**A geological history of Manhattan or New York Island. Together with a map of the island, and a suite of sections, tables and columns, for the study of geology, particularly adapted for the American student / By Issachar Cozzens, jr.**

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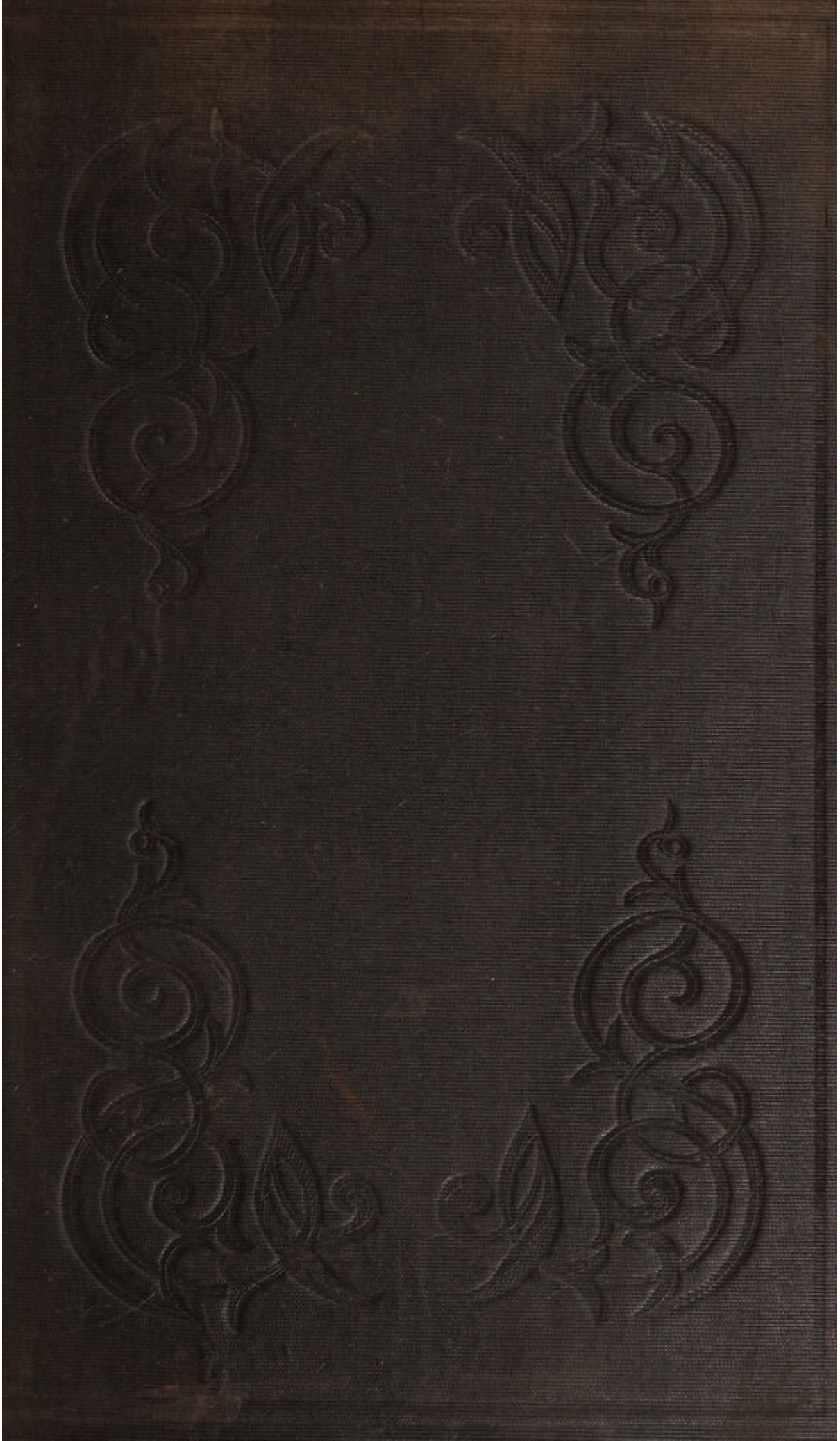

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To the Conductors
of "The Annals and Magazine of Natural
History" London
with the respects of the
Author

80413.

A

# GEOLOGICAL HISTORY

OF

# MANHATTAN OR NEW YORK ISLAND,

TOGETHER WITH

A MAP OF THE ISLAND,

AND A

SUITE OF SECTIONS, TABLES AND COLUMNS,

FOR

THE STUDY OF GEOLOGY,

PARTICULARLY ADAPTED FOR

THE AMERICAN STUDENT.

BY ISSACHAR COZZENS, Jr.,

LIBRARIAN OF THE LYCEUM OF NATURAL HISTORY OF NEW YORK, CORRESPONDING MEMBER OF THE NATIONAL INSTITUTION FOR THE PROMOTION OF SCIENCE AT WASHINGTON, &c., &c., &c.

NEW YORK:
W. E. DEAN, PRINTER & PUBLISHER, 2 ANN ST.

1843.

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TO

DR. J. AUGUSTINE SMITH,

PRESIDENT OF THE COLLEGE OF PHYSICIANS AND SURGEONS, NEW YORK.

DEAR SIR:

Knowing you have taken a greater interest in the promotion and study of Geology than any other person in the city of New York: and as your late lectures have proved your high attainments in the science, I beg leave to dedicate to you this my humble contribution.

I am dear Sir,

Your friend

THE AUTHOR.

*New York, January*, 1843.

# PREFACE.

When I first undertook to make Geological Sections, Maps, &c., it was for my own study and amusement, and I had no thought of publishing my productions; but as I found most of the elementary works on the subject, to be mere collections of hard names and foreign references, and consequently not likely to be looked on by the American student, but as a task, I thought I could show something more agreeable nearer home, and by adding historical facts, anecdotes and reminiscences of the city, I might induce some to read and become interested, in the greatest of all sciences; I therefore enlarged my work, and now, by the advice of my friends, I lay it before the public, hoping, it may at least serve as a *stepping stone* to the young Geologist.

# DEFINITION AND USES

OF

# GEOLOGY.

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*Definition of Geology.*—Geology is the study of the rocks, and all earthy and mineral properties, that form the crust of the globe, which man and his cotemporaries now inhabit; of all the apparent, past changes it has undergone by volcanoes, floods, earthquakes, and other lesser causes, such as heat and cold, the wear and tear of its surface, by rains or any thing else, which alters, or occasions a displacement of any of its materials.

*Uses of Geology.*—The knowledge of Geology seems to be requisite in all states and pursuits of life. The artisan and the mechanic, are benefited by the mineral products of the earth; without Iron alone, (the rusty king of all metals,) man could not exist in a civilized state, for, from the weighty hammer and the delicate needle comes most of the power, that man possesses in the mechanical arts. The agriculturist is assisted by a knowledge of the rocks, which compose the base of the material of

the soil which he is cultivating—practical men have often found out that soil* which is most congenial to the plants they intend to raise, but with the knowledge of Geology, their strength would be supported, and their practice made more perfect. The soil which produces in the greatest abundance, wheat, (the staff of life,) appears to lie beyond the Alleghany Mountains: in the state of New York it is underlaid by what is now called the "Silurian system of rocks:" these rocks consist of Limestone and Sandstone, and shaley clay, impregnated with lime, and some Gypsum, and are great beds of shells, which appear, as if they were once at the bottom of some ocean—the soil lying on the top of these rocks, is the most prolific to the farmer, in its products of grain and grass.

