# Report of Geological Survey (Continued)

3. The gravel-beds are in all cases covered with considerable deposits of loam and sand, which form the present surfaces of the valley. These deposits are arranged in three natural and well marked divisions, viz., the first bottoms, the second bottoms, and the gravel terraces, sometimes called the third bottoms. Of this series, contrary to the general order in geology, the lowest number, viz., the first bottom, is the newest, and the highest number, viz., the gravel terraces, is the oldest. In other words, the first and second bottoms do not extend beneath the gravel terraces, and consequently do not result from the denudation of portions of the valley. The gravel terraces are at least one hundred feet above low water of the river now. They are generally left in small isolated fragments on the margins of the valley, but sometimes they are found to hold considerable areas. In the vicinity of the village of Trenton they can be seen and studied to the best advantage, as also in the vicinity of Post Town, and the Banker and Lucas farms.

To follow their history we must go back to the "Champlain Epoch" of geology—to the period of submergence that followed the glacial epoch. The level of this portion of the country was at that time four hundred feet lower than at present. Stratified deposits, on a large scale, of sand, gravel and clay are found four hundred feet above the present drainage of the country. At the period of greatest submergence there could have been little or no current through the valley, but during the slow-advancing movement of depression the valley was filled with immense accumulations of re-arranged Drift. We may suppose then, that the gravel terraces are a part of the old floor of the valley, and that they once extended with a degree of uniformity throughout the wide basins in which we find the remnants of them to-day. As the continent emerged once more and slowly regained its present elevation, the river channels would be cut deeper and deeper into these deposits, the former surfaces of which were left one hundred feet or more above the present river beds.

Little needs to be said in regard to their composition, as the name by which these deposits are known, viz., the gravel terraces, indicates the main element in their making up. Gravel, sand and loam, variously intermingled, constitute the whole series. The sorting and arranging of materials could only have been accomplished in long-extended periods of time. There are no indications of tumultuous deposition in any portion of the series. The soils formed from the weathering and decomposition of the surfaces of these beds are kind and productive.

(*b*) The second bottoms, like the terraces, must be referred to causes and conditions not now existing in the valley. They lie above the reach of the highest floods, being thirty feet or more above low-water in the main valley. They occupy broad areas, and constitute, by way of excellence, the farming lands of the valley. They consist of loams from two to six feet in thickness, overlying gravel which perhaps belongs to section a. They seem to owe their origin to an arrest of the upward movement of the continent, which continued for a considerable period.

(*c*) The first bottoms are the most recent of the series. They are, indeed, very closely connected with the present state of things. They occupy the deeper parts of the valley, and are covered by all of the higher floods. To these floods they owe their origin in part, being made up of the sediments deposited from high water. An arenaceous deposit filled with land-shells is a common and characteristic member of this formation. The shells must have mainly grown upon the regions where we now find them, and were buried by the deposits of annual floods. The clearing of the valleys and their drainage has introduced many elements of change, and the formation of these bottom lands may almost be said to have been interrupted. This sandy bed, to which reference has been made, is akin in composition and character to the loess of European geologists. An excellent example of the formation may be seen in river banks within the limits of the village of Middletown. It is burned here into a cream-colored brick that answers well for a paving brick, and which is quite extensively used for this service.

Its composition is shown in the following analysis of a specimen taken at the point above named. (*Prof. Wormley.*)

| | |
|---|---|
| Water combined | 5.20 |
| Silicic acid | 43.30 |
| Sesquioxide of iron | 3.48 |
| Alumina | 7.52 |
| Carbonate of lime | 23.21 |
| Silicate of lime | 5.09 |
| Carbonate of Magnesia | 13.09 |
| | 99.89 |

As can readily be judged from such a composition, soils of great fertility are not formed from this deposit, but there can be no doubt that it would serve an excellent purpose as a top-dressing for uplands. It is, in reality, a shell marl, and would reward intelligent use very liberally. The thickness of this bed has not been found to exceed four feet in any exposure noted.

