

GEOLOGY.

Geological remarks on Cincinnati, and the country of Miami, by Daniel Drake, extracted from his statistical view, or picture of Miami country.

"The face of the country around Cincinnati having been depicted in the introductory chapter, the reader is prepared to engage in the examination of its internal structure. If a geologist at this place, ascend from the surface of the Ohio, when low, to the top of an adjoining hill, he observes, first, a region of tabular limestone and argillaceous slate; then a tract of alluvion, or bottom, composed chiefly of loam and clay; succeeded by a tract of the same kind, but more elevated, apparently more ancient and consisting principally of gravel and sand; he then arrives at the same kind of calcareous strata exhibited by the bed of the river; which he sees surmounted by a stratum of loam, covered with soil, and supporting occasional masses of granite and other primitive rocks. In attempting to give some account of these strata, the following order will be pursued: I. Of the limestone formation—II. Of the alluvial formation—III. Of the argillaceous formation, or the stratum of loam and soil—IV. Of the primitive masses.

I. The calcareous or limestone region under examination, is the largest perhaps in the known world. Parallel to the meridian, it extends, with few interruptions, but with considerable variations of character, from the shores of lake Erie to the southern part of the state of Tennessee, and probably to the cape of East Florida; as Mr. Ellicott informs us that the rocks of the celebrated reef, bordering that promontory, are calcareous. From the Muskingum are great Sandy on the east, this formation extends westwardly beyond the state of Ohio; but to what distance, has not been ascertained. After passing the Great Miami, in this direction, the strata become disjointed, and lose their continuity, but show themselves occasionally, even beyond the Mississippi. The lead mines, in the rear of St. Genevieve, abound in crystallized carbonate of lime; and the strata of the bed of the river, near that town, are said to resemble those of Cincinnati, except that they contain a notable proportion of chert or petrosilex.

The strata throughout this extensive region, agree in having a horizontal position, and in containing marine remains: it is therefore a floetz, or secondary formation—a vast precipitate from a lake or sea of salt water. To what depth it extends beneath the bed of the Ohio, has not been ascertained. In some parts of Kentucky, perforations in search of salt have been made more than 300 feet deep, without passing through it.

In the qualities and characters of this limestone, there is much diversity. At Cincinnati, it is of a blue or greyish blue colour, has a coarse grain: receives but an indifferent polish; is of various densities, with the medium specific gravity of 2.55: affords lime of a dark colour, but of sufficient strength; and is in strata from one to eighteen inches thick, which alternate with layers of clay-slate, the argilla fissilis of Turton. This substance which is in larger quantities than the rocks it separates, has a dull blue colour; breaks

into thick irregular fragment; softens and is *diffusible* in water; effervesces with acids; contains neither sulphur nor bitumen; and has the specific gravity of 2.55. To the south it nearly appears, and the calcareous strata change their character, passing into the state of marble; large quantities of which are quarried along the Kentucky river. To the east, when the argillaceous strata disappear, the limestone becomes charged with silicious earth, the species of slate called shivers is discovered, and in advancing a little farther, the transition to sandstone is found to be complete. This takes place before reaching Chillicothe, on the Scioto river. Limestone, however, again shows itself in spots, but with few of the characters it exhibits at Cincinnati. To the north of this town, the argillaceous slate has a great preponderance of the limestone strata; which have in that direction less solidity, and are more abundant in marine remains. This is the case for about fifty miles, when the region of silicious limestone suddenly commences. It appears at first in large quantities, but on approaching the sources of the Great Miami, it is seldom visible. The prevailing colour of stone is an ash grey; the proportion of sand or silicious earth is variable; it is frequently soft or crumbling when taken from the quarry and hardens on exposure to the air; in some places, as at Dayton, it assumes the texture of an indifferent marble; it effervesces with acids but feebly; abounds in nodules of flint; affords white lime by burning; the laminae are generally thicker than those of the Ohio, and frequently found consolidated into huge masses, which have irregular cavities and perpendicular or oblique fissures. An additional distinguishing characteristic, is the existence of rapids or cascades, in all the streams which flow over it.