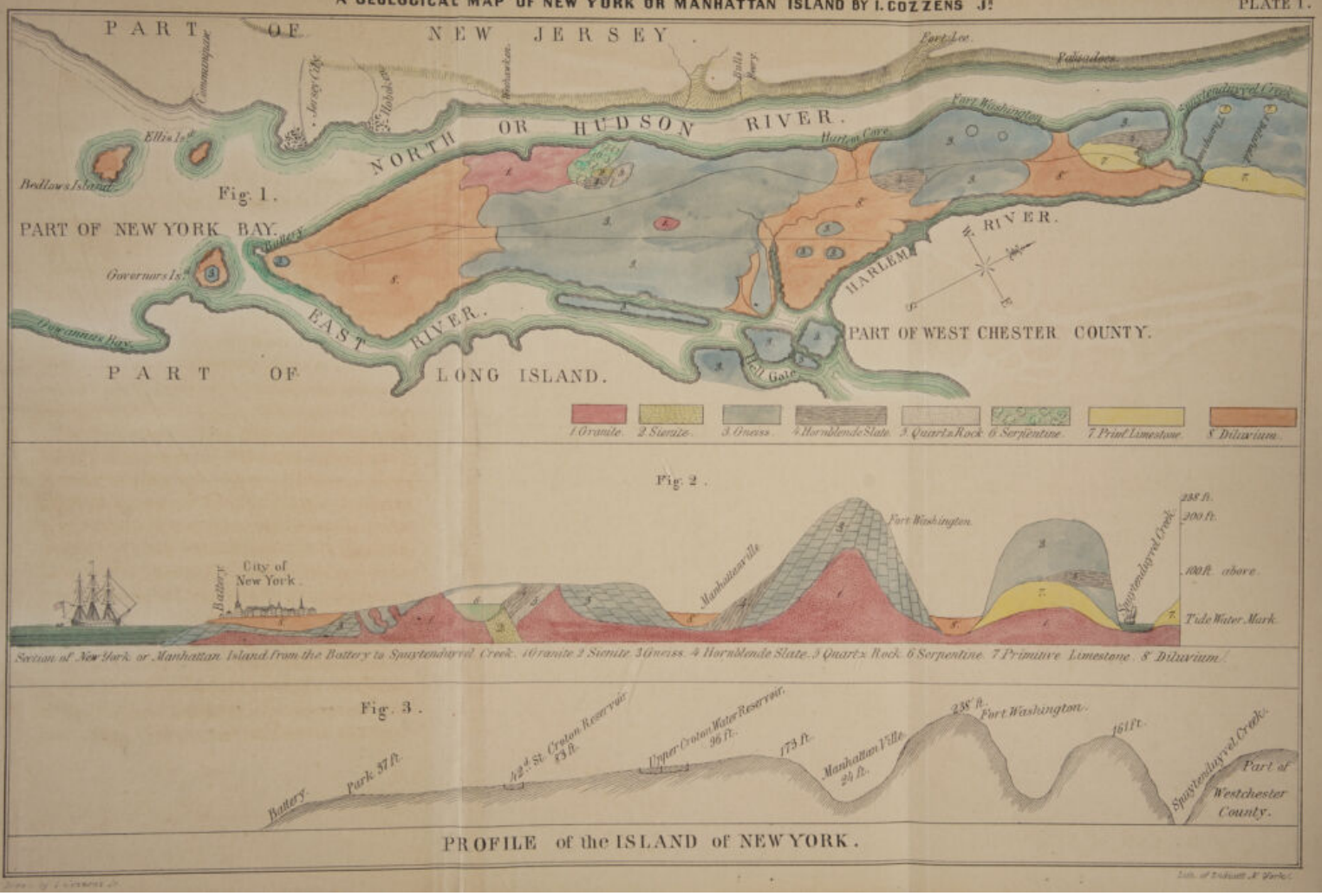
Even to the well-digger, a certain knowledge of the dip and make of the rock is requisite, that he may know how deep he must descend, and whether water can be obtained, and if attainable at all, at what spot. I have known well-diggers to pass

* On the warm, sandy soil of south New Jersey and Long Island, you can raise the sweet potatoes, (Convolvulus Batata,) although this plant, grows more luxuriantly in more southern latitudes. I have known these potatoes to grow from 12 to 16 inches long on the sandy soil of New York Island, on the farm of J. M. Bradhurst, Esq., 9 miles north from the City Hall, on the Kingsbridge road, while as far south as the city of Washington, in a clayey soil, they did not grow much longer than one's finger.

through some rocks upwards of 100 feet, and not find water after all that vast expense, when, if they had gone from 1 to 500 yards from the spot where they commenced, they would surely have got a good supply. It is my opinion, that it is almost an absurdity to commence digging or boring, below the top of any of the primitive rocks, to obtain water of any sufficient quantity, for wherever I have known excavations made in these rocks, the water which filled the cavities had always penetrated or wept in, between the Diluvium at top and the main rock, whether it was Granite, Gneiss or any of those which the older Geologists designated as primitive; and yet there is a small chance that water might be obtained through some unknown hollow fissure, but these cavities appear very rarely in the older rocks. To the miner, as it gives him the dip and the strike of rocks, and may show him when the mine will be flooded, the knowledge of this science, is of the first importance, whether it is intended to mine for coal, the ores of metals, or even in quarrying stone. Many more instances might be adduced, to show the usefulness of Geology; but as it expands the mind, being a matter of fact study, this alone, is sufficient to recommend it more generally.

A GEOLOGICAL MAP OF NEW YORK OR MANHATTAN ISLAND BY I. COZZENS Jr.

PLATE 1.




PROFILE of the ISLAND of NEW YORK.

# DESCRIPTION

OF

# NEW YORK OR MANHATTAN ISLAND.

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*Plate* 1, *Fig.* 1.

This island is about 13 miles long, in a straight line, from the point of the Battery to Kingsbridge; but by the old road, with all its windings, it is 15 miles. It consists of eight different series or formations of rock as follows:

1st Granite.—(*See Map and Section, plate* 1, *fig.* 1 *&* 2, *marked* 1.) This begins to show itself at 28th Street, a little east of the 8th Avenue, and runs in an interrupted line to the North river at 32nd Street, from thence, it is seen between the 10th Avenue and river, and parallel with the river, to 60th Street; it then crops out again at 86th Street, between the "Harlem Railroad Tunnel" and the "Receiving Reservoir" of the Croton Water Works: in levelling east 22nd Street, near, and south of the "Bellevue Alms House," it was exposed in two places in a pyramidal form, the top of which was cellular, and had a spongy appearance,

in the cells were found small crystals of Quartz, Feldspar and Prismatic Mica; the Gneiss lying superincumbent, with its dip varying from 30° to 45°.

