all contain more or less balls or nodules of clay in them, which are very hard, and the soils here are more friable and apt to wash, thus leaving the heavy layers exposed.

This last division is not so uniform over the county as any of the other groups. At some places the section resembles the character as seen in Garrard and Madison, where the shales and half sandy layers culminate in the top of the Hudson Beds with the great bed of columnaria corals. On the other hand, changes are seen on the southern border of this exposure where some of the elements are left out, and several layers of magnesian limestones and shales come in below the coral bed.

It seems that here in the beds of the Upper Hudson the conditions which afterward ended in the formation of the great deposits of the magnesian limestones, which made up the rocks of the Upper Silurian, began their work.

The *Orthis lynx* Bed is finely developed in this county, all the varieties are present, and are to be found in immense numbers, while associated with them are the usual fossils found at this horizon. *Rhynconella dentata*, *Strophomena rhomboidalis*, and *Zygospira modestea var. kentuchensis* are more common than I have met with before.

There is much interest centered in the great coral reef which lies at and near the top. It is found at every exposure in the county where its horizon is to be seen. So common is the form, *Columnaria alveolata*, that their large coralums are used in places for stone fences, piled up to prevent the wasting of the banks of creeks, and for miles they are the best or easiest procured material to macadamize the turnpikes. The bed is sometimes twenty feet thick. Sometimes the corals are imbedded in limestone; sometimes in clay shale or even in

clay beds. The interiors are always more or less crystalized, but often the exterior is beautifully preserved. *Tetradium minus* is generally but not always seen associated with it, while *Beatricia*, *streptelasma* and *Orthis occidentalis* are common associates. Sometimes above the bed is a heavy, impure rock, and on top of this is ten or more feet of clay beds, containing *Rhynconella copax*, *Orthis quadrata*, *Streptorhyncus peamunbona*, *Protaria vetusta*, and some other fossils.

I collected one soil for analysis from the farm of S. P. Stiles. It was of a light-brownish buff color, very friable, and containing no gravel. From where it was taken it was as light as a bank of ashes, did not wash much; had perhaps been in cultivation for forty years or more. Mr. Stiles thought it quite unproductive. Dr. Peters has furnished me with the following analysis:

Organic and volatile matters	3.020
Alumina and iron and manganese acids	9.772
Lime carbonate	.145
Magnesia	.305
Phosphoric acid (P_2O_5)	.173
Potash extracted by acids	.438
Water expelled at 340° F.	.612
Sand and insoluble silicates	84.820
	99.285
Potash in the insoluble silicates (per cent.)	1.200
Soda in the insoluble silicates (per cent.)	.646
Hygroscopic moisture (per cent.)	2.350

There is some less lime in this soil than is usual at this horizon, but it shows a large percentage of potash, and the above analysis shows it to be better than the average of soils. It would be improved, however, by the turning under of green crops or the application of leaf mold or stable manure.

Other Features.—In these rocks of the Hudson River beds there are no large springs, and largely the water supply for household purposes is drawn from wells and cisterns. The character of the rocks are such that not a great deal of water penetrates down through the limestones and the nearly impervious shales which lie between them. Ponds are easily

made, and these are very common over much of the territory underlaid with this series.

Clays for brickmaking purposes are freely distributed, and a fair article is manufactured, as quite a number of substantial residences illustrate.

Building stones of good quality are not always convenient of access, but stones which are suited for foundations for houses, stone fences, and other common uses can be taken from the hillsides on nearly every farm.

The soils are capable of being improved to a large extent without the addition of foreign fertilizers, though in some cases their intelligent application would be of much benefit. There is not that care taken to save the waste products of the farm and stable, and their preparation as compost.

In some parts of Europe so important is this saving considered that children follow the roads traveled by animals and collect all their droppings into baskets. With some of the farmers of our State the rule is as opposite as it is possible to be, for they build their stables and pools directly over or by a creek, where all the rich manures are washed away by every rain that comes. It is no wonder that some of our soils become poorer every year.

UPPER SILURIAN.

Niagara Period.—To the northeast and north of Kentucky the Upper Silurian Formation is one of great extent and thickness. In places its various strata measure more than three thousand feet. Like all the other formations it comprises various types of sandstones, shales and limestones, and is divided into a number of distinct periods and minor divisions. The larger part of these divisions are absent in the west and perhaps the whole of the formation comprised in the rocks of Kentucky, Tennessee, Indiana and Ohio are included in the Niagara Period. The rocks comprised in this period have thinned out to the west and have lost largely their distinctive characters. For this reason it has been

quite difficult to separate them into their lesser groups. This series of rocks was named from their occurrence at Niagara Falls and in the cliffs below.

The rocks of the Niagara Period are divided into the following epochs—Oneida, Medina, Clinton and Niagara, divisions which have not all been satisfactorily made out in the West, and in Kentucky they have been included in the general term Niagara. It would not for economical purposes make any difference about the determination of the smaller groups, but as scientific facts in the study of the changes of conditions over this region during the deposition of these rocks it would be of some importance if they could be known.

On Scrub Grass Creek, in Boyle county, some years since, I found resting upon the top of the Hudson River beds a conglomerate two inches thick with the characters as given the Oneida Conglomerate in New York. It is the only point at which I have been able to find it, yet it is not unusual to see in our soils and in the beds of many branches of Central Kentucky gravel which may have resulted from the destruction of the same rock.

Throughout the counties which I have studied, reaching from Clark to Nelson, wherever the upper limit of the Hudson River Beds are reached they are overlaid with an argillaceous sandstone, which is quite fragile in exposures and disposed to break up into small squares. In some places it is quite a tough stone and wears well when put into structures, but more often it is quite treacherous and unfit for any purpose. This rock is sometimes filled largely with the casts and impressions of branching forms of sea-weeds, but in such poor state of preservation that it is not possible to determine their species. This sandy mud rock is present at all the exposures at the base of the Upper Silurian rocks in Nelson county, varying much in thickness, but holding its usual character without much change. This rock can be seen at different exposures varying from three to twenty feet, sometimes appearing massive and at others seen only in thin sandy-like layers, which have split and eroded from its bedding.

This sandstone holds the position and the lithological characters, in part, of the Medina and is probably the western extension or representative of that epoch, yet it is too soon in the detailed work of the State to refer it definitely to that group. Other facts may be brought out in the prosecution of the work in other counties where it is exhibited which may determine its proper place in the formation.

The sandstone in Garrard, Lincoln, Madison and part of Marion counties is overlaid with a number of feet of various colored shales to which I gave provisionally the name of Crab Orchard Shale. This shale is seen near the Church of the Holy Cross, in Marion county, not more than a mile and a half from the Nelson county line, and though, there, showing all the characters and thickness as shown in Lincoln county, it was not seen in Nelson in a greater thickness than two or three feet. This shale I had concluded was a part of the Clinton Beds and have seen no reason since to change them to any other division.

Above those shales are imposed a number of feet of limestones. These are sometimes coarse, crystalline and uneven in their bedding, often heavy balls and nodules of iron pyrites included. Where they have leached out they leave on the face of the strata a series of irregular holes, which from their size and usual shape may have been the moulds from which have leached out shells of *Pentamarus oblongus*. At other places the strata seems to have no regular bedding and breaks every way with very irregular surfaces. Included in this rock is often the casts of the aforementioned shell with a number of other fossils which are difficult to determine. Toward the top of these limestones, where they are in full force, is a number of fossils included in layers of cherty hornstone. Among these may be mentioned *Favosites niagarensis*, *Stromatopora concentrica*, *Atrypa reticularis*, *Leptœna sericea*, *Strophomena rugosa*, with fragments of trilobites and bryazoa. These layers perhaps represent the Clinton Limestone.

The next part of the Upper Silurian seen in the county is a group of variegated shales which vary very much in thickness in different parts of the county, sometimes being reduced to less

than a foot and again aggregating to thirty-five feet. These are red, yellow, blue and green in separate parts, but when exposed for a long time the iron which gives them their colors leaches out, and they become yellow and even dirty white. These shales, decomposed to clays, are seen in many places in the county on the surface, sometimes as sterile spots and at others as cedar glades. This clay is stiff and tenacious, and some of the roads passing over it become almost and even quite impassable at certain seasons of the year. They are not readily permeable to water to much depth, but when trodden by animals and vehicles during the wet season, they soften and become a stiff mud. Usually the water from rains runs off the surface, without much penetration.

These shales are overlaid with a massive layer of limestone which is often fourteen feet in thickness. This is a cavernous rock, giving quite a number of small caves, and besides the whole rock is porous, being everywhere filled with small cavities from which various fossils have in time been leached out. The rock is a magnesian limestone, but the fossils were carbonate of lime, and from their chemical character more easily acted upon by the carbonated waters passing down through them. When broken the porous character of the layer can be seen on every face. It does not quarry easily, and is not for this reason used for any purpose, except at times it may enter into the erection of stone fences.

This cavernous member is the reservoir for a great number of fine springs in the parts of the county where it is near the surface. Water penetrating the soils above enters all the little cavities and fills them and passing down through the rock flows off on the layer of impervious shales beneath. Some of these springs can be termed magnificent, as they afford so large and continuous flows of water. These shales are often washed from beneath the bluffs of this limestone, and then the large overhanging masses of rock break off and fall into the hollow beneath. This character has produced many steep gulches in the county, and where a stream of water passes over those ledges a waterfall is often to be found. During and after hard

rains many of these cascades are pretty as well as very interesting. Some little romantic cliffs are shown in the county which have been produced in the above manner, and so characteristic is this feature that this series is oftener known by the name of Cliff Limestone than any other.

Above the porous limestone is a number of layers of smooth even-bedded magnesian limestones. They have no clay or shale partings, are disfigured with few seams or nests of spar, unusually free from nodules of iron pyrites and are quite homogenous in structure, chemically considered. These layers contain on analysis by Dr. Peter:

Lime carbonate	50.00
Magnesia carbonate	35.00
Silica and silicates	10.00
Alumina, iron, etc.	5.00
Total	100.00

These beds are probably the equivalent of the Springfield stone of Ohio, a building stone held in very high estimation in parts of that state, and very largely quarried at Yellow Springs and vicinity. Prof. Edward Orton, Vol. II, Geology of Ohio, page 672, gives on authority of Prof. Wormley the following as the composition of the Springfield stone:

Carbonate of lime	51.10
Carbonate of magnesia	41.12
Sand and silica	5.40
Alumina with trace of iron	1.40
Total	99.02

These layers are not continuous over the Upper Silurian region of the county but extend nearly uniformly in a northeast line across the center of the county. Toward the South they change, as do all the other members, and become thinner. Whether they were thicker to the north and east in time we do not know, as there are no evidences presented to demonstrate that point, but that the Upper Silurian once covered the Lower Silurian rocks all over the county seems evident to my mind.

The balance of the Niagara rocks in the county exposed above these are of not much economic importance. They are yellowish, soft, easily eroded magnesian limestones and shales, and when in place are usually covered with the clays and chert derived from the decomposition of the next higher group—the Corniferous Limestone.

The following section is seen on Mill Creek, near the residence of B. Humphrey:

No.		Feet.	Inches
1	Corniferous waste (clay and hornstone)	. .	. .
2	Covered space	14	. .
3	Magnesiam limestone layer	1	. .
4	Shales	19	. .
5	Soft buff magnesian limestone	2	3
6	Rough bedded layer buff limestone	. .	9
7	Light buff magnesian building stone	1	5
8	Light buff magnesian building stone	. .	11
9	Light buff magnesian building stone	1	4
10	Light buff magnesian building stone	1	. .
11	Light buff magnesian building stone	. .	10½
12	Dark buff magnesian building stone	. .	7
13	Dark buff magnesian building stone	. .	5
14	Light buff magnesian building stone	1	3
15	Light buff magnesian building stone	. .	3
16	Light buff magnesian building stone	. .	10
17	Light buff magnesian building stone	. .	7
18	Light buff magnesian building stone	1	2
19	Light buff magnesian building stone	. .	1
20	Light buff magnesian building stone	1	6
21	Light buff magnesian building stone	. .	3
22	Light buff magnesian building stone	1	2
23	Light buff magnesian building stone	. .	10
24	Massive layer, cavernous more carbonate	12	. .
25	Soft earthy limestone and shales	10	. .
26	Thin layers magnesian	2	3
27	Heavy magnesian layer	1	6
28	Sandy shales and sandstones	15	. .
	Total	92	02½

The numbers from seven to twenty-three inclusive are evenly bedded, of great uniform thickness, without partings of shale or other material, are of a tint interiorily which is difficult to define, but perhaps would be better characterized as an olive grey. They all, however, change where exposed to atmospheric influences to various shades of buff. These layers have been quarried; some for local use, and have stood exposure for

a long time remarkably well. They are easily raised from the quarry, and work under the chisel with much facility. This locality, if close to transportation, would make one of the most valuable quarries within many miles.

A section of near one hundred feet of the Upper Silurian is exposed on the east side of Bardstown, and there are many places to the east, south and west of the town where good sections of part of the series can be seen, and the individual characters of the various members studied.

The fossils existing in these rocks are not in great numbers, and exist only as casts in the Niagara and the Clinton, excepting the *Favosites niagarensis* and *Stromatopora concentrica*, which are silicified. In some places the common trilobite of the Niagara *Calymene niagarensis* is quite common around Bardstown, and some good specimens of their casts are obtained.

The building stones are in immense quantities, and many quarries could be opened if there was sufficient demand for their products. The Louisville and Nashville Railroad has several quarries along their Bardstown branch, mostly in Bullitt county. From these openings large quantities of stone are raised and shipped along its various lines for the construction of culverts and bridge masonry.

A number of the layers of the more earthy magnesian layers of the Upper Silurian in this county would make a good article of hydraulic cement. At many places they are so exposed on and near the surface that they could be quarried very cheaply.

The porous character of the massive cavernous layer is finely illustrated in some situations. In a bottom above Wm. Irvine's, where this stratum is about fourteen feet thick, a number of large blocks have fallen from the bluff above, and lie isolated in the valley. It had rained three days before, and upon examination the water which had fallen on the surface was dropping from the bottom and sides after that length of time. The moisture held within was sufficient to keep trees, several inches in diameter, growing thriftily on the top of these rocks.

The building stones have a better appearance in rough

exteriors than when polished. Their varying shades of buff give them an ancient appearance, when not smooth, which is very pleasing to the eye of many persons. It also requires some care in the selection of the various stones, as some of the layers are not as durable as others. The best courses are real durable stones, and have many characters to recommend them.

The clays derived from the Niagara Shales are well suited to the manufacture of common pottery ware, and the supply is practically inexhaustible. For brick-making purposes, drain, and other tiles these clays seem to be well suited, and if practical tests were made, a large industry of this character could be built up in this county. A large number of acres of land in the county would be much improved by a system of tile drainage, and the manufacture of them in the county might bring them into general use where most desired.