There is often associated with above-named formation a sort of clay from two to four feet thickness that agrees in physical characters very closely with the *"joint clay"* of the western valleys. Its composition is shown in the appended analysis. (*Prof. Wormley*)

| | |
|---|---|
| Water combined | 4.20 |
| Silicic acid | 70.10 |
| Sesquioxide of iron | 5.30 |
| Alumina | 13.90 |
| Silicate of lime | 2.10 |
| Magnesia, carbonate | 1.44 |
| Potash and soda | 3.20 |

This deposit can also be seen at the point named under the last head. It is, however, less widely distributed through the valley.

## *GEOLOGICAL SCALE, ETC.*

The bedded rocks of Butler county belong, with the exception of the very limited area of one or two square miles, to the Lower Silurian, or Cincinnati Group of Ohio.

The exception named above is found in the north-eastern corner of Oxford township, where a spur of the Cliff Limestone crosses the county line, and covers a section or two of the county. Dr. Locke called attention to this spur in the report of the former State Survey. Both the Clinton and Niagara formations are shown here, but the area is so small and is known to so few residents of the county, comparatively that it will be dismissed from further consideration at this time.

The general geology of the Cincinnati Group has been treated at length in Chapter X111. of Vol. 1, of the Final Report of the Ohio Geological Survey. This chapter may be taken as a part of the report on the geology of Butler county. To it the reader is referred for the general considerations upon the origin and history of this most interesting formation. The series, which has in the State an aggregate thickness of about eight hundred feet, is there divided into three divisions which are named, respectively—

| | | |
|---|---|---|
| The Lebanon beds | 300 | feet thick |
| The Cincinnati division proper | 425 | " " |
| The Point Pleasant beds | 50 | " " |

The Butler county scale begins at about two hundred above the base of the system, and extends to the summit of the series. It thus contains about six hundred feet of bedded rocks—or, in other words, comprises somewhat more than one-half of the Cincinnati division proper, and the whole of the Lebanon division.

There are few peculiarities of stratification or fossil-contents in the county that deserve special mention here; and, on the other hand, there are few points of interest in the formation at large that are not shown in Butler county. It is emphatically a *Blue Limestone* county, its bedded rocks belonging almost entirely to this series, and its *drift* being also largely referrible to it, while its topography, its soils, and its water-supply are all controlled in considerable part by this formation.

One of the best sections in the county can be found at and near Hamilton. In the quarries just west of the river, the section can be begun at a horizon about two hundred and seventy-five feet above low water at Cincinnati, and it can be followed in frequent outcrops to the summits of Heitsmann's Hill, on the Millville pike, where many of the characteristic fossils of the Lebanon division are found.

The streams in the vicinity of Oxford, Seven Mile, and its tributaries, furnish very prolific although not very extended exposures. The horizon is quite definitely fixed by the presence of Orthis retrosa, Salter—Orthis Carleyi Hall. This shell is found on the banks of Seven Mile very near to the water's edge directly east of the village of Oxford. As was shown in the chapter already quoted, the vertical range of this fossil is very limited while its horizontal range is wide, so that it serves an excellent purpose as a land mark in the system. Its altitude is a horizon about four hundred and seventy-five feet above low-water at Cincinnati.

The Oxford sections are of interest from the fact that they yielded thirty years ago, many of the type fossils of the formation. The early geological work of David Christy, Esq., was done in this field, and through him collections of the fossils found here were distributed among eastern and foreign geologists. The name of Oxford is, accordingly, very widely known as one of the typical localities of the Blue Limestone or Cincinnati Group of Southern Ohio. The original cabinet of Mr. Christy is now in possession of Miami University, at Oxford. It contains a number of interesting fossils.

## *SOIL AND WATER SUPPLY.*

The agricultural capabilities of some portions of the county have already been touched upon incidentally. A few additional statements upon the general subjects of soil and water supply will be, however, appropriate here.

Butler county stands scarcely second in productive power to any equal area in the State. No qualification certainly would be required if the valley of the Great Miami and that portion of the county lying west of the river were alone to be taken into account. This region might put in an unquestioned claim to be styled the garden of Ohio. It is made up of the broad and fertile intervales of the streams that now traverse the valleys or of the still more desirable areas that were valleys of an earlier epoch, but which are now deserted by streams, and which are evenly filled with the beds of the later drift, together with uplands rising by gentle slopes to an altitude of four to five hundred feet above the river, and whose surfaces are scarcely less productive than the areas first named.