2nd Sienite.—(*See Map and Section, plate* 1, *fig.* 1 *&* 2, *marked* 2.) This crops out at the north edge of the Serpentine: it may possibly be a large boulder of Greenstone, but if it proves so, it is the largest on the island; it is buried within a few feet of its top, which presents a considerable surface; it contains more Quartz than any of the Greenstone of the palisades which I have seen, and is a rock almost entirely composed of Quartz and Hornblende.

3d Serpentine.—(*See Map and Section, plate* 1, *fig.* 1 *&* 2, *marked* 6.) Between 54th and 62nd Streets, the shore and 10th Avenue, there are 4 or more small knolls, of black Serpentine, with scales of silvery and golden Talc, accompanied by a vein, about 12 feet wide of Anthophyllite. This vein is in a vertical position. At the north end of the Serpentine proper, this Anthophyllite shows itself in two places, *in place;* one, on the rising ground, and near the Sienite, the other at high-water mark on the shore. Actinolite is found imbedded in the Anthophyllite. The Serpentine locality commences where the Granite ends. At the south end, there is a vein of Carbonate of Lime.

This Carbonate of Lime has many small specks of Serpentine diffused through it, and forms a kind of "Verd antique," which, when polished, makes handsome specimens. At this locality formerly, at a considerable expense and labour, many excavations were made in search of the precious metals; the seekers allowing themselves to be decieved by the glitter of the golden and silvery Talc, through the Serpentine.

4th Gneiss.—(*See Map and Section, plate* 1, *fig.* 1 *&* 2, *marked* 3.) This rock has a greater extent, and shows itself more than any other on this island; it begins at the Battery, which it underlies, and a few years ago showed itself by an out-crop on one of the walks, but it has been levelled and buried, in making improvements, on that most delightful of spots; it was to be seen also (until lately) at the lower end of east 14th Street, near the river, but this was also buried, by levelling that part of the city: in 8th Street, west of the 3d Avenue, in digging a well, it was found about 18 feet below the surface. In boring for fresh water at Disbrow's Blacksmith's shop in Bleecker street, between Broadway and Mercer street, after passing through some 500 feet of Gneiss, the Granite was reached. The first or nearest place where it is now to be seen, is at 22nd Street, near the 8th

Avenue (as is shown by the blue on the map.) This rock begins, on the south side of, and underlies Governor's Island, which is its most southern extent, passing through New York Island, and running through the greater part of Westchester County: it forms the rock, at the straits called Hell-gate, and even at that place (where it may be traced some 8 or 10 miles) underlying Long Island.

The Gneiss of New York Island is a peculiar variety, and has more Mica than common, and which is also in larger plates than usual for this rock: some of this Gneiss, might with propriety, be called coarse Mica Slate. It is not a good building stone, on account of its splintering propensities, which makes it dress uneven and rough, if it is struck with an intent to make a cross fracture, it is sure to split the wrong way. On the 10th Avenue near 60th Street, it is associated with Hornblende slate, and a granular Quartz rock, and at the "Railroad Tunnel" at Yorkville, with Hornblende. On the East River, above Bellevue, are precipitous Gneiss rocks from 20 to 30 feet high, forming bold bluffs, and overhanging the water; at this place, it is sometimes, charged with Sulphuret of Iron in a state of decay, as may be

seen at Hell-gate ferry. The dip of this rock varies from the extreme of horizontal to vertical.

5th Hornblende Slate.—(*See plate* 1, *fig.* 1 *&* 2. *marked* 4.) This rock, is associated with the Gneiss in many parts of the island; at Spuyten-duyvel bluff, at the north end of the island, a large range is seen, which has been opened as a quarry. At Manhattanville, as you go north from the village, there is also a large bluff of this rock. The structure of this rock is lammellar, with black flat and long crystals of Hornblende, and grains of Quartz disseminated through it.

6th Quartz Rock.—(*See plate* 1, *fig.* 1 *&* 2, *marked* 5.) There are on the 10th Avenue near 60th Street, veins of various thickness of gray, granular Quartz, which, when broken out in hand specimens, is so friable, as to crumble into sand; this is associated with the Gneiss and Hornblende slate, in a ledge of rock east of the Serpentine.

7th Primitive Limestone (*See plate* 1, *fig.* 1 *&* 2, *marked* 7.) of Kingsbridge is well known; it is a Dolomite,* and has all the varieties of white, gray and light blue, granular, coarse marble; it begins at the south end of Mr. Dyckman's farm,

* This Dolomite I examined some 16 years ago, and found it to contain about 28 per cent of Carbonate Magnesia, from which I manufactured good Epsom Salts (Sulphate of Magnesia.)

and runs through the middle of the Island to Spuytenduyvel creek; the same rock runs through Westchester County, and is seen on the other side of Kingsbridge, and thence along the river toward Yonkers, especially, at Mr. Delafield's farm, where there is an extensive quarry, at East and Westchester,* at Greenburgh, at Singsing, and at Verplanck's point: a coarse marble for building is worked at Singsing by the prisoners. A quarry was opened at Kingsbridge, some years ago, which proved unprofitable. Lime has been burnt from this Limestone, but as it will not slack quickly, but first crumbles up in small grains, it has been discontinued for fine work.†

There was a few years ago, at the south end of this formation, on a by-road, leading from the main road, to the North river, a spring or natural fountain of pure cold delightful water, which gushed from this rock, and emptied in a natural trough of the same rock, within 2 feet of the level of the road; this trough was large enough

* The Merchants' Exchange in Wall street which was burnt down in the great fire of 1835, was built of the Westchester Marble, (Limestone,) the chafts of the columns were at least 24 feet in height and were of one piece. The new Exchange is built of Sienite called Quincy Granite.

† When time is allowed, for lime made from this marble to slack perfectly, it answers well for strong work, and it has also, been extensively used for agricultural purposes.

for animals to drink out of; but alas! in an evil hour, it was conceived by the owner of the land to quarry the stone at this very spot, and all the curiosity, with the beauty, is now gone. The quarrying at this place had laid bare some hundred feet of surface, on which was seen what are called "wave-marks,"* and which resemble the sand ripples of the sea-shore, after the tide has fallen, at the time of a calm. These wave-marks were no doubt caused by the waters passing through a seam, which lay in a position nearly horizontal, and forming an inclined table, over which the water passes to its outlet, the spring: hence not all the "ripple-marks" mentioned by geologists, and which are supposed by them to be caused by the ocean's ebb, are made in that way, but may have been formed by water (as in this case) passing through seams and fissures of rocks, particularly the Limestone rocks, which water has the power of dissolving.

Another curious fact, although not strictly geological, may be mentioned here, as it caused some wonder about 40 years ago. There were then three

* I visited this locality three weeks since, and found still some remains of the "ripples" on the rock, but they have been mostly obliterated by the crumbling structure of the rock, and the trampling of the cattle which go to drink out of a pool which yet remains on the lower edge of the quarry.

foot-marks (two left feet and a right one) on the smooth surface of the Limestone, on the north end of this formation near the road. These foot-marks appeared to me to have been made thus: first, the person, whoever he was, who made them, had stept in the mud, and then walked up the rock; the mud from his foot gave an outline, and then some sharp instrument was used to check and trace that outline; an Indian stone axe, or a steel one may have been used, for these marks did not seem to be of much antiquity: they were shown as a great curiosity under the denomination of Indian tracks, and were destroyed by the quarry-men, upwards of 30 years ago. Judging from this, and similar wonders which I have seen and heard of, I must infer that the "foot-marks," &c., &c., of the would-be geologists, are not exactly what they are *cracked* up to be. This formation* rests on Granite. For list of minerals imbedded in it, see catalogue.