The soils over the Upper Silurian are as various as the rocks of the formatiom which come to the surface and are decomposed. Those coming from the sandy beds at the base are very apt to wash badly, and so rapid is this erosion in places that many small spots are left uncultivated. Those soils derived immediately from the limestones, rank very well, especially when covered with the clays resulting from the decomposition of the Corniferous Limestone. The best soils lying on this formation are what are termed locally poplar flats. These poplar flats are quite extensive at times, and are highly prized as agricultural soils. They are level or very gently inclined fine lands, situated at the summit of the Upper Silurian, but covered with a red clay soil derived in the larger part, and perhaps in whole, from the Corniferous Limestone. The Corniferous is richer in the elements which make a fertile soil than the Niagara limestones, and, here, are more easily broken down into soils. It is an instructive fact, that here such a large section of the county should have its soils derived from a thickness of rocks that did not exceed seven or eight feet in thickness. Their degradation and decomposition to the exact horizon of these few feet of rocks is remarkable, and as the future fertility of these tracts is based upon the preservation of these few feet

of earth, it can well be understood how the utmost care should be allotted them to prevent any unnecessary waste from heavy rains or unwise tillage.

These flats supported formerly an immense number of large yellow poplars; with these were sugar maple, white oak, red oak, white elm, black gum, white ash, soft maple, rarely beech, and black walnut. Dogwood was the usual undergrowth. On these lands were sometimes clumps of chestnut, which is a very unusual position for them, as their station is usually not lower than the sub-carboniferous.

On the sandy layers, as well as on the Niagara Shale, the timbers are largely post oak, star oak, Spanish oak, sassafras, white oak, winged elm, persimmon, etc. The winged elm is larger here than I have seen it at any other locality; some beautiful specimens were met which were sixteen inches in diameter, while their numbers are unusually large. The red cedar is, however, in greater numbers over the Niagara Shales than any other species, and grows also over the sandy layers at the base of the section. The outcrops of the rocks can often be determined for long distances by the disposition and growth of this species.

At Balltown, and for some distance around it, a singular feature in the distribution of timber occurs. In all the counties to the south there are no pines to be seen, except on the knobs where the more arenaceous shales are left as the capping stones. At all such points they flourish in numbers, and it is only rarely that one is seen below the horizon of the hard shales, and then only when some of the same rocks have fallen below and mixed its constituents with the Black Slate or Waverley Shale. At Balltown, however, the same pines are distributed all over the Niagara Shale in large numbers, and the young growth is mostly of this species. So plentiful are the pines here that the making of tar has been carried on for a long time, and still continues to be a regular industry.

Some mention has been made of the springs which flow out from the base of the cavernous layer. There are a great number of these, and while they flow from magnesian limestones,

the magnesia is of that character which is not readily dissolved in water. I did not learn of any true epsom water in this horizon, yet there are places where they may exist, obtaining their magnesia from the shales which lie near the base or even from the Niagara Shales.

Wells sunk into the cavernous member find an unfailing supply of water usually. The exit of the springs are controlled largely by the dip of the rocks. In some cases they flow entirely from one side of an exposure, and never from the opposite. The dip can thus often be determined by the line of springs around the circle of a large outcrop.

DEVONIAN.

This, another great formation, with a number of distinct groups of rocks, has also thinned out to the West and in Kentucky has only two representatives which are constant in their character. These are the Corniferous limestone and the Black Slate. Both of these are to be seen in the state whenever their proper horizon is exposed.

Corniferous Limestone.—This group, which makes the rocks over which the falls at Louisville descend, is a continuous one around the Silurian basin of Kentucky, and is thinner than usual in Nelson county. Here it seems to have a thickness which does not exceed more than seven feet. In some of the counties it is quite massive and largely filled with hornstone (flint) and the fossils which it contains are almost always silicified. In its outcrops in this county it contains rocks of two kinds: one a light grey half-crystallized limestone, one to two feet thick. This stone is largely made of the stems and fragments of crinoids but contains also several species of horn-shaped coral. This stone is not used for any purpose in the county, but is a good wearing stone, and would make a fair article of lime. The fossils are of the same structure as the body of the stone, and are not separable.

The rest of the series is made up of several layers of a dark buff stone, containing some magnesia, but not to the extent of

the Niagara. It contains quite a percentage of argillaceous matter and some iron.

This stone decomposes into a red clay which is not easily eroded from the surface, so that it can often be seen where the rocks themselves have entirely disappeared.

These clays contain much of the elements which characterize good soils, and through the State rank very well. Mention has been made of the fact that a large part of the soils over the poplar flats are derived from this series of rocks, and it is very probable that the Corniferous was thicker to the north of its present line of outcrop in Nelson.

One of these layers was in many places filled with the hornstone, and the fragments of it are in many places strewn over the soils. Fossils are not usually plenty in the wasted beds or in the rocks now remaining, but I was enabled to find specimens of *Phillipsastrea gigas*, and several species of favosites and zaphrentis corals, which are usually met with at this horizon. Some of these tracts were evidently once wet, swampy flats, as in places over them have been deposited bog iron ore and bog manganese.

Black Slate.—This group of strata is well known in all the counties where it is exposed. It is so continuous in its extent and so homogenous in its color, structure and other characters that it can be recognized at a glance. It lies on the top of the Corniferous limestone in all the southern portion of Nelson county, where it has not been cut through by the streams and eroded from the surface. It has an average thickness here of about fifty feet, being in some places not more than forty but rising in the western portion to sixty feet.

There is no one place where its outcrop can all be seen at once, yet they are many places where partial sections can be seen and measured and its character studied. When a cut has been made into this slate it is seen to be quite hard and solid, with an intensely black surface. When exposed it becomes fissile, splits into fragments, and rapidly loses its color, becoming an ashen grey.

The black color of this slate is due to the presence of bituminous matter, of which it holds in its unleached condition a large percentage. Efforts have been made in all the near counties to find reservoirs of petroleum in it, and so often is this talked about and so many persons are found who are willing to engage in the enterprise, that it is thought best, even by repeating what has been so often written, that the conditions do not exist in this region where the boring of wells for oil would likely prove a success.

There are no large districts in this county where the slate lies unbroken and covered with the condition by which the storage of oil in large reservoirs can exist. Every stream which runs on the surface has cut down into and beneath its bed, and as the oil is decomposed from the shales continuously, it escapes by innumerable channels to the surface and is lost.

This escape can be seen by careful investigation at many places, where the shale outcrops, for it is not unusual to see the water which comes from these rocks bearing a film of oil on its surface. The quantity as seen under such circumstances is much smaller than is generally supposed. A single spoonful of oil on water will cover a large surface and less than this quantity seen at one time has led to the exploration, by boring or digging, to find its source in some vast deposit.

Much money has been uselessly expended in this search, where the conditions were as fully favorable, or even more so, than can be seen in any part of Nelson. It seems from all the examinations made here that it is almost certain that any efforts made for finding petroleum in this county can only end in failure.

Sulphide of iron is commonly present, especially in the lower portion of the Black Slate. This in its destruction within the slate often forms sulphur springs, of which they are several in the county. These springs are generally well known and are resorted to by the people who live within easy reach of them. The change which takes place in this form of iron often discolors the laminæ of the slates, so that on partial exposure they are yellow, brown, green and red. At some places the quan-

tity of this iron appears to be in excess. In these places the shales become very red and are more rapidly destroyed, producing a red clay soil. This decomposition of the iron has a chemical effect upon the other ingredients of the clays and soils, which makes them lighter in texture and richer in their productions.

The soils produced from the degradation of the Black Slate are rather stiff clays, but in cases where the destruction is not complete the small pieces of slate have an effect in making the soil looser and more porous. All analyses of these soils prove them to be richer in agricultural elements than are usually accredited them. Some good farming lands are based on these soils, and some of the richest garden spots in the State have been made from them. Many tracts in Nelson based on this group of slates are quite level, and are beautiful to the eye. Often the soils are not deep over them, and the impervious character of the rocks prevent their proper drainage. Deep plowing with a good system of underground drains would produce in many of them a wonderful change in their producing capacities.

Parts of these soils are sometimes overflowed by back water from the Rolling Fork, and are apt to remain wet for some time afterward. These lands in part have been treated by shallow surface drains, by plowing trenches about forty feet apart. This improves them to some extent but it is not what these lands require. Valuable lands in many places can be underlain with tiles and the improvement in the crops and the ease of cultivation outweigh largely all the trouble and expense incident thereto.

Some of the clays from the Black Slate and those from the hills above it would make tiling of good quality, and so many lands in the county could be so improved that it would seem as if the manufacture of tiles along the Louisville and Nashville railroad could be made a profitable industry.

On the road leading from Bardstown to Boston there are a number of outcrops of the Black Slate. In one of these about twenty feet above the base I found a layer of phosphatic sand-

stone ten inches in thickness. I could trace it by its exposure for about twenty feet; being slightly more resisting than the shale, above and below, it stood out as a ledge. This is probably a local phase, as I was not enabled to find it at any other point. The sandstone is made up of small grains of hyaline quartz and fragments of bones, teeth, fins, etc., of fishes, and was perhaps one of those localities common to certain places in our modern seas, and also seen in various rocks, where the fish collect and die. Such places are usually vast deposits of the exuviæ of fish confined to narrow limits, while for long distances surrounding them no such remains are to be found. Included in this sandstone are some small teeth-like forms which have been given the name of conodonts.

The following description and analysis is furnished by Dr. Robert Peter:

"A grey sandstone, mostly made up of hyaline quartz, somewhat rounded; mixed with small dark colored granules and broken organic remains. It contains (*air dried*):

	Per cent.
"Sand and insoluble silicates	67.040
Phosphoric acid (P_2O_5)	11.162

Combined with iron oxide and lime and magnesia, being equivalent to 24.372 per cent. of *bone phosphate.*"

If this rock was in large quantities it could be made very profitable in the manufacture of a commercial fertilizer. As it is, it would be interesting to have experiments made with it on some of the surrounding soils. It can be crushed very easily, and its application in that condition would evidently be of advantage. Experiments heretofore made on the soils of the Black Slate by the application of bonedust have proven very satisfactory.

The fossils otherwise than these mentioned are few, and rarely met with. Two species of lingula, a discina and casts of sea weeds are the more common. The silicified wood, *Dadoxylon newberryi*, was seen a number of times in Nelson as it has been in the other counties where the Black Slate is in position. It is sometimes removed some distance from the

slate outcrop. Its hard silicification makes it very durable, so that many feet of the shale would be carried off before a large fragment of the petrified wood could be destroyed by atmospheric agencies. Some of the specimens are remarkably and beautifully preserved, the smallest cellular structure being as perfect as can be seen in any recent wood.

The timbers over the Black Slate vary with the slope of the surface. Where it is well drained or not too wet beech and oaks of various species prevail. On the flats there is much sweet gum, white elm, black gum, winged elm, yellow bark oak and some white oak.

SUB-CARBONIFEROUS.

Lower Sub-carboniferous:—The rocks of this division make up nearly the whole of the so-called knobs of Nelson county. They are nearly uniform, with the same series in the counties toward the south, and have been described in the reports of other counties. A mass of clay shales at the base, with some sandy shales and thin sandstones above, and at the top a massive sandstone.

The clay shales decompose readily under exposure into a stiff poor soil, which, when cleared of its timbers, is apt to wash into deep ravines and leave barren spots. Some of these are of considerable extent in many of the counties, but more rare in Nelson. The harder shales above are more resisting, and protect the lower ones from entire destruction, which fact gives to the knobs steep slopes.

The whole group is more barren of fossils than towards the south, yet in places they show the same species. At the base the coprolites form usually a conspicuous horizon, and among them I found *Lingula melia*, *Ceratiocaris bradleyi*, *etc.*, elytroides, teeth of fish, and fragments of large fish bones.

The bands of iron ore which are so continuous in other counties show something more of a development in the southwestern part than I have seen yet. These have increased to at least six different layers in one hundred and fifty feet. Some of

these, however, are very thin, but altogether there is quite an amount of ore contained in these shales. Part of it is segregated as kidneys, some of them weighing perhaps a hundred pounds. There is one layer which is continuous, and has a pavement-like structure. The best of these ores—the kidneys—contain about thirty-five per cent. of iron.

A furnace was erected at Nelsonville in 1856, and was in operation for sometime when it proved a failure as an investment. The knobs all have steep slopes, and the shales containing the iron, decompose rapidly. The iron ore thus liberated slides down the slopes, and is exposed at many places. It is not probable that the ore is in quantities sufficient to make it an article of value now, as so many fields are opened where it can be mined and delivered much cheaper than it can be at this point.

The number and character of the geodes which usually mark the upper part of this division has changed from what it was in Marion and Boyle. At one horizon, and only in a few places did I notice them of any size, and these seem to have replaced and partially surrounded a species of goniatite (*G. lyoni?*). These have been found not only in this county, but extend into Bullitt, where they are in greater numbers than in Nelson.

GEODIFEROUS SANDSTONE ON KEITH'S KNOB.

The top of this division is capped with ten to twenty feet of sandstone, the knobstone of Owen, the freestone of some of the counties, and the Waverley sandstone of Ohio.

This stone has been quarried to some extent in Nelson, and the hearthstones at the Nelsonville furnace were made from it. This is a fair building stone, quarrying in even courses, and works well under the chisel. It contains some iron which is apt to discolor it and mar its beauty. It is quite resisting, and is sometimes seen on the remnant of knobs where more than fifty feet of shales have eroded from beneath its former position.

The soils derived from the Lower Beds are not valued as agricultural soils through this whole region, and it is but seldom that they have been cleared for that purpose. Lying as they

do, usually as steep slopes, they soon wash into the shales, and then become barren. There is some potash in all of these shales, and they have been called marls after decomposition. They might to some loose soils act favorably as fertilizers, but not much can be expected from them in this particular.

These clays are plastic and would make common pottery ware, but would not stand a great degree of heat.

The timbers over them have been of a mixed character, white oak predominating in some localities, but usually chestnut, black oak, red oak, chestnut oak, poplar, beech and hickory. The chestnut oak has about all been destroyed for its bark, and while some young trees are growing, they are usually few. The white oak has been very largely destroyed for crossties, barrel-making and other purposes. Over some tracts this species is being reproduced in considerable numbers, and all these should be cared for and protected for the future. A number of these knobs can never be used for any purpose other than timber culture, and to that purpose they should be devoted in the time to come.

Upper Sub-carboniferous.—On the tops of some of the knobs in the extreme southern part of the county there remain as capping stones a number of feet of the lower part of the limestones of the Sub-carboniferous. They are composed of grey crinoided layers, bluish earthy layers, and some little shale between them. Their position here demonstrate the fact that they have in time past been very extensive, covering at this horizon the whole country over. The remains of this series and even higher layers of the same group is marked over the country by the presence of specimens of a highly silicified fossil, *Lithostrotion canadensis*, which belongs to, and is highly charactertic of, the St. Louis Limestone.