The soil of all this district contains, in great measure, decomposed limestone gravel, and exhibits every excellence of limestone land. A single area may be noted here as furnishing a unique line of facts in the native vegetation of the county. A chestnut grove is to be found in the south-east corner of Union township, near Pisgah Church. It is well known that the chestnut confines itself generally to the slate and sandstone soils of the county. Indeed, the boundary between the slates and the limestones in south-western Ohio could be defined with satisfactory precision by noting the line where the chestnuts begin as one passes eastward. Isolated trees are known in the gravels and sands of limestone districts, it is true, but they are very rare. Dr. John A Warder has called attention to one growing near Milford, in the Little Miami Valley, and another is known in Green county, but in the area to which attention is now invited, a forest growth in which the chestnut in a large element, is found. The trees have attained a diameter of four feet in some instances and in others stumps, long dead, are seen with large trees growing from them. The tree fruits well here and reproduces itself abundantly. Chestnuts (the fruit) were sold to the amount of forty dollars from a single farm three years ago.

The soil does not betray any peculiarities upon the superficial view, but the wells in the vicinity all show a great deposit of yellow sand beneath the surface here. Many fruitless attempts to secure wells in the neighborhood are on record, the sand proving to be a quicksand, and caving in so rapidly as to frustrate the sinking of the shaft to water. It has been thought that the sand would prove to be a moulding sand, but no trails of it have been made. The bed of sand is anomalous, and it is interesting to note that the native forest growth which covers it is also exceptional. There are no peculiarities in the remaining drift soils of the county that deserve special mention.

The poorest of them, as those covering the uplands of the northern and western townships, if handled with skill and subjected to a rational system of agriculture would take high rank when compared with even the strongest lands of the Atlantic border. Measured against the fruitful valleys and slopes just mentioned, and tilled under a system which even these noble tracts cannot much longer endure, they seem somewhat stubborn and sterile.

There are no native soils on the uplands of the county, but the beds of drift grow thinner as we pass to the southward, and occasionally they disappear for limited areas from the slopes of the Mills. The soil that is there formed from the waste of the shales and limestones of the Cincinnati series is of unusual excellence. The famous blue-grass land of Kentucky, it will be remembered, is derived from this same system.

The fact that the boundary of the drift is being rapidly neared as we approach the southern line of the county explains certain points in the topography of the four south-western townships. They are much rougher and more broken than the remaining areas. This arises from the failure of the drift to cover the irregularities here as it has elsewhere done. There is certainly no reason to suppose that the contour rock of the rocky floor is more irregular in one district than in another. What Butler county owes to the drift can be well seen by comparing Liberty and Union townships of the south-west.

The views furnished by the uplands, especially as we approach the Great Miami Valley from either side, are many of them, very wide and attractive. Several can be named that are not to be surpassed in quiet, pastoral beauty by anything within the limits of the State.

From Snively's Hill, near Jacksonburg, a wide and beautiful expanse of country is shown, of the main valley on the east and south, and of the valley of Seven Mile Creek on the west.

A still more commanding outlook is furnished on the farm of Randolph Meeker, Esq., near Pisgah. It comprises nearly one-fourth part, and that the richest corner of Butler county.

Such elements as these are not to be omitted in making out the catalogue of attractions that a country possesses for human occupation.

The water-supply of Butler county can not be said to be good. The geological formation from which the county is built is universally and necessarily poor in this respect. The rain-fall cannot penetrate the fine-grained clays of the Cincinnati series and is consequently turned outwards in surface drainage. Wherever, the rock is heavily covered with drift beds, the supply is improved, both in quality and quantity; but in the thinly covered uplands reliance can not be safely placed on wells. There is no excuse, however, for a defective supply for either man or beast in a district which has so generous a rain-fall as Southern Ohio enjoys. It is only necessary to save the roof-water in properly-constructed and properly-guarded cisterns.