8th Diluvium.—(*See plate* 1, *fig.* 1 *and* 2, *marked* 8.) This formation covers almost all the island; but under the city, and at the lower or

* Boulders of this Limestone are seen at Newtown, (Long Island,) which is about 10 miles south of Kingsbridge—a piece of one, on the road to Williamsburgh, would weigh at least 500 pounds; it has been broken to make stone wall.

distributing Croton Reservoir, in 42nd Street, and at Harlem flats, and on the Kingsbridge road, near the 12 mile stone, it is of the greatest depth: (it is coloured on the map as a reddish-brown.) In this wash, as it is called by some, are found types of all the rocks of the valley of the Hudson. As seen when taken in mass, its colour are a mixture of yellow, red, gray, and brown; it is a compound of boulders, gravel, sand and silicious clay. In its structure it differs; in some places it is a fine yellow sand lying on the top, as around the region of Broadway and 8th Street, (old Sandy Hill Lane,) and on part of Mr. Bradhurst's farm, and on the Kingsbridge road between the 7th and 8th mile stone. Part of a hill of this sand may still be seen at Mr. Brevoort's place, at 10th Street, west side of Broadway. This kind of sand,* whenever seen, always lies on top.

In describing the hills which have been dug down, I shall begin with the ridge,† which commenced at Warren Street, ran parallel with the

* This same kind of sand forms the earthy part of Bedlow's Island, the peninsula of Paulus Hook, (Jersey City,) Hoboken, and a large field near Hackensack, N. J., and also large areas on the south part of Long Island; and always lies on the top of the coarser Diluvium, and is never more than four or five feet in depth from the top.

† On a hill near where the corner of Provost and Varick Street now is, there was a revolutionary fort still standing in 1797, in which some of the old cannon lay dismounted.

North River, and ended at Mr. Lispenard's place, near where Canal or Laight Street now is. The sand, gravel, and other material of these hills, were not so coarse and so varied as those to be described.

In the same line, after passing Lispenard's creek,* we come to what was called Richmond Hill, (or rather, as the boys 50 years ago called it, "The General's Woods,") which was 30 feet higher than the present level of "Tivoli Garden."† The materials of this hill were the coarsest of all the hills on the North River ridge, but the boulders were not so large as those at Corlaer's Hook.

A high hill was dug down between where Anthony and Canal Streets now cross Broadway. In this hill were all the varieties of this formation; its height was from 25 to 30 feet above the present level.

On this hill, near where Franklin Street now is, on the east side of Broadway, stood a water basin, built before the Revolution, for supplying the city with water. A large well was dug near where White Street now crosses Elm Street; this well

* This creek commenced at the Collect pond and ran through Lispenard's meadows to the North River.

† This house stands within a few feet of the spot where it stood 50 years ago, but has been lowered to its present level; around this old mansion stood oaks, chestnuts, and other aboriginal trees of gigantic size. I remember one old chestnut tree which was at least 7 feet in diameter.

was from 30 to 40 feet span, and was to have had a steam engine, to force the water up the hill into the basin. The author has in his possession three paper bills, issued in 1775 and 1776, for the purpose of carrying this project into execution.

*Description of the Bill—on the face.*

NEW YORK WATER WORKS.

4 [No. 1257.]

THIS NOTE shall entitle the BEARER to the Sum of

EIGHT SHILLINGS,

current Money of the Colony of *New-York*, payable on DEMAND, by the MAYOR, ALDERMEN, and COMMONALTY of the City of *New-York*, at the Office of Chamberlain of the said City, pursuant to a Vote of the said Mayor, Aldermen, and Commonalty, of this Date. Dated the Fifth Day of *March*, in the Year of our Lord One Thousand Seven Hundred and Seventy-six.

*By Order of the Corporation,*

ANDW. GAUTIE,

8s. H. BRASHER.

On the reverse is a plate of an old-fashioned steam (?) engine, with a fountain on each side; and on one of the margins, "Eight Shillings"—on the other, "New York, printed by H. Gaine." The two four-shilling bills are dated 1775, and are signed by Wm. Waddel and J. H. Cruger. Tradition says this project failed in consequence of the breaking out of the Revolutionary War, which is very probable.

On the west side of Broadway, and nearly opposite to the water basin, stood an old fort (built of earth) which had been used during the Revolutionary War: on the outside of this fort, on the slope of the hill, were buried many of the American prisoners of war who had died in the old "Sugar House" in Liberty Street, then Crown Street, or in "The North Dutch Church" in William Street, both of which were used as prisons by the British. These bodies were buried so near the surface, that by the slight washing of the hill their bones were exposed; and many a time, when a boy, have I seen their remains pulled out and abused by my thoughtless companions—as late as 1800.

The next hill to be described was the highest and steepest on the south end of this island, and was called "Bunker's Hill;"* it stood where now

* They commenced levelling this hill about the year 1802, and in digging down, the earth was removed more than 14 feet lower than the bottom of the well; in it were found old iron hoops and other relics; among which was an old cannon, (a nine pounder,) which I saw there at the time. How often have I, when a boy, stood on the breast-work of this hill, and looked, with delight, to the south, over that beautiful sheet of water, the Kolck (Collect,) on the small city, with its few spires and domes. Beyond was seen the bay, with the hills of Staten Island still further in the south; then turning to the west, the "Noble Hudson," with the Newark Mountains in the distance, the farm houses and country seats of the island, and that stupendous work of nature, the palisades, on the north, and on the east the high ridge of that fertile plain, Long Island, "all covered with their native green."

is the junction of Grand, Orange, and Elm Streets, and where now stands "Centre Market." The Diluvium of this hill was similar to the rest of the hills of the island. It was a steep, and somewhat pyramidal hill, about 100 feet higher than the present level of Grand Street. On the top stood an old fort, in the centre of which was a well, from whence I have seen water drawn as late as 1800, and which, no doubt, had supplied the garrison who quartered there during the Revolutionary War. It is a curious fact, that after the earth was removed from the surrounding hills, and from around this well, the bottom of it was left dry; this shows that the well was supplied with water from the surface, and that surface wet by rains.

A coarse gravelly range of hills* lay on the west side of Broadway, north from Canal Street, to near where 4th Street now is. In this range were few large boulders. It was composed chiefly of coarse gravel and small boulders fit for paving stones.

* Most of these hills being covered with a small growth of cedar, and other trees, many kinds of game birds were found in great plenty, as late as 1797, as near the then city as Reade Street on the North River, and Rutgers' Street on the East River, such as Quails, (Perdix Virginiana, of Lin,) Woodcock, (Scolopax Minor, Gmel.,) Snipe, &c., &c., with all the smaller tribes of the neighbourhood; and in the salt marshes, and on the shore, were seen all the varieties of the water birds.