This completes the list of the rocks now present in Nelson county, but as pebbles derived from the Millstone Conglomerate are often seen in the soils in every part of the county, it seems evident that it once extended over the whole area of the county, but like so much of the strata below it has been eroded

away in the long time which has passed since this part of the State has been above the ocean level.

ELEVATIONS.

The following is a partial list of elevations above sea level in Nelson county. They are from the profiles of the Louisville and Nashville Railroad and branches, and from the triangulation of the United States Coast Survey:

KNOXVILLE BRANCH.

	Feet.
Boston, Black Slate	431
Nelsonville, Black Slate	434
New Haven, Upper Silurian	444
Gethsemane, Upper Silurian	458
New Hope, Upper Silurian	488
Coon Hollow, Upper Silurian	570

BARDSTOWN BRANCH.

Sayers' Depot, Upper Silurian	674
Samuels, Upper Silurian	652
Nazareth, Upper Silurian	693
Bardstown, Upper Silurian	637
Rohan's Knob, Lower Subcarboniferous	1,053
Lebanon Junction, Bullitt County, Black Slate	429
Bardstown Junction, Bullitt County, Black Slate	417

OTHER NOTES.

It will be noticed by an examination of the map of Spencer and Nelson that the lines where the various divisions described in these reports begin and end, are in a general northwest and southeast direction and that the oldest and lowest rocks are seen to the north while the newest and uppermost are on the south. This interesting fact is due to the presence of an uplift in the rocks which passes through Marion, Boyle, Garrard and other counties, and which has been called the Kentucky Anticlinal. This elevation slopes northwest to the Ohio River but the arch falls also to the southwest. It is due to these two features that while all the rocks drip to the northwest, yet from the center of Nelson county there is a well marked bend down in all the strata to the southwest also.

It is this dip to the south which has caused the Rolling Fork

to excavate such a wide valley while the other streams have cut narrow and deeper ones, The rocks are all of that character in the southern part of the county to make wide valleys possible. The lower shales of the Sub-carboniferous are of easy destruction, and when the river had excavated to the Black Slate it found another formation which was easy of destruction, and with a dip on one side of the current, the water worked against the lower side hollowing it out in benches below, while from above the crumbling shale fell into the stream and was carried away. This valley is in places as wide as the valley of the Ohio, but it is not probable that it was ever occupied by a larger stream than flows in it to-day.

Some of the bottoms are alluvial but the materials are such as exist now along its upper course, or have existed as higher rocks over those now to be seen. The stones, pebbles and sand seen in its valley belong to all the groups from the Hudson River to the Coal Measures. These alluvial bottoms are very fertile, and some of them receive a deposit of sediment over them every season. Those based on the Black Slate have been mentioned.

The bottoms on Salt River and Chaplin are wider where they have excavated to the Lynx Beds than where the other divisions are at the level of the river. This fact is produced by the shaly character of the strata, modified to some extent by the dip of the rocks.

There are no mounds or earthworks of prehistoric tribes in Nelson county. On Keith's Knob there was said to have been several graves, also a grave or two on a knob to the north of Keith's. A number of stone axes and other relics have been found in the plowed fields over various portions of the county, but never in any great quantities. At Mrs. Gates', near Froman's Creek, was found some years since about one hundred lance heads under a shelf of rock. These were about three inches long and of the same type and material.

My thanks are due to a number of citizens of both Spencer and Nelson county for acts of kindness and hospitality, and especially is this due to the family of Mr. Henry McKenna, whose house was my home during my work.

APPENDIX A.

SPENCER AND NELSON COUNTIES—SOIL ANALYSES.

The following table contains all which has been done in the analyses of soils, subsoils, under clays and marls of Spencer and Nelson counties. All of them were made by Dr. Robert Peter, whose reputation as an agricultural chemist is second to no one in the Union. Some of these examples were collected in 1856 by Dr. D. D. Owen, and are referred to the group of soils as near as can be at this time. Some unimportant error may have been made in locating some of them but it is barely possible.

Referring to the average composition of the various soils of the State, Dr. Peter makes these remarks. "Comparative Views of the Composition of the Soils, Limestones, Clays, Marls, Etc." By Robert Peter, Chemist Kentucky Geological Survey, p. p. 23-4:

"*Black Slate Soils.*—Contains more than average proportions of organic matters, alumina and iron oxide, lime, magnesia and phosphoric acid, and has less than average potash, and sand and insoluble silicates, but sometimes need drainage.

"*Corniferous Soils.*—Have more than average organic matters, alumina and iron oxide, lime, magnesia, phosphoric acid and potash, and less than average sand and silicates.

"*Upper Silurian Soils.*—Contains more than average proportions of nearly all the essential ingredients and less than average potash and sand and silicates.

"*Upper Hudson Soils.*—Contains much more than average proportions of all the essential ingredients; less thsn average sand and insoluble silicates.

"*Middle Hudson Soils.*—Contains average organic matters, alumina and iron oxide and phosphoric acid; more than average magnesia and sand and insoluble silicates, and less than the average of carbonate of lime and potash.

ANALYSES OF SPENCER AND NELSON COUNTY SOILS, SUBSOILS, CLAYS AND MARLS.

Number in Reports	County.	Organic and volatile matters	Alumina, iron oxides, etc.	Lime carbonate	Magnesia	Phosphoric acid (P_2O_5)	Potash extracted by acids	Soda extracted by acids	Water expelled at 380° F.	Sand and insoluble silicates	Moisture expelled at 210° F.	Potash in the insoluble silicates	Soda in the insoluble silicates	Rock fragments and gravel	Number
758	Spencer	4.317	6.201	.345	.493	.187	.236	.014		89.970					1
759	Spencer	2.973	5.306	.245	.241	.144	.183	.047		90.095					2
760	Spencer	2.347	5.804	.220	.454	.106	.154	.030		90.320					3
761	Spencer	3.256	12.655	5.890	.979	.123	.424	.148		76.040					4
2439	Spencer	3.550	7.809	.320	.250	.236	.228	.192	.727	86.175	1.850	1.063	.473	.000	5
2440	Spencer	3.205	11.849	.295	.274	.221	.470	.117	.830	82.320	2.875	1.206	.384	.000	6
714	Nelson	6.659	9.165	.770	.452	.535	.222	.026		82.196					7
715	Nelson	3.423	6.245	.330	.282	.316	.130	.036		88.895					8
716	Nelson	2.804	7.080	2.30	.254	.277	.101	.034		88.970					9
717	Nelson	4.090	15.685	1.725	.731	.438	.334	.032		77.275					10
718	Nelson	4.449	13.600	.520	.967	.368	.283	.058		79.730					11
719	Nelson	5.298	8.185	.270	.416	.114	.098	.036		85.895					12
720	Nelson	5.384	8.655	.405	.492	.228	.193	.049		84.395					13
721	Nelson	4.858	8.360	.222	.553	.351	.298	.015		85.585					14
722	Nelson	4.088	11.370	.336	.487	.345	.275	.055		83.210					15
723	Nelson	6.280	17.505	.645	1.100	.773	.449	.272		73.095					16
724	Nelson	7.195	6.977	.425	.522	.342	.154	.021		84.595					17
725	Nelson	7.164	7.250	.520	.656	.343	.125	.027		83.770					18
726	Nelson		11.850	.393	.966	.120	.749	.482		84.990					19
728	Nelson	1.127	9.430	.843	1.533	.144	.657	.229		85.840					20
729	Nelson	4.200	5.070	.396	.613	.172	.282	.095		84.495					21
2213	Nelson	3.360	7.977	.270	.166	.108	.116	.225	1.215	86.650	1.485	1.669	.274	1.400	22
2214	Nelson	2.990	10.349	.245	.187	.061	.164	.045	0.900	85.075	2.525	1.835	.400	.500	23
2215	Nelson	3.300	14.368	.880	.809	.102	.361	.657	2.415	76.840	1.129	2.742	.225	1.000	24
2396	Nelson	3.020	9.772	.145	.305	.173	.438		.612	84.820	2.350	1.200	.646		25

No. 1 is virgin soil taken from near Beech Creek, Spencer county, and is derived from the sandstones and shales of the Middle Hudson beds. No. 2 is from the same farm and a field which had been cultivated between fifty and sixty years, while No. 3 is the subsoil beneath No. 2.

No. 4 is a marl or blue clay which is so often seen between layers of hard rocks through this part of the state. It was taken from near Taylorsville. These clays are sometimes used as fertilizers and produce good effects when used with phosphatic manures. Nos. 5 and 6 are mentioned in the body of this report as taken from the farm of D. C. Wigginton.

No. 7 is a "woods pasture virgin soil," and is perhaps a mixture of the Upper and Middle Hudson River Beds. No. 8 is the same soil, but, which had been cultivated for thirty-three years, while No. 9 is the subsoil from the last.

Nos. 10 and 11 are under earths collected in the northeastern part of Nelson on Chaplin river by Dr. Owen. His notes are not such that they can be definitely located.

No. 12 is from an uncultivated soil, collected near Cedar Creek Church, and derived from the upper part of the Niagara section where the best building stones are found.

No 13 was collected from the lower part of the Upper Hudson beds, where the timbers are blue ash, sugar maple, wild cherry, etc. No. 14 is the same soil after forty years of cultivation, and No. 15 the subsoil of the same. No. 16 is a shell earth from the same farm. No. 17 is a virgin soil, blue ash land, Upper Hudson River beds. No. 18 is the same soil after fourteen years of cultivation.

No. 19 is a marl or clay from the Lower Sub-carboniferous, two and a half to three miles from New Haven. This is the clay which is so often seen at all the licks and waste places at the foot of the knobs. This contains valuable proportions of potash, sulphuric acid, magnesia, lime and soda. To exhausted lands the application of this marl would often prove of great benefit if mixed with bonedust or other phosphatic manures. No. 20 is a marl from the same horizon. No. 21 is a shell

earth taken from the northern portion of the county on the blue ash land.

No. 22 is from the eastern part of Nelson and taken from the mixed soils of the Corniferous Limestone and the Black Slate. No 23 is the subsoil of the same, while 24 is the under clay taken two feet beneath the surface, where no roots had penetrated.

The soils on the Upper Silurian are often of that character which allows them to wear away easily, and much care is required to keep them up to a standard of excellence. Over them every diversity may be seen from the poorest sterile spots, to those which rank high in the quantity and good quality of the grains and grasses which they produce.

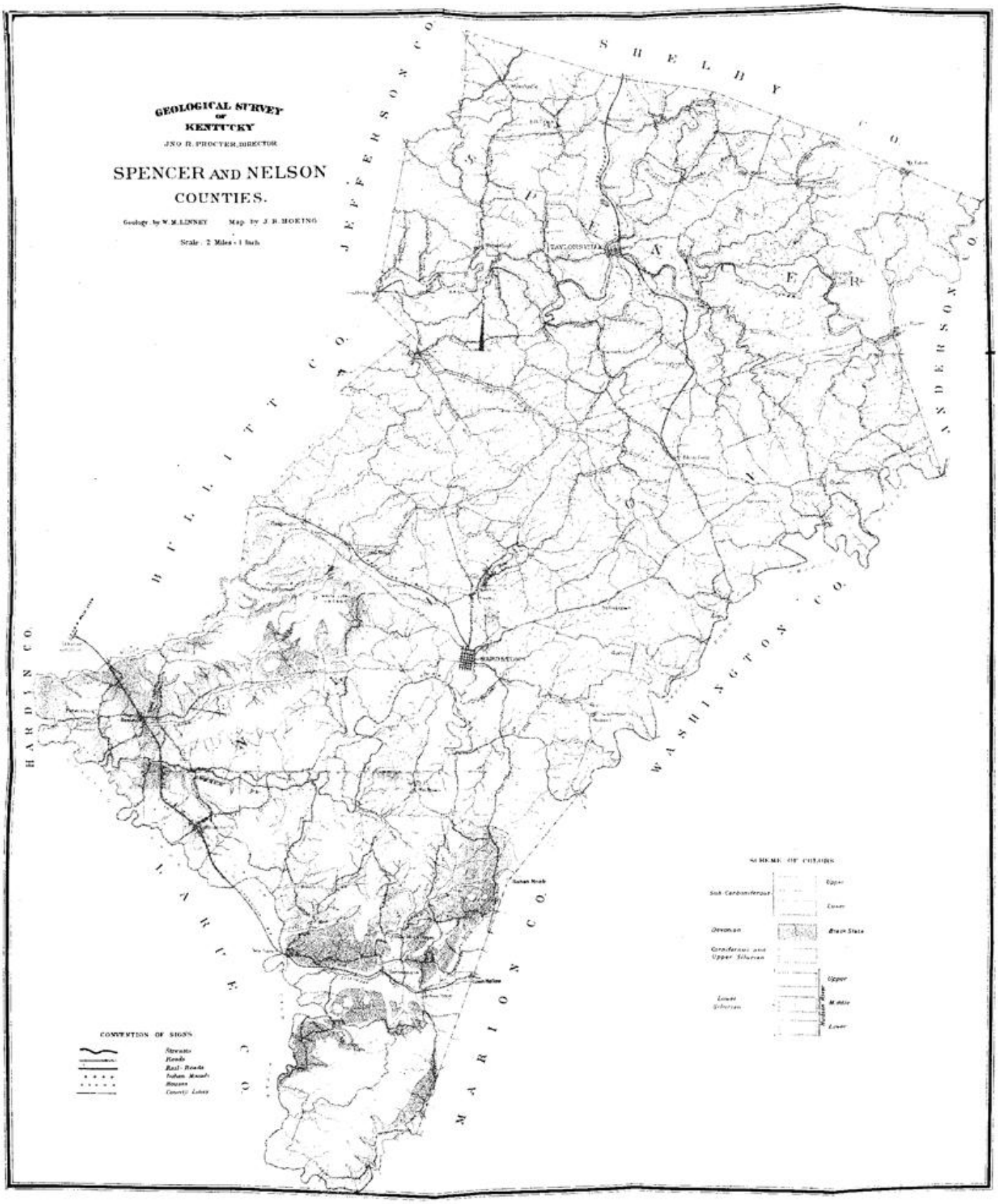
In a number of places can be seen fields or farms which have been much improved by a careful system of tillage and fertilizing. Though living on lands which were wasted and worn at the time of their purchase, the Monks of La Trappe have wrought great improvements in some of their gardens, fields and pastures, and have every reason to continue to improve them in the future.

APPENDIX B.

STATISTICS OF NELSON COUNTY, COMPILED FROM THE UNITED STATES CENSUS OF 1880 AND OTHER SOURCES.