No vestiges of sea animals are to be found in these ancient strata, except a large bivalve shell, the name of which I am unable to assign. But the more recent tract of greyish blue limestone around Cincinnati, contains numerous marine exuvia, of which the following are the most common.

1. The *anomia terebratula* and *placenta*—both composed of carbonate of lime. They are found in abundance, sometime detached and between the strata; at other times imbedded or consolidated; never compressed, and occasionally studded inside with six sided pyramids of transparent crystallized limestone.

2. The habitations of several species of *nautilus*, usually denominated *belemnites*, *cornua ammonia*, *thunder-stones*, &c. found both detached and imbedded, consisting generally of carbonate of lime.

3. *Entrochi* or *pulchra*, formerly supposed to exist only in the fossil state now said to be the remains of a species of *isis* or coral, named the *isis entrocha*. These are all silicious, and are commonly found detached.

4. Different species of *corallina* or *coralline*, found imbedded and detached, in large quantities—generally calcareous, now and then silicious.

Many other species, and perhaps genera, of these curious remains, could undoubtedly be designated by a skilful naturalist.

I have never observed the bones of any animals between, or imbedded in the strata of this formation. The head of the

sus tajassu, or hog of Mexico, discovered by Dr. Brown in one of the nitrous veins of Kentucky, had in all probability been brought and deposited there by the former inhabitants of this country.

The metals hitherto found in this formation, are not numerous. Where it borders on the sandstone region, as towards the Scioto and in Kentucky, iron ore of an excellent quality has been discovered. Near to the Yellow Spring, in Green county, described in the last chapter, specimens of silver ore of blend and pyrites have been dug up, but not in sufficient quantities to be worked. In the Indiana territory, where the same formation exists, combined and intermixed with much silicious matter blend and galena have been found.

Of saline matters, the most valuable which it affords are common salt, glauber's salt, eysom salt, saltpetre and calcareous nitre. The three first have only been found in solution. The latter exist abundantly in some of the sandstone strata and limestone caverns of Kentucky; and in some parts of this state.

II. The alluvial lands on the south side of the Ohio are narrow; but to the north of that river, when a looser stratification has permitted the streams to undermine their banks, the vallies are in general from one quarter, to a mile in breadth, and the depositions of alluvion very great. This is especially true of the Ohio, the Miamies, and their tributary and intermediate streams. The lands of this formation, generally rise in two or three successive tables from the stream to the hill, and are evidently of different ages. Most of them are lower near the hill, than at the side adjoining to the river. This is perhaps owing to the descent, in former times, of water from the uplands, which upon reaching the plain, instead of traversing it, would flow along the base of the hill; the surface in that direction having the same fall with the stream. Thus, in the rear of most bottom lands, there are brooks or rivulets. The older alluvions are composed chiefly of sand, gravel and water worn pebbles, covered from two to six feet deep with a bed of yellowish loam, that supports but a thin layer of soil. They are not without clay, iron and vegetable remains; though in general these are less abundant than the newer alluvions. The upper table in the town of Cincinnati, is of this kind. The gravel and pebbles are chiefly calcareous, though the water worn fragments of chert, flint, quartz and granite are not uncommon. A large proportion of the calcareous pebbles are fragments of the variety of limestone last described. Horizontal veins of blue clay now and then present themselves near the southern edge of this plain. Veins of ferruginous puddingstone (gravel cemented by iron) exist in a few places, and injure the well water. Vegetable substances, chiefly the decaying remnants of trees, have been found in different parts, at various depths, from 20 to 100 feet. The larger pebbles of this tract are generally nearest the surface, and on the side next the river. The beds of sand lie, in most parts, at considerable depths, and have an oblique or wave-like stratification, while that of the superincumbent pebbles is chiefly horizontal. The bottom, or lower table is composed of loam and clay to the depth of 20 feet or more, when gravel and sand, entirely silicious, and unlike those of the