The hills at "Corlaer's Hook" were dug down between the years 1800 and 1830. Some of them, at the east of Col. Rutgers' house,* were nearly 80 feet in height; they were composed of all the different kinds of drift wash, &c., which are found on this island, and particularly of a vast number of large boulders, laying on, and next to, each other, and this to a greater degreet han in any other place. These heights have been levelled; but even now, in many parts of this region, when cellars are to be dug, many of these boulders appear, and when broken up, a sufficient quantity of stone is obtained to build the foundations. In digging down these hills, and breaking the boulders, many handsome minerals and fossils were found, which I shall enumerate in the catalogue. Two of these boulders were Anthophyllite, one of which was 18 feet long, 9 or 10 feet high, and about 12 feet broad; in this were beautiful crystals of Actinolite.† This Anthophyllite

* The country seat of Col. Henry Rutgers stood where now stands a new building (in a square) occupied by his nephew, Col. Crosby; in the rear of this, towards the east, on the highest of these hills, was a fort; this hill, if I recollect rightly, was more than 60 feet above the present level of Montgomery Street. There was also a fort where Division and Pitt Streets join Grand Street, on a hill called Mount Pitt.

† Near this boulder lay another large one of Chlorite slate, which was translucid, showing a beautiful green light through its thin edges. This boulder cannot be referred to any known locality in this neighbourhood.

had the same character as that of 60th Street, mentioned in the description of the Serpentine locality.* There were many boulders of Granite, Gneiss and Greenstone, as large as the two above-mentioned. The place where the young mineralogists used to roam in search of specimens, is now built upon, and churches and houses cover the spot.

At 42nd Street, on Murray Hill, at the Distributing Reservoir of the Croton Water Works, the Diluvium is a tough cement of clay, gravel, and boulders, very hard to dig. In digging through 42nd Street, the pickaxe had to be used for every shovelful of this clayey cement which formed what is called, a hard-pan, of about fourteen or more feet in thickness. At this locality there were more large boulders than at any other, if we except Corlaers' Hook.

The Diluvium of Manhattanville and Harlem flats, consists of gravel and pebbles, with boulders the size of a paving stone, and a few specimens of Kingsbridge marble, but no Serpentine. There is on "the flats," and after you pass the Tunnel, three or more detached spurs of the Gneiss

* Boulders of Anthophyllite and Serpentine are strewed all over this island, and Long Island, below the line of 60th Street.

rock, of some elevation. There was once a very large boulder of "Hudson River Slate" on Mr. Myers' farm, near his house, this was one of the largest pieces of this rock, which has been seen south of the Highlands, it was long since broken up, and used for building stone.

At an old tavern, called the "Cross Keys," on the Kingsbridge road, in the tavern-yard, is a detached rock of Gneiss cleft in two pieces lying side by side, and on the top of the Gneiss rock which lies in place, the striae of this removed rock, cross at right angles, the rock in place below—it is as much as thirty feet long, the two pieces together, being about nine feet broad and ten feet high.

In the valley, between Forts Washington and George, on the Kingsbridge road, and on the left side, there are a vast number of detached pieces of Gneiss rock, which have evidently been precipitated from the cliff above, which forms the hill of Fort Washington. The largest of all the boulders on the island, is the one which stood on a bare Gneiss rock at Depeyster's place, on the east side of the Kingsbridge road, where it is now crossed by 106th Street, and near the six mile stone. There was also a boulder, or rather large piece of rock, (which had been detached,

and slipped from its natural place,) near the old post road, and near where 51st Street crosses the 3rd Avenue; this large flat piece of Gneiss, lies supported against the rock of which it once formed the top, presenting the appearance of a cavern, particularly when it was surrounded by trees and undershrubs, overgrown and entangled with briers, giving it a deep shade.

*Fresh water ponds.**—There were three or more fresh water ponds on this island: the first and largest, was called the Kolck† (Collect) by the worthy Knick-

* In these ponds, were several kinds of fish, one peculiar to fresh water —viz. (Labrus Auritus, of Mitchill,) or fresh water sun-fish; the other species were common to both fresh and salt water. The common eel (Anguilla Vulgaris, of Mitchill,) three varieties of Killifish, (Esox pisculentus, of Mitchill) one of which, I do not recollect having seen any where else, it was called by the boys, "Yellow-bellied Cobbler," on account of its abdomen being of a golden colour. The "stickle back" (Gasterosteus quadracus, of Mitchill) was found in the powder-house pond, but did not inhabit "the Collect."

† This pond, when frozen over, was a most delightful spot for skating, and sliding, to which all the boys of former days repaired, some hundred might be seen amusing themselves, forgetting in the ardour of play the intense cold of the weather; but woe to those who were caught there on Sunday; old Delamater, old Thompson, and afterwards old Hays, then a young man, (the Sunday constables of that time,) gave them more terror, with the thoughts of Bridewell, than all the pleasure was worth. At the great undertaking of filling up this pond, and levelling the surrounding hills, a curious fact took place which should be noticed here. The specific gravity of the sand and gravel of the hill, was so much greater than the mud and sediment of the pond, that it pushed up in its centre large islands of this sediment, exposing a soft quagmire, and the

erbockers. This pond lay under that part of the now city, which is Duane, between Cross and Elm Streets, and between Elm and Orange Streets, the middle of which is now called Centre Street, and but a few years ago called Collect Street. "The Hall of Justice," that Egyptian fabric, vul-

continual throwing in of the heavy materials, raised the mud in some places from 8 to 10 feet, above the original level of the water, this mud became somewhat dry, and cracked open some 8 or 10 feet deep, falling over the heavy material and exposing what may be supposed, was once the under part and lay near the bottom of the lake; in this substance were Hickory, Butternut, acorns and seeds of all the surrounding forest trees, which had formerly skirted this pond; with great thickness of leaves, and some limbs of trees, and other black vegetable matter resembling peat; this induced the corporation of the city to employ men to make what the Irish call hand turf, it being too soft to cut with a turf spade; a large quantity of this turf was dried and carried to the almshouse for fuel, but it had a peculiarity not dreamed of, and which could not have been supposed as coming from the bottom of a fresh water pond, namely, an overcharge of marine salt. This I proved by burning out the vegetable matter, and leeching the ashes, (which consisted of a large porous mass, as large as the size of the peat acted upon,) and concentrating the lixivium to a pelicle. The knowledge of this analysis, caused Dr. Pascalis to say that this small lake, had formerly been a natron lake, similar to the natron lakes of Egypt. The salt in this mixture prevented the turf from burning, and, of course, making turf from the bottom of the collect was discontinued. It was about the year 1801 when they commenced filling up the collect—the first earth thrown in came from the excavations then making for the cellar and foundation of the "City Hall," in the park. In this pond, where now Pearl Street is, between Cross and Elm Streets, there was a natural island, with a powder-house on it, which gave the name of Magazine Street to that part of Pearl Street; and at the corner of Anthony and Collect Streets, was a point of natural ground.

garly called "the Tombs," stands near what was once the middle of this small lake.

The second pond of any size was called "Powder-house pond," and was a little west of Kipp's Bay, near where 32nd Street crosses the 4th Avenue. There was a small pond on the Greenwich road, now Greenwich Street, near where Provost Street crosses it, called "Higby's pond," and another where St. John's church now stands, in the rear of Mr. Lispenard's place, called the "Cat-fish pond," I have seen cat-fish (Silurus cottus, of Mitchill,) in this pond, but do not think they originated there.