1880. Total population	16,609
1870. Total population	14,804
1860. Total population	15,799
1880. White population	11,893
1870. White population	10,886
1860. White population	10,160
1880. Colored population	4,716
1870. Colored population	3,918
1860. Colored population	5,639
1880. Native population	16,353
1870. Native population	14,348
1860. Native population	15,283
1880. Foreign population	256
1870. Foreign population	456
1860. Foreign population	516
1880. Bardstown, population	1,803
1880. Bloomfield, population	455
1880. Fairfield, population	189
1880. New Haven, population	437
1880. New Hope, population	204
Number of farms	1,453
Acres improved land	170,934
Value of farms, buildings and fences	$4,513,697
Value of farm implements and machinery	$122,220
Value of live stock	$637,658
Cost of building and repairing fences, 1879	$43,484
Cost of fertilizers, 1879	$2,520
Estimated value of all farm products, 1879	$718,901
Assessed valution, real estate	$3,006,480
Assessed valuation, personal property	$1,686,460
Assessed valuation, total	$4,692,940
Taxation, State	$21,353
Taxation, county	$7,500
Taxation, town and school district	$1,511
Taxation, total	$30,364
Miles of railroad	26.45
*Value of railroads in county	$413,625
Miles of turnpikes	. .
Average cost of turnpikes per mile	. .
Number of horses	5,079
Number of mules and asses	1,139
Number of working oxen	89
Number of milch cows	3,434
Number of other cattle	7,930
Number of sheep	15,554
Number of swine	29,279
Pounds of wool	68,519
Pounds of butter	168,720
Pounds of cheese	265
Gallons of milk	. .
Bushels of Indian corn	987,007
Bushels of wheat	177,020
Bushels of oats	59,783
Bushels of rye	10,434
Bushels of Irish potatoes	21,947
Bushels of sweet potatoes	3,725
Bushels of barley	. .
Bushels of buckwheat	103
Tons of hay	4,469
Value of orchard products	$15,265
Pounds of tobacco	4,722
Manufacturing establishments	80
Capital invested in	$913,915
Number of hands employed	288
Amount paid in wages	$96,846
Cost of material	$839,941
Value of products	$1,238,896
Bonded debt	. .
Floating debt	. .
Total debt	. .
Sinking fund	. .
Net debt	. .
Total acres of land, 1880	. .
Average listed value per acre	. .

*Bloomfield Branch not added.


GEOLOGICAL SURVEY
OF
KENTUCKY
JNO. R. PROCTER, DIRECTOR
SPENCER AND NELSON
COUNTIES.
Geology by W. M. LINNEY
Map by J. B. HOEING
Scale: 2 Miles = 1 Inch
SHELBY CO.
JEFFERSON CO.
BULLITT CO.
HARDIN CO.
LARUE CO.
MARION CO.
WASHINGTON CO.
ANDERSON CO.
TAYLORSVILLE
SPENCER
NELSON
CONVENTION OF SIGNS
SCHEME OF COLORS
Sub Carboniferous
Upper
Lower
Devonian
Black Slate
Upper
Middle
Lower

KENTUCKY GEOLOGICAL SURVEY.

JOHN R. PROCTER, Director.

LIST OF THE

BIRDS OF NELSON COUNTY.

BY CHARLES WICKLIFFE BECKHAM.

ELECTROTYPED FOR THE SURVEY BY JOHN D. WOODS, PUBLIC PRINTER AND BINDER, FRANKFORT, KY.

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INTRODUCTORY.

THE following paper is based almost entirely upon my former list of the birds of this locality,* written in January, 1883, and is prepared at the suggestion of Professor Procter, State Geologist, to accompany Mr Linny's report on the geology of Nelson county.

So short a time has elapsed since the former paper was written, and my opportunities for field work have been so limited, that I can only add four species to the fauna as herotofore given, namely: *Coturniculus henslowi*, *Ionornis martinica*, *Nettion carolinensis*, *and Fuligula collaris*. The first, third and fourth of these were all taken by myself, and the circumstances which induce me to include the latter are fully set forth in another place.

Most of the observations were made in the immediate vicinity of Bardstown, which is situated in N. Lat. 37°52′, W. Long. 85°18′, just on the western limit of the "Bluegrass Region," forty miles southeast of Louisville, and about one hundred southwest of Cincinnati.

The sylvan flora of this locality is quite diversified. The

* A list of the birds of Bardstown, Nelson county, Ky. By Charles Wickliffe Beckham.—Journal of the Cincinnati Society of Natural History, Vol. VI., July, 1883, pp. 136–147.

most characteristic trees are beech, red and white oak, black walnut, butternut, poplar, (*Liriodendron tulipifera*), sycamore, black gum, dogwood, white elm, and hickory (*Carya alba, tomentosa et glabra*), and in some places there are dense and extensive glades of red cedar.

The country is gently undulating, and is mostly in a high state of cultivation. In summer the greater part of the small water courses become dry, and there is a corresponding scarcity of that desirable liquid. In the western part of the county there are still many large tracts of wild, uncultivated land, where such birds as the Pileated Woodpecker, the Ruffed Grouse, and the Wild Turkey are still to be found.

The list represents barely two-thirds of the birds that are, doubtless, to be found here at one season or another, but it is thoroughly trustworthy, as far as it goes, for no species has been admitted on any but the best of evidence. Out of the one hundred and seventy-one enumerated, the writer is personally responsible for all but eight of them. He here takes the opportunity to say that any information in regard to the birds of this and neighboring counties, that may be in the possession of any one into whose hands this paper may fall, will be gratefully received.

The nomenclature followed in this catalogue may strike some as being rather peculiar—which it doubless is—but I am merely adopting the emendations and corrections that are being carried out under the authority of the American Ornithologists' Union, principally by Dr. Leonhard Stejneger, whose intimate acquaintance with the classical literature of ornithology fit him particularly well for this difficult task. The reasons for all of these changes are clearly set forth in his "Analecta Ornithologica" articles, already published and to be published in "*The Auk.*"

The average ornithologist loves diversity in the closet as well as in the field—when he can't find a new bird to describe, he

will go to work and give a new name to an old bird—and for most of them—

> "——the new has charms which the old has not,
> And the stranger's face makes the friend's forgot."

But let us hope that, with the "Stricklandian Code" as a beacon-light, our nomenclatural pilots will be enabled to steer the name-battered old bird-ship into a safe and *final* port before she is engulfed by the sea of synonyms that just now surges around her.

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BIRDS OF NELSON COUNTY.

Species known to breed here are indicated by an asterisk (*); those strongly inferred to do so, by a dagger (†).

Order **PASSERES**: Perching Birds.

Suborder **OSCINES**: Singing Birds.

Family **TURDIDÆ**: Thrushes.

Genus **Hylocichla.**

1. ***Hylocichla mustelina*** (GMEL.). Wood Thrush.

A common summer resident; arrives about April 20th; departs about October 15th. In quality of tone perhaps the most gifted of our woodland vocalists. The song of no bird that I know comes anywhere near the full, liquid *timbre* of the note of the wood thrush. It is most often heard during the last hours of the long spring and early summer afternoons; and he also, when in pursuit of the "early worm," doubtless serenades the rising sun, but I have never heard him at that unseasonable hour. The song, however, lacks one important element of attractiveness—that is, quantity. The bird generally stops singing just as you prepare to give him your undivided attention. Their food is composed almost entirely of insects.

2. ***Hylocichla fuscescens*** (STEPH.). Wilson's Thrush.

Transient; uncommon in April and May. I have only seen this bird upon two occasions in the spring, and have never recognized it at all in the fall. It breeds in the northern part of the United States and in Canada.

3. ***Hylocichla aliciæ*** BAIRD. Grey-cheeked Thrush.

Transient; common during the last week of April and the first week of May. Generally found in company with the next, which it much resembles, as I have taken specimens that gave me considerable trouble to distinguish from the other sort.

4. ***Hylocichla ustulata swainsoni*** (CABAN.). Olive-backed Thrush.

Transient. The most abundant of the thrushes during the migrations, except the robin. A few stragglers are seen as late as May 20th.

5. ***Hylocichla unalascæ pallasi*** (CABAN.). Hermit Thrush.

Transient; common; arrives last of March; leaves for the South about November 1st. It is highly probable that a few of these thrushes winter here in sheltered places, as I have found them common at the same latitude in Maryland, where the temperature was as low as 6° Fah., and they are known to winter north of here in Illinois.

Genus **Merula.**

6. ****Merula migratoria*** (LINN). American Robin.

A permanent resident. It is quite likely that the Robins we see during winter leave in the spring, and are succeeded by birds that have wintered farther South. On the 15th of February, 1881, immense numbers of these began to congregate in the dense cedar groves near Fredricksburg, in Washington county, nine miles from Bards-

town, and remained about there until March 8th. Thousands of them were captured by merely picking them off the branches of the cedars at night, and were sold as low as ten cents a dozen. The "roost" was raided in force, by a lot of men and boys, on the night of February 21st, and eight thousand birds were killed. [See files of *Nelson County Record* for February and March, 1881.

Genus **Mimus.**

7. **Mimus polyglottus* (LINN.). Mocking-bird.

A common summer resident. A few remain all the year, as I have observed them in every one of the twelve months. Ten years ago they were comparatively rare here, but now there are few gardens or yards where one or more pairs do not nest. They often sing quite late in the fall. I heard one in full song on the 8th of November.

Genus **Galeoscoptes.**

8. **Galeoscoptes carolinensis* (LINN.). Cat-bird.

A common summer resident. An inveterate bug-hunter, hence a good friend to the farmer, but he also enjoys strawberry and cherry time about as well as the rest of us, and on this account the small fruit grower regards him with an evil eye.

Genus **Harporhynchus.**

9. **Harporhynchus rufus* (LINN.). Brown Thrasher. "French Mocking-bird."

Common summer resident. Always one of the earliest of the spring arrivals. In 1881 I saw one on March 3rd. Found almost exclusively in thickets and dense shrubbery.

Genus **Sialia.**

10. ***Sialia sialis*** (LINN.). Blue-bird.

A common permanent resident. The habits of this popular bird—"with the sky on his back"—are too well known to require comment here.

Family **SYLVIIDÆ**: Old World Warblers.

Genus **Polioptila.**

11. ***Polioptila cærulea*** (LINN.). Blue-gray Gnat-catcher.

An abundant summer resident. Arrives about April 1st. Fresh eggs are found July 2nd, when fully fledged young are flying about. The nest of this dainty little midget is a marvel of avian architecture, rivalling in the delicate beauty of its structure, and its ingenious illustration of what may perhaps be termed the principle of protective imitation, that of the humming-bird. On account of its outer covering of lichens, which give it the exact appearance of the limb to which it is attached, it is very difficult to find. The bird can not sing, but apparently has a good time trying, as they are quite noisy after their puny fashion.

Genus **Regulus.**

12. ***Regulus calendula*** (LINN.). Ruby-crowned Kinglet.

Transient. Abundant in spring and fall. Arrives about April 1st; departs about October 16th. Most abundant in cedar and other evergreen trees and shrubbery. Their song, which is not often heard with us, is one of surprising depth and sweetness.

13. ***Regulus Satrapa*** LICHT. Golden-crowned Kinglet.

Transient, but a good many winter here. Inhabiting the

same places as the last, with which it often associates. The last of them leave for the North about April 25th.

Family **PARIDÆ**: Titmice, &c.

Genus **Lophophanes.**

14. **Lophophanes bicolor* (LINN.). Tufted Titmouse, "Tomtit." Also known as "Peter-peter," in imitation of one of its notes. An abundant permanent resident. Never taken its nest, and it is a standing mystery why the nest of so common a bird should be so difficult to find, as I have no trouble in finding those of other hole-breeding species.

Genus **Parus.**

15. **Parus carolinensis* AUD. Carolina Chicadee. An abundant permanent resident. Fond of the society of the preceding. The Chicadee raises quite a large family for such a small bird. I have several times counted seven young "chicks" in a nest, and other observers have recorded as high as ten. It must keep the industrious little birds always "a hustling" to provide for so many gaping mouths, and they doubtless make it lively, if not interesting, for the bugs and other creeping things.

Family **SITTIDÆ**: Nut-thatches.

Genus **Sitta.**

16. **Sitta carolinensis* GMEL. White-bellied Nut-thatch. A common permanent resident. This Nut-thatch is popularly "lumped" with that imaginary group, the "Sap-suckers;" i. e., the smaller woodpeckers, but I have yet to see the man who ever saw this useful little bird pursuing this nefarious practice. Their food is strictly insectiverous.

17. ***Sitta canadensis*** LINN. Red-bellied Nut-thatch.

An irregular fall and winter visitant, but whenever present, always quite common.

Family **CERTHIIDÆ**: Creepers.

Genus **Certhia.**

18. ***Certhia familiaris rufa*** (BARTR.). Brown Creeper.

A winter resident; sometimes quite common in spring. Arrives about October 15th; leaves about April 15th.

Family **TROGLODYTIDÆ**: Wrens.

Genus **Thryothorus.**

19. ****Thryothorus ludovicianus*** (GMEL.). Carolina Wren.

An abundant permanent resident. The liveliest and noisiest bird for its size that I know. Appears to always have a quarrel on hand with somebody, and their ire reaches fever heat whenever the ubiquitous cat happens around. Their song is very strong and melodious, and is often heard in mid-winter.

Genus **Thryomanes.**

20 ****Thryomanes bewicki*** (AUD.). Bewick's Wren.

Not uncommon. Probably a permanent resident, as I have seen them in mid-winter. Found almost exclusively in the vicinity of dwellings.

Genus **Anorthura.**

21. ***Anorthura hiemalis*** (VIEILL.). Winter Wren.

A rather common winter resident; arrives about October 15th.

Genus **Cistothorus.**

22. ***Cistothorus stellaris*** (LICHT.). Short-billed Marsh Wren.

I have never seen but one specimen of this wren, a male, which was shot May 1st, 1882, from the top of a small blackberry vine in a rye field, while singing, if the queer stridulous noise he made can be called singing.

Family **MOTACILLIDÆ**: Wagtails and Titlarks.

Genus **Anthus.**

23. ***Anthus ludovicianus*** (GMEL.). American Titlark.

Transient. Captured as late as April 19th. Generally found in wet fields. In my former list it is stated that this bird was sometimes seen here in winter. This statement was made upon what I am now convinced, was insufficient evidence, although it doubtless does occur here at that season.

Family **MNIOTILTIDÆ**: American Warblers.

Genus **Mniotilta.**

24. ****Mniotilta varia*** (LINN.). Black and white Creeper.

An abundant summer resident. Arrived, in 1882, as early as April 1st.

Genus **Helminthophila.**

25. ***†Helminthophila pinus*** (LINN.). Blue-winged Yellow Warbler.

Common from April 10th to May 25th; a few probably remain to breed. Unlike most of the arboreal *Mniotiltidae*, which generally do their so-called "warbling" while flitting about amongst the tree-tops in pursuit of insects, this dainty little beauty perches himself in the top of some small tree thirty to forty feet high, and at intervals of two or three minutes, pours forth his "screepy" solo; sometimes remaining fifteen or twenty minutes on the

same perch. On several occasions, although knowing that the birds were generally only twenty or thirty feet from me, I have had a great difficulty in finding them, so well do they conceal themselves in the foliage.