There is now, on the Kingsbridge road about half a mile north of Harsenville another pond,* at this pond a few years ago the bull-frog (Rana Maxima, of Catesby,) took up his abode, I have never seen this Batracian on any other part of the island: a brook from this pond runs into another pond, between the road and the Hudson River. These are the principal ponds on the island.

*Swamps and Salt Marshes.*—Under the old

* Since writing the above, I have been informed by Major Leconte, that these two ponds were artificially made; the one on the east side of the road, by the British, during the Revolutionary War; the one on the west side by the proprietor of the land: but that there was here a natural stream or brook I have no doubt.

part of the city, were some swamps and salt marshes, the first to be mentioned was at the lower end of Broad Street, the second at old Fly Market, now the lower end of Maiden Lane;* the third, the swamp of Ferry and Jacob Streets—of this swamp something may be said. There was in this city, in 1824, a Mr——, who fancied and persuaded himself and others, that good and wholesome water in great plenty, might be had by tapping the earth in this place; so at it they went, and a great deal of time and money was spent in endeavouring to accomplish this object, but it so happened, they did not know (being neither Geologists nor Philosophers) that all our fresh water comes from the clouds, the rain falls on the earth and is absorbed, seeks its level, leeches through the earth and carries (if any in its way) all the salt, filth, and stuff it is capable of dissolving. As the tanners and curriers of the neighbourhood were very anxious to have good soft water, they employed this man to bore. He began his operation in Jacob Street, passed through

* At the corner of Maiden Lane and Gold Street, in digging to lay a foundation, the bottom of some old tan-vats were exposed, with the tan in them in a good state of preservation; the ground on the top, had evidently been made, as the bottom exhibited all the features of an ancient swamp or salt marsh.

the made ground on top, and came to the old swamp, with all its black mud, its remains of peat, roots of trees and other materials, such as are known to be in these places, but no fresh water, on the contrary, it was hard and stinking. What was to be done? after spending so much money! no good water! no good water! "Why it is a mineral spring," said one; "It is a mineral spring," said another, "The Corporation should certainly purchase it for the public," cried a third; "There's no doubt but it will cure all diseases, the Corporation should certainly purchase it!" a petition to this effect was sent in, and a Committee of the Corporation appointed for this purpose. The committee sent to Drs. Torrey and Macneven, and to the writer of this through Alderman ——— requesting an analysis of the water. Drs. Torrey and Macneven did nothing as I have understood, I examined the water, and gave an analysis to Alderman ——— but never received any acknowledgement, although by this analysis and report, the Corporation, no doubt, saved some thousands of dollars, which the owners and projectors of the spring asked. A regular fountain was set up at the spring, and six cents per glass was charged for this corrupt tanyard swamp water—one glass which I drank gave me a cramp in the stomach; I

thought at the time, and do still, that the proprietors of the concern put an extra quantity of salt in the well, for sometimes the water was salt as brine, while at others it was only brackish. At this "Spa," as it was called by the puffers in the news papers, a large number of people were collected; all the credulous, the searchers after the marvellous, were there, and were true believers in its medicinal effects.* Another swamp lay under that part of the city where Oak Street crosses Oliver—here, it was said, that another of these medicinal springs was discovered, by a *negro* but a few years ago.

The next swamp and largest of all, was called "Lispenard's meadows;" one arm of this swamp began near to, and a little north of, Reade Street, between Church Street, and the range of hills before described, which ran parallel with the Hudson River. The middle of this swamp, ran through

* It seems to me that there are people who delight in being humbugged, or else why run after these second kind of Cotton Mather witchcrafts—Animal Magnetism, Phrenology, the coming of the Millenium in 1843, Mormonism, Homœopathy, &c., &c., (though this last being in small doses, is not so difficult to swallow,) all these have their firm admirers and believers, as has "the Mermaid," a thing made of a Codfish's tail and an Ape's head, and its body stuffed with oakum. It does me some good to think that I foiled them once—viz; at the swamp spring, and that Dr. J. Augustine Smith, in his "Select Discourses," has staggered the phrenologists.

that part of the city on which West Broadway is now built, crossed Canal Street, and ended where Spring Street now intersects Laurens Street—from east to west, it ranged between Howard and Walker Streets, west of Orange Street, and was bounded on the south by the Kolck pond, it covered much of the ground on each side of Canal Street, had a creek in its centre, whose source was the aforesaid Kolck pond, and ran under the "stone bridge," into the Hudson, where the foot of Canal Street now is. Another brook came in from the north; these streams, met in the middle of the swamp, near where West Broadway and Laurens Street meet Canal Street—at the source of the northern branch, there was a spring of fresh water, which gave the name to Spring Street. At "spring tides" the water of the creek was often backed up, and could be seen running up, as far as the stone bridge, which stood where Canal Street crosses Broadway.

The "Minetta water" which gave the name to that little crooked lane, Minetta Street, was a small brook, the head of which lay north of part of "old Potters' Field" now Washington Parade Ground, and near where the corner of 6th Street and 5th Avenue now is. In 1820, there was still a small colony of muskrats, bordering this creek. The

brook passed along the lower end of Potters' Field, and formed a large pond called Bollus's pond, where Downing Street now is; the low swampy grounds that were filled up, caused this pond, which lay a little north-west of Richmond Hill.

*Salt Meadow.*—The next great tract of land, which has been altered by improvements, is "Col. Marimus Willet's and Stuyvesant meadows," Col. Willet's house stood a little north of Corlaer's hook point; at the first lowland, near where Rivington and Columbia Streets cross each other, at this point, the salt marsh began, and ran along the East River, to a small distance beyond what was called Brandt Mühle point," (Burnt Mill Point,) from a wind-mill formerly burnt down at that place. It was afterwards called Manhattan Island, and now the Dry Dock. This was once a famous place for the credulous to go money-digging, for it was said by all the wags of those days, that the pirates Kidd and Blackbeard had buried their plundered treasures here. The writer has seen more than 20 large holes which had been dug in this little knoll. About 25 years ago, the spot was covered with beautiful native oaks and other trees, and on its beach I used to catch an insect called the Cicindela. These meadows were nearly a mile long on the shore, and more than half a mile in

width, now they are almost all filled over with the earth of the surrounding hills, and built upon.

There are some salt meadows yet beyond the six mile stone, on the East River, which are somewhat altered.

At the foot of 30th Street, near the Hudson River, was a small salt marsh now all covered over with earth from the surrounding hills. There is yet a salt marsh, which has had no improvements on it, but the filling up and grading of the 10th Avenue, this is on the North River, near the foot of 42nd Street, at the upper end of the "Timber basin:" and there are a few other formations of the same kind near Kingsbridge.

There were many small streams or brooks on the Island, but none of importance, if we except the one called Harlem creek, which runs through the salt marsh, at the six mile stone; this creek has two or three branches, one of which follows along the lowlands to near Manhattanville, where some projectors in a speculation commenced a few years since, a canal, which they left when partly finished.

In digging down the hills of this Island, to fill up the swamps and low grounds, there has been a fine chance, for the geologist to observe, how the materials of this Diluvium were deposited; in some

parts, as at 40th Street, near the Distibuting Reservoir, all the pebbles, sand, gravel, clay, and boulders, are intimately mixed, and it has the same appearance at the top, as at 15 or 20 feet, below the surface.

At Corlaer's hook, most of the large boulders lay the lowest, but yet there were some at top: in many other places, the boulders were near the top, gravel next, then the sharp-grained sand, used for making mortar; but it must be observed, that almost always, if there was any sand, it was found in the lowest part of the strata: in some of the hills, there would be from five to ten different kinds of strata, composed of nearly the same materials; on the top, yellow, Silicious clay of one or two and sometimes three feet in thickness, (which appears to be an Alluvium*) then much gravel, small quartz

* *Alluvium*, (a member of the Diluvium.) There was on this Island, in many of the valleys or hollows, a fine yellowish-brown, Silicious clay of some tenacity, which was used for making moulds and forms by the founders of Iron, Brass, &c., and by masons for making a coarse cheap mortar; the localities in and about the city, are all dug out and built upon—in Broadway opposite Park Place, in laying the Iron pipes for the Croton water, one of these clay beds was come to, which had been partly dug out, and filled in with rubbish, and which I saw but a few days ago. On the Island beyond the city, in the valleys, these beds are still to be found. If there is any formation, that can be called Alluvial, in my opinion it is formed thus—an earthy matter, is carried up in the sap of trees, or other plants, and is kept in an organized form, until the tree has lived its time, when the tree dies and decays, all the matter of its

sand, with some large boulders the size of a paving stone, (the largest, being 3 or 4 feet thick) then a soft brown coloured sand, with little grit and considerable mica, from two inches to sometimes a foot in thickness; then a clear sharp-grained coarse sand, with very little mica, five or six feet thick; next a gravel of small pebbles, two or three inches thick; then a sand, similar to the one above, but not so clean and sharp; giving the bank a striped ribbon-like appearance, of gray, brown and ochre yellow: these different layers appear to have been deposited under different circumstances, or from a different influence, or at different times. There are some of these hills, which have twenty varieties of deposit, each deposit having its peculiar colour, its coarseness or fineness, its material; and then again, some

compound, (if we except its earthy,) is in time dissipated, the ashes of which, in the form of earth is left, and is washed down by rains, to the low grounds, and there forms beds, if the locality on which the plant grows is Silicious, this Alluvial clay is Silicious, if Calcareous, the clay will be Calcareous, or if Aluminous, it will partake of the Aluminous quality, and so on; when these vegetable products fall in swamps, or other wet places, and are not shifted by mechanical or altered by chemical changes, they retain their skeleton forms, and have been called Infusoria by some, and have excited much wonder, as they are thought to be of animalcular origin; it is not to be supposed, that *all* these minute skeleton forms are of vegetable origin, some may be of animal, but when we take into consideration, the vast quantity of vegetable matter, that the earth produces, and the comparitively, small quantity of animalcular, there is some reason to doubt, that all the beds of clayey earth, which form the bottom of ponds, &c., are of animal origin.

of these deposits, have all the materials of every kind, but contain no carbonaceous matter. How all these formations came where we find them, and at what time, and by what means, so regularly irregular, I shall not attempt a conjecture: no one believes those, who pretend to make it out by metaphysical reasoning, and as to facts, we have so few; we know that it is here, and was in some place else once, but any further, is a grand puzzle.

*Water.*—The water of the Island of New York, in most of the natural springs and wells was good, and is so now, on all that part of the Island above 42nd Street, where there has not been this digging down of hills, filling up of swamps, and other low grounds. But it is not to be supposed, the element could continue pure with our dense population, and where, all kinds of animal and vegetable substances, are brought for food, and other purposes; the drainage of the sinks and cispools, carrying down all the salts, both alkaline and earthy in solution, is enough to contaminate the city wells in a very few years. It is an unpalatable fact, that the draining of the sinks, forms part of the water, which we are daily using and have been drinking for so many years. I have always been an advocate for pure water, and was one of the first, who suggested the idea of bringing old Croton

to our city, and now after a lapse of some 30 years, I rejoice that this limpid stream is led to our doors. There were some few wells and springs on the Island, which were somewhat charged with iron, making them Chalybeate ; the one near where 24th Street, crosses the 8th Avenue, is so strong with iron, that it could not be used, for any useful purpose, neither had it any medicinal quality. Two of these springs were opened at the upper end of the Island, beyond the 8 mile stone, which were also abandoned, having no medical property.

## SECTION OF THE PALISADES,

### *West Side of the Hudson River.*

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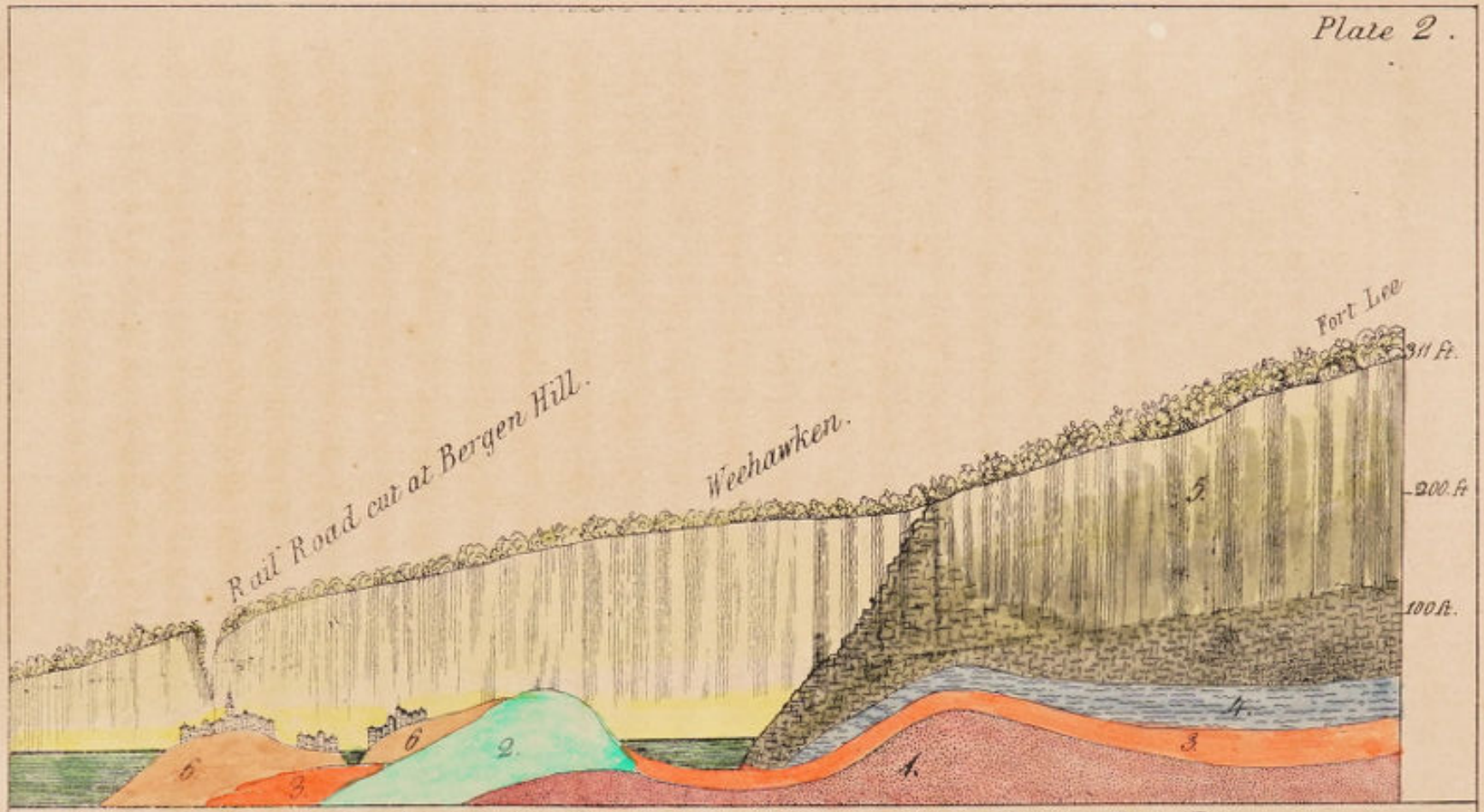
In describing plate second we will begin as before, with the lowest rock.