26. ***Helminthophila chrysoptera*** (LINN.). Golden-winged Warbler.

Rare; one specimen only. On May 11th, 1877, while sauntering through my favorite collecting ground, I saw four or five warblers skipping about the top of a small willow tree; getting two of them in line, I fired, and down came this bird and a Cape May Warbler—two species entirely new to me, and both very rare in this locality. Only those who are "in the secret" can appreciate my feelings upon that occasion.

27. ***Helminthophila ruficapilla*** (WILSON). Nashville Warbler.

Transient; not uncommon.

28. ***Helminthophila celata*** (SAY.). Orange-crowned Warbler.

Transient.

29. ***Helminthophila peregrina*** (WILSON). Tennessee Warbler.

Transient; sometimes common in the fall.

Genus **Compsothylpis.**

30. ***†Compsothylpis americana*** (LINN.). Blue yellow-backed Warbler.

A common summer resident. Very abundant in spring. Exceedingly variable in plumage.

Genus **Perissoglossa.**

31. ***Perissoglossa tigrina*** (GMEL.). Cape May Warbler.

Transient. Rare; two specimens only; both taken in May.

Genus **Dendrœca.**

32. ***Dendrœca æstiva*** (GMEL.). Summer Yellow-bird.

A common summer resident; arrives about April 15th. This warbler, which is found all over the United States during the breeding season—"from Sandy Hook to the Golden Gate," is perhaps the most abundant representative of the genus here.

33. ***Dendrœca cærulescens*** (LINN.). Black-throated Blue Warbler.

Transient. Common; arrives about May 5th; departs October 10th to 12th. Frequenting the lower limbs of trees and bushes in preference to the tree-tops.

34. ***Dendrœca maculosa*** (GMEL.). Black and yellow Warbler.

Transient; abundant. Arrives about May 7th; departs about October 10th.

35. ***Dendrœca coronata*** (LINN.). Yellow-rumped Warbler.

An abundant winter resident; arrives about October 10th and the last of them leave about May 8th. They winter in the cedar glades near Bardstown, where their lively "tsip" is often the only sound to be heard in those dismal solitudes.

36. ***Dendrœca cærulea*** (WILSON). Cærulean Warbler.

A common summer resident; arrives about April 10th. Very abundant in the spring. I have several times killed two at one discharge of my gun.

37. ***Dendrœca pennsylvanica*** (LINN.). Chestnut-sided Warbler.

Transient. Common; particularly so in September. Arrives about May 7th; departs about October 10th.

38. ***Dendrœca castanea*** (WILSON). Bay-breasted Warbler.

Transient. Not common; arrives about May 10th.

39. ***Dendrœca striata*** (FORST.). Black-poll Warbler.

Transient. Rather uncommon; arrives May 7th to 10th; departs about October 10th.

40. ***Dendrœca blackburniæ*** (GMEL.). Blackburniaen Warbler.

Transient. Very common in September; but all of them are very plainly colored then as compared with the fiery hues of the vernal costume. Generally an early arrival. In 1882 I took one on April 3rd. They leave towards the last of September, but I have taken stragglers as late as October 13th.

41. ****Dendrœca dominica albilora*** BAIRD. Sycamore Warbler.

A common summer resident; arriving very early in April. Almost always found along streams in the sycamore trees (*Plantanus occidentalis*), amongst the branches of which they creep in their search for insects with more of the habits of a *Certhia* than those of a warbler; occasionally uttering their rather musical song, which is singularly like that of the Indigo Bird. Their nest I have never been able to find, although they undoubtedly breed here.

42. ***†Dendrœca virens*** (GMEL.). Black-throated Green Warbler.

Transient. Very common. Arrives about April 18th; departs October 10th to 15th. I saw and identified one on July 14th, 1882, but, of course, didn't have a gun along, and the bird was not captured. All the specimens I have ever taken show great variation in the amount and intensity of the black on the breast.

43. ***Dendrœca pinus*** (WILSON). Pine-creeping Warbler.

Transient. Common in April and September. It is quite likely that this bird breeds here.

44. ***Dendrœca palmarum*** (GMEL.). Red-poll Warbler.

Transient. Quite common. A few undoubtedly winter here in sheltered places, as I have seen them in December and in the middle of January. Exclusively a terrestrial bird; generally associating in flocks with the smaller sparrows.

45. †***Dendrœca discolor*** (VIEILL.). Prairie Warbler.

Common in the spring. So far as my observations have extended, this warbler is transient here, but for reasons too lengthy to mention now, I feel quite sure that a few of them breed. An inhabitant of sassafras and cedar bushes, etc., that have grown up in old abandoned fields, where its curious song, which Dr. Coues likens to "a mouse complaining with the toothache," can always be heard in spring, during the intervals between his short flights after mosquitoes, flies, and other pestiferous flying things.

Genus **Siurus.**

46. †***Siurus auricapillus*** (LINN.). Golden-crowned Thrush.

Common in spring and fall. Nearly always found in woodland, where their loud monotonous chant "drowns" all other bird music.

47. ***Siurus noveboracensis*** (GMEL.). Small-billed Water Thrush

Transient. Rare, as I have never seen but two here—on May 17th, 1882.

48. ****Siurus Motacilla*** (VIEILL.) Large-billed Water Thrush.

An abundant summer resident; arrives about April 1st. Frequenting small woodland watercourses, every one of which generally has a pair. They are first-class musicians, but do most of their singing during the first two

weeks after their arrival from the South. They are said to build their nests among the exposed roots of trees along the streams, but I have never been able to find one of them.

Genus **Oporornis.**

49. ***Oporornis agilis*** (WILSON). Connecticut Warbler.

Transient; rather rare. I have taken it only twice in the spring—May 12th and 13th, and once in the fall—October 11th.

50. ****Oporornis formosa*** (WILSON). Kentucky Warbler.

A common summer resident; arrives about April 20th. This handsome ground warbler is another bird that indulges in the erroneous idea that he knows how to sing, if one may judge from the stolid persistency with which he grinds out his wearisome ditty, but it doubtless has the desired effect upon "Mrs. Kentucky," and he cares not for the plaudits of any one else.

Genus **Geothylpis.**

51. ***Geothylpis philadelphia*** (WILSON). Mourning Warbler.

Transient; rather rare. I have only taken three specimens, all in May. Its habits are very similar to the next, but its song impresses me as being much finer.

52. ****Geothylpis trichas*** (LINN.). Maryland Yellowthroat.

An abundant summer resident. Arrives about April 20th; departs October 10th to 12th. An inhabitant of bushes and tangled thickets in the neighborood of streams. Very suggestive of the wrens in its nervous, jerky disposition and quick movements. Sometimes, during the breeding season, the males indulge in a curious habit of flying up obliquely to the height of thirty or forty feet, and then descending, singing volubly all the time.

Genus **Icteria.**

53. ***Icteria virens*** (LINN.). Yellow-breasted Chat.

A common summer resident; arrives about April 25th. If birds were not known to be temperance folks, the Chat would be accused of "alcoholism," for this would be a very logical explanation of his absurd squawkings and clown-like gyrations in mid-air when the nuptial ecstasy is upon him. Like the preceding species they prefer the seclusion of thickets to all other places, and in such haunts they generally bring up their families; but I once knew a pair to build their nest in a wren box on a piazza. [See Bulletin Nuttall Ornithological Club, 1881, Vol. vi., p. 115].

Genus **Sylvania.**

54. ***Sylvania mitrata*** (GMEL.). Hooded Warbler.

Transient. One of our rarer, as well as most beautiful warblers. I have never taken but two specimens—April 19th and May 9th, 1877.

55. ***Sylvania pusilla*** (WILSON.) Black-capped Yellow Warbler.

Transient in May; not common. Generally in low trees in sparsely wooded thickets.

56. ***Sylvania canadensis*** (LINN.). Canadian Fly-catching Warbler.

Transient. Abundant in May; arrives May 10th to 15th. A bird of the forest. This and the Black-poll generally form the "rear guard" of the great sylvicoline army in their annual march towards the North, as it is always, with us, the last of the warblers to appear.

Genus **Setophaga.**

57. ***Setophaga ruticilla*** (LINN.). American Redstart.

Summer resident. Very abundant during the migrations, but not very common in summer. Arrives April 23rd; departs about September 15th. Fresh eggs found May 27th. One of the handsomest representatives of our sylvan ornis, and unrivalled as an insect-catcher; it must be a very "cold day" indeed when the Redstart has to go without his dinner.

Family **VIREONIDÆ**: Vireos, or Greenlets.

Genus **Vireosylvia.**

58. ***Vireosylvia olivacea*** (LINN.). Red-eyed Vireo.

An abundant summer resident; arrives April 10th. They nest in the immediate vicinity of dwellings as well as in the forest.

59. ***Vireosylvia philadelphica*** CASSIN. Philadelphia Vireo.

Rare. One specimen only; shot May 19th, 1877.

60. ***Vireosylvia gilva*** (VIEILL.). Warbling Vireo.

A common summer resident; arrives about the 1st of May. All the nests of this species I have ever seen were placed near the tops of trees instead of within a few feet of the ground—situations that the Red-eye and White-eye generally select. This dull-looking, inconspicuous little bird is one of our sweetest songsters, although his voice is not particularly strong, and the variety of his notes is limited.

Genus **Lanivireo.**

61. ***Lanivires flavifrons*** (VIEILL.). Yellow-throated Vires.

Rather common; arrives about April 20th. I have never

taken the nest of this greenlet, but I think that they breed here.

62. ***Lanivireo solitarius*** (VIEILL.). Blue-headed Vireo.

Transient. Not common. Arrives about April 20th; leaves about October 20th.

Genus **Vireo.**

63. ****Vireo noveboracensis*** (GMEL.). White-eyed Vireo.

Abundant in spring, and rather common in summer. Arrives April 15th to 20th. Fresh eggs found May 16th. An inhabitant of the thicket, exclusively, and an exceedingly lively little bird, with a voice loud enough for one four or five times his size. Capt. Saville Reid, in his "Birds of the Bermudas" likens one of its characteristic calls to the suggestive phrase "ginger-beer-quick."

Family **AMPELIDÆ**: Waxwings.

Genus **Ampelis.**

64.† ***Ampelis cedrorum*** (VIEILL.). Cedar Waxwing. "Cherry Bird."

An irregular, but at times very abundant, permanent resident. Common in the cedar glades, whenever here. In Louisiana this bird is known as the "Ortolan." There are no less than five different birds that have had this name applied to them: 1st. The *true* Ortolan, *Emberiza hortulana* of Europe. 2d. The Sora-Rail, *Pozana carolina.* 3d. The Bobolink or Reed-bird, *Dolichonyx oryzivorus.* 4th. The Shore Lark, *Otocorys alpestris* (see Lemoine's "*Oisseaux du Canada*," p. 225); and 5th, the bird under consideration. It is suggested that those who contend for a vernacular nomenclature, instead of a Latin and Greek one, put this in their pipes and smoke it.

Family **HIRUNDINIDÆ**: Swallows.

Genus **Progne.**

65. **Progne subis* (LINN.). Purple Martin.

A common summer resident; arrives about March 20th; sometimes as early as the 10th. A general favorite, breeding here, as elsewhere, in boxes put up for their accommodation, which sometimes occasion a triangular fight between this bird, the Blue-bird and the English Sparrow. In one three- or four-days battle, which I witnessed, the Blue-birds came off victorious.

Genus **Petrochelidon.**

66. **Petrochelidon lunifrons* (SAY). Cliff Swallow.

A rather common summer resident. I have never seen their nests.

Genus **Chelidon.**

67. **Chelidon erythrogastra* (BODD.). Barn Swallow.

An abundant summer resident; arrives about April 20th. These swallows do not appear to be nearly as common about here as they were ten or fifteen years ago. Boys destroy a great many of their nests, in the barns and other out-buildings, which has doubtless had a very appreciable effect upon their numbers.

Genus **Clivicola.**

68. †*Clivicola riparia* (LINN.). Bank Swallow. "Sand Martin."

A common summer resident.

Genus **Stelgidopteryx.**

69. **Stelgidopteryx serripennis* (AUD.). Rough-winged Swallow.

A common summer resident. In the immediate neighborhood of Bardstown this is the most abundant of all the swallows. Their favorite nesting places about here are natural cavities in the limestone cliffs that surround the town.

Family **TANAGRIDÆ**: Tanagers.

Genus **Piranga.**

70. *Piranga erythromelas* (VIEILL.). Scarlet Tanager.

Transient. Abundant in May and September; not seen during the summer; arrives about May 1st. A bird of the forest; rarely seen about cultivated places.

71. **Piranga rubra* (LINN.). Summer Red-bird.

A common summer resident; arrives April 20th to 25th. Fresh eggs are generally to be found about May 15th. Their nesting sites are confined exclusively to "the open," and almost always near a path or road. The terminal portion of a lower limb is selected, upon which the nest is "saddled;" the beech being their favorite tree. They frequently build in the immediate vicinity of dwellings. One was taken by me in May, 1882, in a small dogwood near a cistern, directly over a paved way, and within twenty or thirty feet of the house. About four-fifths of the nests contain three eggs—the remainder four. They have a rather pleasing song, which is heard only in May and June. In September they seem to become particularly abundant, and wander around in an uneasy, anxious sort of way, constantly uttering their querulous call-note.

Family **FRINGILLIDÆ**: Finches, Sparrows, &c.

Genus **Carpodacus.**

72. *Carpodacus purpureus* (GMEL.). Purple Finch.

A common transient. A few probably winter here. Prin-

cipal food the leaf-buds of trees; those of the "poplar" (*Liriodendron*), being apparently preferred to any other. I have heard them singing in October, but have never seen any birds in the red plumage at that time, all of the males being then in the sombre plumage of the female.

Genus **Loxia.**

73. ***Loxia curvirostra americana*** (WILSON). American Cross-bill.

A flock of six or eight of these birds appeared here on November 18th, 1882, in some pine trees, the first time I had ever observed them. They remained only a day or two, and none were seen until the 17th of March, following, when I shot eight out of a flock of about twenty, in the same place where they had previously been seen. Several flocks were observed about the same time near Bloomfield and Glenville, in this county, and excited considerable comment on account of their queer bills. The weather at the time was quite mild, so their appearance here was probably due to some other cause.

Genus **Spinus.**

74. ****Spinus tristis*** (LINN.). American Gold-finch. "Yellow-bird."

An abundant permanent resident; more so in spring and fall than in summer and winter. Always in flocks, except for a short time while they are nesting.

75. ***Spinus pinus*** (WILSON). Pine Gold-finch.

I observed two small flocks of this bird here in November, 1882. Their habits appeared to be very similar to those of the last species.

Genus **Passer.**

76. **Passer domesticus* AUCT. English House Sparrow.

These obtrusive aliens made their appearance here about the year 1879, and are increasing at a rapid rate, and are to be found at several places in the country, as well as in town. They are generally appreciated by the poople at their true value, and are regarded as an unmitigated nuisance. Pert and impudent here, as everywhere else, they act as if they owned the town. There must be something wrong about a theory—"survival of the fittest"—that lets this bird live—what are they fit for anyway?

Genus **Passerculus.**

77. *Passerculus sandwichensis savanna* (WILSON). Savanna Sparrow.

Transient; abundant; arrives about March 20th. Most common in wet meadows.

Genus **Poœcetes.**

78. **Poœcetes gramineus* (GMEL.). Grass Finch.

A common summer resident; arrives about the middle of February, and leaves about November 20th. A first-rate songster; although eminently a "ground bird," whenever one of them experiences the musical impulse he flies to the top of the nearest high tree, and perching himself upon the topmost twig "turns himself loose."

Genus **Coturniculus.**

79. **Coturniculus savannarum* (GMEL.). Grasshopper Sparrow.

A common summer resident. Fresh eggs found May 20th. I have taken the bird here as late as October 26th. They build on the ground in open fields, and conceal their nests

with more dexterity than any other sparrow that I know of. Their note is about on a par with that of an able-bodied Kansas grasshopper.

80. ***Coturniculus henslowi*** (AUD.). Henslow's Sparrow.

On October 30th, 1884, while out quail shooting one of my dogs, a green pointer puppy whose field education was just beginning, "came down" in a wet clover field. Going up to the spot I flushed the bird, which turned out to be Henslow's Sparrow, and a new one to this locality. Of course the dog escaped the threshing he deserved for not distinguishing the difference between a "jack-sparrow" and a Bob White. The bird flew a few yards before alighting, and then scurried through the short tangled clover like a mouse, which it did so dexterously that I had great difficulty in getting a shot. The only other Kentucky record of this sparrow that I am aware of, is that given by Audubon (Birds of America, 1841, iii, p. 75), who took the type of the species near the Ohio river, opposite Cincinnati.

Genus **Chondestes.**

81. ****Chondestes grammacus*** (SAY). Lark Finch.

An abundant summer resident; arrives about April 22d. They hatch two broods; the young of the first brood are fully fledged and able to fly about June 25th. A most accomplished musician. In California, according to Mr. Ridgway, they are in great demand as cage birds. Wallace, in his "Geographical Distribution of Animals" (vol. 1, p. 24), mentions two species of North American birds, *Thryothorus ludovicianus*, and *Petrochelidon lunifrons*, that have greatly extended their range since the time of Alexander Wilson (the beginning of the century), and he

might also have included this bird. In Bonaparte's edition of Wilson's work (1834), the Mississippi river is given as the eastern limit of their range, but now they are very common hundreds of miles to the East of that stream, and have even been seen at Washington (Ridgway) and in Massachusetts (Brewer). They certainly have increased in numbers in this locality since I first began to "notice" birds.

Genus **Zonotrichia.**

82. ***Zonotrichia leucophrys*** (FORST.). White-crowned Sparrow.

Transient. Common in May. I have seen them in the fall as late as October 31st.

83. ***Zonotrichia albicollis*** (GMEL.). White-throated Sparrow.

Transient. Very common. A few winter here, as I have seen them on December 24th, and on February 1st. One of the last of our birds to leave for the North; stragglers sometimes seen as late as May 18th.

Genus **Spizella.**

84. ***Spizella monticola*** (GMEL.). Tree Sparrow.

A common winter resident; arrives about October 12th.

85. ***Spizella socialis*** (WILSON). Chipping Sparrow. "House Sparrow."

An excessively abundant summer resident. It is probable that some of them winter here, as I have seen them here in cold weather, as late as December 28th, and as early as February 24th. Here, as in most places, the best known and most familiar of the sparrows.

86. ***Spizella pusilla*** (WILSON). Field Sparrow.

An abundant summer resident; arrives about March 1st;

leaves about December 1st. One of the last of our birds to leave off singing in the summer, as their pleasing song is heard all through "blackberry-time."

Genus **Junco.**

87. ***Junco hyemalis*** (WILSON). Junco. "Snowbird."

An abundant winter resident, from October 25th to April 15th. Often caught around barns, when the snow is on the ground, by boys in "figure 4" traps.

Genus **Peucæa.**

88. ***†Peucæa æstivalis bachmani*** (AUD.). Bachman's Finch.

Rare. Only one specimen ; shot April 28th, 1877, from a low limb of a small oak while singing. The song was an exceedingly soft snd sweet strain, and seemed to be somewhat ventriloquial, apparently issuing from several different places, as it was sometime before I could discover the bird.

Genus **Melospiza.**

89. ****Melospiza fasciata*** (GMEL.). Song Sparrow.

In the previous list this bird is given as "an abundant resident." This is partially incorrect as they are quite scarce in Summer. I have never found the nest. One of the earliest of our birds to "tune up" for the great Spring song festival, and on this account quite a general favorite.

90. ***Melospiza georgiana*** (GMEL.). Swamp Sparrow.

Transient. Rather uncommon ; arrives April 1st to 10th.

91. ***Melospiza lincolni*** (AUD.). Lincoln's Finch.

Transient. Not uncommon in May. Like the last an inhabitant of wet and swampy places.

Genus **Passerella.**

92. ***Passerella iliaca*** (MERREM). Fox-colored Sparrow.

Abundant in March and November, and common during some winters. A bird of the thickets, in preference to all other places.

Genus **Pipilo.**

93. †***Pipilo erythrophthalmus*** (LINN.). Towhee. "Joree."

A common permanent summer resident. Thickets and brush-piles are their favorite resorts.

Genus **Cardinalis.**

94. ****Cardinalis cardinalis*** (LINN.). Cardinal Grosbeak. "Redbird."

An abundant permanent resident, and a favorite cage-bird. Three is the most usual number of eggs that their nests contain.

Genus **Habia.**

95. ***Habia ludoviciana*** (LINN.). Rose-breasted Grosbeak.

I have never met with this beautiful grosbeak but upon two occasions. On May 1, 1882, I shot one out of a flock of eight or ten individuals, and the following day, in the same place, I saw the same flock and four more were sacrificed to the cause of science. They were feeding apparently upon the seeds of the sycamore tree. I heard no note from them whatever.

Genus **Passerina.**

96. ****Passerina cyanea*** (LINN.). Indigo Bunting.

An abundant Summer resident from April 20th to October 18th. A voluble, but rather poor singer, compared to some of his Fringilline cousins, but his intentions are good and he doubtless does the best he "knows how."

At least one-third of the nests I have found contained eggs of the cow-bird.

Genus **Spiza.**

97. ***Spiza americana*** (GMEL.). Black-throated Bunting.

A very common Summer resident, but they conceal their nests with so much skill that I have never been able to find one. During May they sing a great deal; their favorite perches when they are uttering their stridulous notes being the tops of the stakes of rail fences.

Family **ICTERIDÆ:** American Starlings.

Genus **Molothrus.**

98. ***Molothrus ater*** (BODD.). Cow-bird.

A common Summer resident. The only parasitic bird we have in the Eastern part of North America. They congregate in large flocks in the Fall, and leave for the South about November 20th.

Genus **Agelaius.**

99. ***Agelaius phœniceus*** (LINN.). Red-and-buff-shouldered Blackbird.

A common Summer resident. Arrives in large flocks early in March.

Genus **Sturnella.**

100. ***Sturnella magna*** (LINN.). Meadow Lark. "Field Lark."

Resident all the year. Abundant in Spring and Fall. There is a current belief, doubtless well founded, that, at certain seasons, the flesh of this bird is infested with worms, perhaps some species of *cestoidea*, but I have never observed the phenomenon myself.

Genus **Icterus.**

101. ***Icterus spurius*** (LINN.). Orchard Oriole.

A common summer resident. Arrives about April 20th. Sings a great deal on the wing.

102. ***Icterus galbula*** (LINN.). Baltimore Oriole.

A common Summer resident. Arrives about the same time as the preceding. A great depredator upon grape arbors. Gov. J. Proctor Knott finds them a great nuisance in his large vineyard near Lebanon. When engaged in their robberies they are absolutely silent, and are perfectly aware, that, as far as they are concerned, grapes are forbidden fruit, for whenever a man with a gun comes into view, they are "off like a shot"—and it may be superfluous to add, *before* they are shot.

Genus **Scolecophagus.**

103. ***Scolecophagus carolinus*** (MÜLL.). Rusty Blackbird.

Transient. Common during the migration. Sometimes appearing as early as the middle of February, and occasionally seen as late as November 4th. The "rusty" part of his name will apply as well to his voice as to his coat.

Genus **Quiscalus.**

104. ***Quiscalus purpureus æneus*** RIDGWAY. Bronzed Grackle.

A summer resident; very abundant in early spring. This is the commonest and best known of the three blackbirds we have here. A noisy colony of them have for many years bred in some tall pine trees in a large yard in Bardstown, and one night in August, 1880, during an exceedingly violent storm many of them were killed, probably by flying, or being violently blown against obstacles of some sort.

Family **CORVIDÆ**: Crows and Jays.

Genus **Corvus.**

105. ***Corvus americanus*** (AUD.). Crow.

An abundant permanent resident. Here, as everywhere else, a pariah amongst birds, but the brainiest of them all. He has no friends, and apparently doesn't want any, for he increases and multiplies in the face of the most unrelenting persecution. He knows the range of every gun in his bailiwick, and in him the honest farmer's unsightly "scare-crow" excites no emotions, save those of derision and contempt.

Genus **Cyanocitta.**

106. ***Cyanocitta cristata*** (LINN.). Blue Jay.

A permanent resident; very abundant in the fall. Nests generally placed in tall trees near dwellings. A noisy, quarrelsome, and nest-robbing pirate. The popular belief that he is in league with the devil and visits his sulphurous majesty every Friday, to report to him and consult upon mundane affairs, is amply supported by his wicked disposition and general "cussedness."

Family **ALAUDIDÆ**: Larks.

Genus **Otocoris.**

107. ***Otocoris alpestris praticola*** HENSHAW. Prairie Lark.

A common winter resident; appearing in irregular flocks about the first week of November.

Suborder **CLAMATORES**: Songless Perchers.

Family **TYRANNIDÆ.**

Genus **Tyrannus.**

108. ***Tyrannus tyrannus*** (LINN.). King Bird. "Bee Martin."

An abundant summer resident; arrives about April 20th.

Several years ago, in May, I saw one of these birds occupying an exposed perch on a pear tree in bloom, about which many bees were darting. Several times I observed that the bird caught the insects without leaving his perch, by quickly turning his head and "grabbing" them. My attention being thoroughly aroused, I noticed that many of them seemed to fly directly towards him; the majority appearing to "shy off" at a short distance and change their course, but very few that came within reach escaped him. The question naturally suggests itself: did the thrifty *Hymenopteræ* mistake the fully displayed crimson crown (I could see that the crest was erected) for a flower? Once since I have observed the same phenomenon, but not as well as upon this occasion. Mr. C. C. Nutting, who has spent considerable time studying the birds of Costa Rica and Niagara in their native haunts, states that he has seen *Muscivora mexicana* perched upon a twig, and waving its curious and brilliant fan-shaped crest after the manner of a flower swayed by a gentle breeze, and thus attracting insects within reach. In fact the majority of the fly-catchers, a family that numerically reaches its greatest development in the Neotropical Region, all have some lively colored coronal decoration, which, perhaps, has been evolved for the special purpose above suggested. I understand that this subject has been discussed by Mr. H. K. Coale in a recent paper read before the Ridgway Ornithological Club, of Chicago, but I have not seen it, and am unaware whether or not he has touched upon this particular phase of the matter.

Genus **Myiarchus.**

109. **Myiarchus crinitus* (LINN.) Great-crested Fly-catcher.

An abundant summer resident; more numerous than the

preceding. They arrive about April 20th when they immediately begin to make the wood, orchards and gardens ring with their loud call-notes. They all appear to put in their appearance on the same day, and do not straggle in from the South like most of the migratory birds. Fresh eggs are to be had about a month after their arrival. All of the few nests I have found of this species—they breed in hollows in trees—contained the inevitable cast-off snake skins. Whether or not they act upon the idea that "the hair of a dog is good for his bite," which is merely a homely rendition of the homeopathic canon of "similibus similibus curantor," and put the skins in to keep the snakes out, I leave for the determination of some of our ornithological quidnuncs.

Genus **Sayornis.**

110. ***Sayornis phœbe*** (LATH.). Pewee.

A common summer resident, and one of our best known birds. On account of their confiding habit of building their nests in conspicuous and easily accessible situations, they are the most common victim of the nest-destroying-small-boy vandals, who on account of the vast amount of total depravity and original sin that is in them, break up their well made houses "just because," as one of the little fiends said to me, "they's so easy to punch with a stick." The pewees build much earlier than any of our common birds. I have found fresh eggs on March 29th. A few undoubtedly winter here, as I have seen them in December, January and February.

Genus **Contopus.**

111. ***Contopus virens*** (LINN.). Wood Pewee.

An abundant summer resident. I have seen them here as

late as October 10th. As its name indicates this fly-catcher is exclusively a woodland bird, and builds the handsomest nest of any eastern representative of its family, but it is a very difficult one to find.

Genus **Empidonax.**

112. ***Empidonax flaviventris*** BAIRD. Yellow-bellied Fly-catcher.

Transient. Rather uncommon.

113. ****Empidonax acadicus*** (VIEILL.). Acadian Fly-catcher.

A common summer resident; arrives about May 1st. Fresh eggs found May 20th. Their nests are quite strong, but are so slightly built that the eggs can be easily seen by anyone standing beneath them.

114. ***Empidonax minimus*** BAIRD. Least Fly-catcher.

Transient in April and May. Common. An inhabitant of orchards and open places, in preference to the woodland.

Order **PICARIÆ**: Picarian Birds.

Suborder **CYPSELIFORMES.**

Family **TROCHILIDÆ**: Humming Birds.

Genus **Trochilus.**

115. ****Trochilus colubris*** LINN. Ruby-throated Humming Bird.

A common summer resident; arrives about April 25th. On account of the differences of plumage between the male and female Ruby-throat, it is popularly believed that we have two species of humming birds, but out

of the four hundred kinds known to inhabit the two American continents, only one is found east of the Mississippi river. This particular little "winged gem" has a curious habit, when just caught alive in the hand, of "keeling over" on its back and feigning death, but they always neglect to close their eyes and so rarely deceive anyone. One spring, many years ago, dozens of them frequented an extensive honeysuckle vine, in a large tree within ten or twelve feet of the house, and at least twenty of them, at different times, flew into the open windows, and were captured, all of which invariably "played possum" in the way above indicated, to the great interest and amusement of the inmates of the house. They can be easily tamed and taught to feed upon sugared water, and make very interesting pets.

Family **CYPSELIDÆ**: Swifts.

Genus **Chætura.**

116. ***Chætura pelagica*** (LINN.). Chimney Swift. "Chimney Swallow."

An abundant summer resident; arrives about April 10th. A general favorite, all of whose habits are too well known to bear repetition here.

Family **CAPRIMULGIDÆ**: Goat-suckers.

Genus **Caprimulgus.**

117. †***Caprimulgus vociferus*** WILSON. Whip-poor-will.

An uncommon summer resident. I have never heard it in the vicinity of Bardstown.

Genus **Chordeiles.**

118. †***Chordeiles virginianus*** (GMEL.). Night Hawk. "Bull Bat."

Summer resident. Abundant in August and September,

and excessively so during a warm "spell" which lasted during the first three days of October, 1879. Bull Bat shooting is a favorite sport here during the last hour of the afternoon in August and September, but their uncertain and devious flight taxes the skill of the most expert gunner.

Suborder **PICIFORMES**: Piciform Birds.

Family **PICIDÆ**: Woodpeckers.

Genus **Dryobates.**

119. **Dryobates villosus* (LINN.). Hairy Woodpecker.

Permanent resident, not very common, but more so in winter than at any other time. A rather shy bird.

120. **Dryobates pubescens* (LINN.). Downy Woodpecker.

A common permanent resident.

Genus **Sphyrapicus.**

121. **Sphyrapicus varius* (LINN.). Yellow-bellied Woodpecker.

Winter resident. Rather common in the Fall, when they are most often seen about orchards, etc., where they are supposed to carry on their nefarious practice of "sap-sucking." The name "sap-sucker," is popularly applied to this bird as well as the two last, but the others should certainly stand acquitted of the crime. In fact all of the woodpeckers are insectivorous and are of incalculable benefit to man.

Genus **Ceophlœus.**

122. †*Ceophlœus pileatus* (LINN.). Pileated Wood-pecker. "Wood-cock."

An uncommon permanent resident in heavily wooded portions of the county. Less than fifteen years ago I often

noticed them within a mile or two of town but now they seem to have entirely disappeared from this vicinity. Always, a wary bird and very difficult to approach except in Florida where I found them quite tame.

Genus **Centurus.**

123. ***Centurus carolinus*** (LINN.). Red-bellied Wood-pecker. "Checker-back."

A common permanent resident. Also, accused by the farmers, without reason, however, of being a "sap-sucker."

Genus **Melanerpes.**

124. ***Melanerpes erythrocephalus*** (LINN.). Red-headed Woodpecker.

A permanent resident. Very abundant at times, but during some years none are seen for several months. They are rolicking, noisy sort of birds, and sometimes in October the racket that two or three dozen of them will make in the woods is almost deafening. Like the rest of his family he is eminently an insect eater, but is also very fond of a nice ripe cherry, and during the season makes frequent excursions to the orchard, where he is often shot for his pains, along with the Cherry Birds, by the watchful boy on guard—if the latter isn't up the tree himself.

Genus **Colaptes.**

125. ***Colaptes auratus*** (LINN.). Yellow-shafted Flicker. "Yellow hammer."

An abundant permanent resident. Stays much on the ground, feeding in company with robins. Very fond of the berries of the black gum. Here the Flicker is the principal "game" of juvenile sportsmen, and some people eat them, but they are not popular as an article of diet.

Suborder **CUCULIFORMES**: Cuculiform Birds.

Family **ALCEDINIDÆ**: Kingfishers.

Genus **Ceryle.**

126. **Ceryle alcyon* (LINN.).

Rather common. Not observed in winter, but a few are doubtless to be found here at that season.

Family **CUCULIDÆ**: Cuckoos.

Genus **Coccyzus.**

127. **Coccyzus americanus* (LINN.). Yellow-billed Cuckoo. "Rain Crow."

A common summer resident; arrives about May 1st; departs about October 12th. An inhabitant of the densest foliage of the tree-tops, where it is easy enough to hear him, but very difficult to see him.

128. *†Coccyzus erythrophthalmus* (WILSON). Black-billed Cuckoo. "Rain Crow."

A rather uncommon summer resident. Similar in habits to the last. As is very well known these two birds get the name of "Rain Crow" from the wide-spread popular belief that their mournful notes are only heard before a rain. Like most signs it signally fails in dry times.

Order **RAPTORES**: Birds of Prey.

Suborder **STRIGES**: Nocturnal Birds of Prey.

Family **ALUCONIDÆ**: Barn Owls.

Genus **Aluco.**

129. *Aluco flammeus pratincolus* (BONAP.). American Barn Owl.

In the museum of the Louisville Polytechnic Society there is a mounted specimen of this owl, which was shot in Bullitt county, fifteen or twenty miles north of here.

Family **STRIGIDÆ**: Owls.

Genus **Asio.**

130. ***Asio accipitrinus*** (PALL.). Short-eared Owl.

Rare: one specimen only, flushed from a clump of briars, November 17, 1881, and shot by Mr. W. H. Rowan, of Bardstown.

Genus **Scops.**

131. ****Scops asio*** (LINN.). Little Screech Owl.

A common permanent resident. I have seen fully fledged young birds on the wing May 31st. For two or three years a pair bred in a locust tree on the edge of a carriage way, and within thirty feet of the door of a large house.

Genus **Bubo.**

132. ****Bubo virginanus*** (GMEL.). Great Horned Owl.

A rather common Summer resident. A gentleman near here caught six or eight within a week with steel traps placed on a conspicuous perch in his barn-yard where the big marauders were accustomed to get their suppers.

Genus **Nyctea.**

133. ***Nyctea nivea*** (LINN.). Snowy Owl.

A circum-polar bird that occasionally visits these climes during severe winters. I know but two records of its capture: Audubon mentions one being taken "near Bairdstown, Kentucky," and several years ago Mr. E. E. McKay, of this place, shot one sitting on a gate-post during a snow-storm.

Suborder **ACCIPITRES**: Diurnal Birds of Prey.

Family **FALCONIDÆ**: Hawks, Etc.

Genus **Falco.**

134. ***Falco sparverius*** (LINN.). Sparrow Hawk.

A common permanent resident. Very wary; understanding as well as a crow how to take care of their skins.

Genus **Accipiter.**

135. ***Accipiter cooperi*** (BONAP.). Cooper's Hawk.

Sometimes rather common.

136. ****Accipiter fuscus*** (GMEL.). Sharp-shinned Hawk.

A common permanent resident.

Genus **Buteo.**

137. ****Buteo lineatus*** (GMEL.). Red-shouldered Hawk. "Chicken Hawk."

Permanent resident; probably the most common hawk found here.

Genus **Halietus.**

138. ***Halietus leucocephalus*** (LINN.). Bald Eagle. "Gray Eagle."

A newspaper paragraph (Nelson County *Record*, June 27, 1881) mentions the fact of one of these birds having been seen for several days near Boston, in this county.

Family **PANDIONIDÆ**: Ospreys.

Genus **Pandion.**

139. ***Pandion halietus carolinensis*** (GMEL.). Fish Hawk.

Rare. Mr. Rowan Wickliffe, of Bardstown, shot one in April, 1882, which is the only record of its occurrence here that I am aware of.

Suborder **CATHARTIDES**: American Vultures.

Family **CATHARTIDÆ.**

Genus **Cathartes.**

140. ***Cathartes aura*** (LINN.). Turkey Buzzard.

A common permanent resident, most abundant in summer.

Genus **Catharista.**

141. ***Catharista atrata*** (WILSON). Black Vulture. Carrion Crow.

An uncommon summer resident.

Order **COLUMBÆ**: Columbine Birds.

Suborder **PERISTERÆ.**

Family **COLUMBIDÆ**: Pigeons and Doves.

Genus **Ectopistes.**

142. ***Ectopistes migratoria*** (LINN.). Passenger Pigeon. Wild Pigeon.

Excessively common during some falls, but not nearly as abundant as formerly. There was an enormous flight of them here about fifteen years ago. The following extract from Alexander Wilson's account of this species in his "American Ornithology," published about the year 1810, will doubtless prove interesting: "Not far from Shelbyville, in the State of Kentucky, about five years ago, there was one of these breeding places, which stretched through the woods in nearly a north and south direction, and was several miles in breadth, and was said to be upwards of

forty milles in extent! In this tract almost every tree was furnished with nests, wherever the branches could accommodate them. The pigeons made their first appearance there about the 10th of April, and left it altogether, with their young, before the 25th of May. As soon as the young were fully grown, and before they left the nests, numerous parties of the inhabitants, from all parts of the adjacent country, came with wagons, axes, beds, cooking utensils, many of them accompanied by the greater part of their families, and encamped for several days at the immense nursery. Several of them informed me that the noise in the wood was so great as to terrify their horses, and that it was difficult for one person to hear another speak without bawling in his ear. The ground was strewed with broken limbs of trees, eggs, and squab pigeons, which had been precipitated from above, and on which herds of hogs were fattening. Hawks, buzzards, and eagles were sailing about in great numbers, and seizing the squabs from their nests at pleasure, while from twenty feet upwards to the tops of the trees the view through the woods presented a perpetual tumult of crowding and fluttering multitudes of pigeons, their wings roaring like thunder, mingled with the frequent crash of falling timber, for now the axe-men were at work cutting down those trees that seemed to be most crowded with nests, and continued to fell them in such a manner that in their descent they might bring down several others, by which means the falling of one large tree sometimes produced two hundred squabs, little inferior in size to the old ones, and almost one mass of fat. On some single trees upwards of one hundred nests were found. It was dangerous to walk under these flying and

fluttering millions, from the frequent falling of large branches, broken down by the weight of the multitudes above, and which, in their descent, often destroyed numbers of the birds themselves, while the clothes of those engaged in traversing the woods were completely covered with the excrements of the pigeons. These circumstances were related to me by many of the most respectable part of the community in that quarter, and were confirmed, in part, by what I myself witnessed. I passed for several miles through the same breeding place, where every tree was spotted with nests, the remains of those above described. In many cases I counted upwards of ninety nests on a single tree; but the pigeons had abandoned this for another, sixty or eighty miles off, towards Green river, where they were said at that time to be equally numerous. From the great numbers that were constantly passing overhead to or from that quarter, I had no doubt of the truth of this statement. The mast had been chiefly consumed in Kentucky, and the pigeons, every morning a little before sunrise, set out for the Indiana territory, the nearest part of which was about sixty miles distant. Many of these returned before ten o'lock, and the great body generally appeared on their return a little after noon." Shelbyville is about thirty-eight miles north of Bardstown. It is hardly necessary to state that no pigeon "roost" is known to exist in Kentucky at this day.

Genus **Zenaidura.**

143. ***Zenaidura carolinensis*** (LINN.) Mourning Dove.

A common permanent resident. They congregate in large flocks in the corn-fields during the fall and winter.

Order **GALLINÆ**: Gallinaceous Birds.

Family **MELEAGRIDIDÆ**: Turkeys.

Genus **Meleagris.**

144. †*Mealeagris gallopavo* LINN. Wild Turkey.

Said to still occur sparingly in the western part of the county.

Family **TETRAONIDÆ**: Grouse.

Genus **Bonasa.**

145. **Bonasa umbellus* (LINN.). Ruffed Grouse. "Pheasant."

Permanent resident. Not uncommon in deep wooded ravines and other suitable places in the western part of the county.

Family **PERDICIDÆ**: Partridges and Quails.

Genus **Colinus.**

146. **Colinus virginianus* (LINN.). Bob White. American Quail. "Partridge."

A common permanent resident, but with hawks, cold weather and sportsmen, has a hard time of it in "the struggle for existence." They sometimes breed very late. On October 15, 1884, I found a large bevy in a corn field so young that they were unable to fly. During the early part of the shooting season the birds spend most of their time in the woods; only taking to the stubble during cold weather.

Order **HERODIONES.**

Family **ARDEIDÆ**: Herons.

Genus **Ardea.**

147. ***Ardea herodias*** LINN. Great Blue Heron.

Transient. Rather uncommon, on account of the absence of suitable places for them.

Genus **Herodias.**

148. ***Herodias egretta*** (GMEL.). American Egret.

Mr. J. W. Fowler, of Louisville, informs me that he shot one of these herons in October 1881, near Fairfield, in this county.

Genus **Garzetta.**

149. ***Garzetta candidissima*** (GMEL.). Snowy Heron.

A hunter informs me that several years ago he shot a "white fly-up-the-creek" near here, which is probably referable to this species.

Genus **Butorides.**

150. ****Butorides virescens*** (LINN.). Green Heron. "Fly-up-the-creek."

A common Summer resident. Arrives about April 20th. Fresh eggs obtained May 12th. Nests generally placed in cedar trees, ten to twenty feet from the ground near streams.

Genus **Nycticorax.**

151. ***Nycticorax griseus nævius*** (BODD.). Black-crowned Night Heron.

Transient in May ; not very uncommon.

Genus **Botaurus.**

152. ***Botaurus lentiginosus*** (MONTAG.). American Bittern.

Transient ; rather uncommon.

Order **LIMICOLÆ:** Shore Birds.

Family **CHARADRIIDÆ:** Plovers.

Genus **Oxyechus.**

153. ****Oxyechus vociferus*** (LINN.). Killdeer.

A permanent resident. Common in the Spring, but rare in summer and Winter.

Family **SCOLOPACIDÆ:** Snipe, Etc.

Genus **Philohela.**

154. ***†Philohela minor*** (GMEL.). Woodcock.

Transient, so far as I know, but a few probably breed here. Not very common.

Genus **Gallinago.**

155. ***Gallinago wilsoni*** (TEMM.). Wilson's Snipe. "English Snipe.

Transient. Abundant in March and the first part of April.

Genus **Rhyacophilus.**

156. ***Rhyacophilus solitarius*** (WILSON). Solitary Sandpiper.
Transient. Quite common in Spring.

Genus **Actitis.**

157. ***Actitis macularia*** (LINN.). Spotted Sandpiper.
Transient, so far as my observations have extended. Arrives April 5th to 10th, when it becomes rather common for several weeks.

Order **ALECTORIDES:** Cranes, Rails, Etc.

Family **RALLIDÆ:** Gallinules, Rails and Coots.

Genus **Rallus.**

158. ***Rallus virginianus*** LINN. Virginia Rail.
Transient. Rare; but one specimen—May 10th, 1882, which was killed with a stone by a boy, who brought it to me.

Genus **Porzana.**

159. ***Porzana carolina*** (LINN.). Sora Rail.
Transient; rather common in October in fields overgrown with briars, where they are very difficult to flush. October 12th is the latest record I have of their occurrence here. Not seen at all in spring.

160. ***Porzana noveboracensis*** (GMEL.). Little Yellow Rail.
Transient; rare. The only time I have ever met with this rail was on October 1, 1880, when a male and female were shot in an old briary field.

Genus **Ionornis.**

161. ***Ionornis martinica*** (LINN.). Purple Gallinule.

Fourteen or fifteen years ago, when the writer was a boy of ten or twelve years of age, a strange looking bird was caught on "the creek" by one of his juvenile companions in iniquity, and for several days we held it captive with a string tied around one of its legs, and finally, I believe, not knowing what to do with it we turned it loose. The appearance of the bird with its brilliant plumage, its queer feet with the long toes, &c., made such a lasting impression upon me, that years afterwards, when I first saw a Purple Gallinule in Florida, I immediately recognized it as the counterpart of our quondam pet in Kentucky. On account of what I am now satisfied was over caution, this bird was not included in my former list.

Genus **Fulica.**

162. ***Fulica americana*** GMEL. American Coot.

Transient. Rather uncommon. In October, 1880, two were captured alive and brought to me. They were confined during the winter in a dry and well-lighted basement room, by themselves, and became very tame, always coming up when called by the person who fed them. Their food consisted of corn-bread crumbs and other miscellaneous table "scraps," upon which they throve finely. In April they were liberated in the yard with the poultry, and made no attempt at all to leave, but soon made themselves at home, and, by their strongly evinced disposition to assert their rights, enforced the respect of the numerous domestic birds with which they were brought into contact, who seemed at first inclined to regard them as intruders, who were to be vigorously put down. After

the first two or three days it was quite amusing to watch the other fowls sidle off when the Coots came up for their rations. The nearest water was a spring branch a hundred yards distant, which they regularly visited two or three times a day. They remained all summer, apparently perfectly satisfied with their humdrum domestic life, but in September they wandered off, probably impelled by the migratory instinct. An account of these two birds was published in *Forest and Stream* in July, 1881.

Family **GRUIDÆ**: Cranes.

Genus **Grus.**

163. ***Grus americana*** (LINN.). Whooping Crane.

Mr. E. E. McKay informs me that many years ago he observed this bird near Bloomfield in this county.

164. ***Grus mexicana*** (MULL.). Sandhill Crane.

Inserted on the authority of Mr. E. E. McKay, who has frequently seen it on the Beech Fork of Salt River in this county.

Order **ANSERES.**

Family **ANATIDÆ**: Swans, Geese and Ducks.

Genus **Branta.**

165. ***Branta canadensis*** (LINN.). Canada Goose. "Wild Goose."

Rather common in the air; but very few are seen on *terra firma* in these parts.

Genus **Anas.**

166. ***Anas boscas*** LINN. Mallard.

Transient; common.

Genus **Querquedula.**

167. ***Querquedula discors*** (LINN.). Blue-winged Teal.

Transient; common. The last of the ducks to pass northward in the spring.

Genus **Nettion.**

168. ***Nettion carolinensis*** (GMEL.). Green-winged Teal.

Transient; common. By one of those slips that happen to all of us, this duck was omitted from the former list.

Genus **Aix.**

169. ****Aix sponsa*** (LINN.). Wood Duck. Summer Duck.

An uncommon summer resident.

Genus **Fuligula.**

170. ***Fuligula collaris*** (DONOV.). Ring-billed Blackhead.

The only time I have ever met with this duck was on February 16, 1883, when a solitary female was shot on a small pond in a woodland.

Order **PYGOPODES**: Diving Birds.

Family **PODICIPEDIDÆ**: Grebes.

Genus **Podilymbus.**

171. ***Podilymbus podiceps*** (LINN.). Thick-billed Grebe. "Didapper." "Helldiver."

Transient; common on the streams and ponds in early spring.

It will be at once observed that, as regards the Birds of Prey and Water Birds, the list is very incomplete. Not being sufficiently acquainted with the former to infallibly identify them at a distance, or expert enough, as a collector, to shoot them, I have to leave out many species that undoubtedly occur here; and on account of the almost total absence of marshes, sloughs and ponds, very few water birds ever halt here during the migrations. The Passerine portion of the list is very much better; the only additional species that can reasonably be expected to occur here being *Parus atricapillus*, *Troglodytes ædon*, *Telmatodytes palustris*, *Protonotaria citrea*, *Helmitherus vermivorus*, *Hirundo bicolor*, *Lanius ludovicianus*, *Plectrophenax nivalis*, *Guiraca cærulea*, *and Empidonax pusillus trailli*.

Audubon speaks of *Protonotaria citrea* as being common near Louisville, and there are many other birds he alludes to as being found in Kentucky, which on account of the local character of this list are not included.

The following tables of seasonal distribution of the different species will doubtless prove interesting:

Winter Residents.

Birds that go north in Summer but spend the Winter here.

1. Regulus satrapa.
2. Certhia familiaris rufa.
3. Anorthura hiemalis.
4. Dendrœca coronata.
5. Dendrœca palmarum.
6. Carpodacus purpureus.
7. Zonotrichia albicollis.
8. Spizella monticola.
9. Junco hyemalis.
10. Passerella iliaca.
11. Otocorys alpestris praticola.
12. Sphyrapicus varius.

Summer Residents.

Birds that spend the Summer here but winter further south.

1. Hylocichla mustelina.
2. Galeoscoptes carolinensis.
3. Harporhynchus rufus.
4. Polioptila cærulea.
5. Mniotilta varia.
6. Helminthophila pinus.
7. Compsothylpis americana.
8. Dendrœca æstiva.
9. Dendrœca cærulea.
10. Dendrœca discolor.
11. Dendrœca dominica albilora.
12. Siurus auricapillus.
13. Siurus motacilla.
14. Oporornis formosa.
15. Geothylpis trichas.
16. Icteria virens.
17. Setophaga ruticilla.
18. Vireosylvia olivacea.
19. Vireosylvia gilva.
20. Lanivireo flavifrons.
21. Vireo noveboracensis.
22. Pronge subis.
23. Petrochelidon lunifrons.
24. Chelidon erythrogastra.
25. Clavicola riparia.
26. Stelgidopteryx serripennis.
27. Piranga rubra.
28. Poœcetes gramineus
29. Coturniculus passerinus.
30. Chondestes grammica.
31. Spizella socialis.
32. Spizella pusilla.
33. Peucæa æstivalis bachmani.
34. Passerina cyanea.
35. Spiza americana.

36. Molothrus ater.
37. Agelaius phœniceus.
38. Icterus spurius.
39. Icterus galbula.
40. Quiscalus purpureus œneus.
41. Tyrannus tyrannus.
42. Myiarchus crinitus.
43. Sayornis phœbe.
44. Contopus virens.
45. Empidonax acadicus.
46. Trochilus colubris.
47. Chætura pelagica.
48. Caprimulgus vociferus.
49. Chordeiles virginianus.
50. Ceryle alcyon.
51. Coccyzus americanus.
52. Coccyzus erythrophthalmus.
53. Catharista atrata.
54. Butorides virrscens.
55. Aix sponsa.

Transients.

Birds that are only found here during the Spring and Fall migrations.

1. Hylocichla fuscescens.
2. Hylocichla ustulata swainsoni.
3. Hylocichla aliciæ.
4. Hylocichla unalascæ pallasi.
5. Regulus calendula.
6. Cistothorus stellaris.
7. Helminthophila ruficapilla.
8. Helminthophila celata.
9. Helminthophila peregrina.
10. Helminthophila chrysoptera.
11. Anthus ludovicianus.
12. Perissoglossa tigrina.

13. Dendrœca cærulescens.
14. Dendrœca maculosa.
15. Dendrœca pennsylvanica.
16. Dendrœca castanea.
17. Dendrœca striata.
18. Dendrœca blackburniæ.
19. Dendrœca virens.
20. Dendrœca pinus.
21. Siurus noveboracensis.
22. Oporonis agilis.
23. Geothylpis philadelphia.
24. Sylvania mitrata.
25. Sylvania pusilla.
26. Sylvania canadensis.
27. Vireosylvia philadelphica.
28. Lanivireo solitarius.
29. Piranga erythromelas.
30. Passerculus sandwichensis savanna.
31. Coturniculus henslowi.
32. Zonotrichia leucophrys.
33. Melospiza georgiana.
34. Melospiza lincolni.
35. Habia ludoviciana.
36. Scolecophagus ferrugineus.
37. Empidonax flaviventris.
38. Empidonax minimus.
39. Ectopistes migratoria.
40. Ardea herodias.
41. Herodias egretta.
42. Garzetta candidissima.
43. Nyticorax griseus nævius.
44. Botaurus lentiginosus.
45. Philohela minor.
46. Gallinago wilsoni.
47. Rhyacophilus solitarius.
48. Tringoides macularius.
49. Rallus virginianus.
50. Porzana carolina.
51. Porzana noveboracensis.

ANALYSES OF SPENCER AND NELSON COUNTY SOILS, SUBSOILS, CLAYS AND MARLS.

Number	County	Number in Reports	Organic and volatile matters	Alumina, iron oxides, etc.	Lime carbonate	Magnesia	Phosphoric acid P_2O_5	Potash extracted by acids	Soda extracted by acids	Water expelled at 380° F.	Sand and insoluble silicates	Moisture expelled at 210° F.	Potash in the insoluble silicates	Soda in the insoluble silicates	Rock fragments and gravel
1	Spencer	758	4.317	6.201	.345	.493	.187	.236	.014	.	89.970	.	.	.	.
2	Spencer	759	2.973	5.306	.246	.241	.144	.183	.047	.	90.095	.	.	.	.
3	Spencer	760	2.347	5.804	.220	.454	.106	.154	.030	.	90.220	.	.	.	.
4	Spencer	761	3.256	12.655	5.890	.979	.123	.424	.148	.	76.040	.	.	.	.
5	Spencer	2439	3.550	7.809	.320	.250	.236	.228	.192	.727	86.175	1.850	1.063	.473	.000
6	Spencer	2440	3.205	11.849	.295	.274	.221	.470	.117	.830	82.320	2.875	1.206	.384	.000
7	Nelson	714	6.659	9.165	.770	.452	.535	.222	.026	.	82.195	.	.	.	.
8	Nelson	715	3.423	6.245	.330	.282	.816	.130	.036	.	88.895	.	.	.	.
9	Nelson	716	2.804	7.080	2.30	.254	.277	.101	.034	.	88.970	.	.	.	.
10	Nelson	717	4.090	15.685	1.725	.731	.438	.334	.032	.	77.275	.	.	.	.
11	Nelson	718	4.449	13.600	.520	.967	.368	.283	.058	.	79.730	.	.	.	.
12	Nelson	719	5.298	8.185	.270	.416	.114	.098	.036	.	85.895	.	.	.	.
13	Nelson	720	5.384	8.655	.405	.492	.228	.193	.049	.	84.395	.	.	.	.
14	Nelson	721	4.858	8.360	.222	.563	.351	.208	.015	.	85.585	.	.	.	.
15	Nelson	722	4.088	11.370	.336	.487	.345	.275	.056	.	83.210	.	.	.	.
16	Nelson	723	6.280	17.505	.645	1.100	.773	.449	.272	.	73.095	.	.	.	.
17	Nelson	724	7.195	6.977	.425	.522	.342	.154	.021	.	84.595	.	.	.	.
18	Nelson	725	7.164	7.250	.520	.656	.343	.125	.027	.	83.770	.	.	.	.
19	Nelson	726	. .	11.850	.393	.966	.120	.749	.482	.	84.990	.	.	.	.
20	Nelson	728	1.127	9.430	.843	1.533	.144	.657	.229	.	85.840	.	.	.	.
21	Nelson	729	4.200	5.070	.396	.613	.172	.282	.095	.	84.495	.	.	.	.
22	Nelson	2213	3.360	7.977	.270	.166	.108	.116	.225	1.215	86.650	1.485	1.669	.274	1.400
23	Nelson	2214	2.990	10.349	.245	.187	.061	.164	.046	0.900	85.075	2.525	1.835	.400	.500
24	Nelson	2215	3.300	14.368	.880	.809	.102	.361	.657	2.415	76.840	1.129	2.742	.225	1.000
25	Nelson	2396	3.020	9.772	.145	.305	.173	.438	. .	.612	84.820	2.350	1.200	.646	. .

No. 1 is virgin soil taken from near Beech Creek, Spencer county, and is derived from the sandstones and shales of the Middle Hudson beds. No. 2 is from the same farm and a field which had been cultivated between fifty and sixty years, while No. 3 is the subsoil beneath No. 2.

No. 4 is a marl or blue clay which is so often seen between layers of hard rocks through this part of the state. It was taken from near Taylorsville. These clays are sometimes used as fertilizers and produce good effects when used with phosphatic manures. Nos. 5 and 6 are mentioned in the body of this report as taken from the farm of D. C. Wigginton.

No. 7 is a "woods pasture virgin soil," and is perhaps a mixture of the Upper and Middle Hudson River Beds. No. 8 is the same soil, but, which had been cultivated for thirty-three years, while No. 9 is the subsoil from the last.

Nos. 10 and 11 are under earths collected in the northeastern part of Nelson on Chaplin river by Dr. Owen. His notes are not such that they can be definitely located.

No. 12 is from an uncultivated soil, collected near Cedar Creek Church, and derived from the upper part of the Niagara section where the best building stones are found.

No 13 was collected from the lower part of the Upper Hudson beds, where the timbers are blue ash, sugar maple, wild cherry, etc. No. 14 is the same soil after forty years of cultivation, and No. 15 the subsoil of the same. No. 16 is a shell earth from the same farm. No. 17 is a virgin soil, blue ash land, Upper Hudson River beds. No. 18 is the same soil after fourteen years of cultivation.

No. 19 is a marl or clay from the Lower Sub-carboniferous, two and a half to three miles from New Haven. This is the clay which is so often seen at all the licks and waste places at the foot of the knobs. This contains valuable proportions of potash, sulphuric acid, magnesia, lime and soda. To exhausted lands the application of this marl would often prove of great benefit if mixed with bonedust or other phosphatic manures. No. 20 is a marl from the same horizon. No. 21 is a shell

9. Ardeidæ—5 species.
10. Anatidæ—6 species.
11. Hirundinidæ—5 species.
12. Strigidæ—5 species.
13. Rallidæ—5 species.
14. Troglodytidæ—4 species.
15. Scolopacidæ—4 species.
16. Sylviidæ—3 species.
17. Paridæ—2 species.
18. Sittidæ—2 species.
19. Tanagridæ—5 species.
20. Corvidæ—2 species.
21. Caprimulgidæ—2 species.
22. Cuculidæ—2 species.
23. Cathartidæ—2 species.
24. Columbidæ—2 species.
25. Tetraonidæ—2 species.
26. Gruidæ—2 species.
27. Certhiidæ—1 species.
28. Motacillidæ—1 species.
29. Ampelidæ—1 species.
30. Alaudidæ—1 species.
31. Trochilidæ—1 species.
32. Cypselidæ—1 species.
33. Alcedinidæ—1 species.
34. Meleagridæ—1 species.
35. Charadriidæ—1 species.
36. Podicipedidæ—1 species.

MARCH 25, 1885.