1st Granite.—(*See plate* 2, *fig.* 1.) This rock if present, is always seen the lowest.

The Granite, that underlies the shore of New Jersey, was reached, in boring some few years ago, for fresh water, on the Hoboken meadows;* the spot selected for this project, was about half way between the ferry wharf and the foot of Bergen hill. The operators after passing through the mud, sand, and other deposits from the river, which once flowed over it, came to the Sandstone which was easily passed through, and then to a much harder rock, which dulled and destroyed the points of their augurs. The borings which

* About 20 years ago, these meadows were dyked in to keep the tide at high water, from flowing over them, and large ditches were dug in many directions, over the meadows as drains, which exposed a number of recent shells, partly fossilified. These shells consisted of the recent oyster (Ostrea Borealis) Psammobia, Mytilus, Modiola, &c., &c. These shells lay about 4 or 5 feet below the surface.




Section of the Palisadoes on the Hudson River from Jersey City to Fort Lee.
1. Granite 2. Serpentine 3. Red Sandstone 4. Greenstone Slate 5. Trap or Basalt 6. Diluvium.

Drawn by I. Cozzens Jr.

Lith. of Endicott N.Y.

were first brought up, were when dried, a dust of gray Sandstone. After passing through this Sandstone, and just before they stopped operating, they came to the harder rock, the borings of which contained grains of Mica, Quartz and Feldspar. The two borings had at first sight a similar appearance, but the upper had no Mica in its composition. From the presence of Feldspar and Mica in the lower borings and from the greater hardness of the material, it is to be inferred that the Granite was reached, for whenever Mica accompanies the red Sandstone of this region, it has a large portion of per-oxide of iron, (which colours it red,) some clay, and is soft and easy to work. The hardness of the bottom rock, and the difficulty with which it was pierced, caused the stopping of the operation and no fresh water was obtained at this place.

At the side of the Weehawken hill road, soon after you pass the "William Tell House," the Granite shows itself, underlying the red Sandstone, which is in this place very thin, and altered by the trap that overlies it.

2nd Serpentine.—(*See plate* 2, *fig.* 2.) This rock is a different kind of Serpentine* from any

* In 1824, I undertook to make Epsom Salts of this rock, but was foiled

seen from other localities, (if we except the Serpentine of Staten Island,) containing a larger portion of Magnesia than common; it is of a light green colour, with variations, and having many veins of Carbonate of Magnesia, running through it; the Hydrate of Magnesia, not being so plenty. There are also some veins of Magnesian Carbonate of Lime, a kind of Gurhofite, accompanying it, in which, are seen the Hydrate in small scales. Locality—Castle Point, as you go north, from the ferry wharf, to that delightful walk "the Elysian Fields." This has long been a favourite resort for Mineralogists. There was once, at this locality, near the shore, in the perpendicular cliff, a wide seam filled up with a conglomerate of all the surrounding rocks, as well as Serpentine cemented together by a Carbonate of Lime and Magnesia.

3d. Sandstone.—(*See plate* 2, *fig.* 3.) This rock, is said to underly most of the state of New Jersey, north of a line drawn from New Brunswick on the Rariton, to Trenton on the Delaware, if we except the most north-western part of the state, which appears to be a Transition Limestone with

by the great quantity of oxide of iron and other metallic oxides it contained, which is the reason it has not been used for this purpose; I had a large product of impure Sulphate of Magnesia.

occasionally rocks of the more primitive orders such as spurs of the Highlands of the Hudson River. I have always considered this as the old red Sandstone, or an equivalent for it, but as objections are made to its being called the "*old* red Sandstone" we will describe it. In the first place, it is destitute of fossils, it is of many qualities of coarseness, but is not known to have many grains as large as a pigeon's egg. In colour it has all the varieties of red, chocolate brown, buff, yellow, gray and dirty white, and where altered, as if by heat, it passes into jasper, with all the above colours, to which may be added blue and violet. Imbedded in it, are Nodulous, Crystalline, Carbonate of Lime, inclosed in Micaceous oxide of Iron. Micaceous oxide of Iron in geodes, Sulphuret of Copper, &c.; for other minerals see catalogue. It is my opinion, that the impressions of fish said to be found in this Sandstone, do not come from this formation, but from one of the upper members of the Coal Measures* which lie above it, and are in

* Since writing the above, I have visited the Pompton fish locality, and am more strengthened in my opinion, that the shales which hold these fossil fish impressions belong to the Coal Measures. It is situated at one of the extreme westerly points of the trap rocks, and there is all the appearance of a fault, which should be the right place to find a dislocation of this kind. The rocks in situ, lie as described before by Mr. Thompson.

a shale containing Bitumen, and many of the same types, as are founed in the coal fields at Chesterfield, near Richmond in Virginia; where are also the same impressions of fish, ferns, plants and bitumen; the specimens brought from thence by Dr. Draper and presented to "the Lyceum of Natural History" have the same fossils and same character. At the new locality at Pompton, there are according to Mr. Aaron R. Thompson's account, three different series of rock, which lie thus—first and lowest, lies the Sandstone, then shale, with bitumen, impressions of fish, &c., then on the top a conglomerate of pebbles with a calcareous cement, this conglomerate is the same, as what is called at Shawanjunk Mountains, "Æsopus Millstone," and by Professor Rogers "Potomac Marble," which is composed of quartz pebbles and aluminous slate and in which not unfrequently are seen small crystals of native alum or a kind of Sulphate of Alumine. At and on the road which runs from the "water gap," of the Delaware River, this is again seen and is a con-

*See plate* 8, *fig.* 1. Which represents a section of the rocks with the fault, as seen on the east side of the Ramapo River, about half a mile north of Mr. Ryerson's Iron Works, in a ravine through which a brook runs. *Plate* 8, *fig.* 2, represents the rocks on the opposite side of the ravine, with a spur of trap at the highest point.

glomerate of Limestone, quartz and argillitic pebbles; then again the conglomerate of the Potomac is of different kinds of coloured Limestone with few quartz; one of the colums in "the House of Representatives" at Washington City has a quartz pebble in it, which may be seen by its projection above the other parts of the surface of the column. As this faint and *interrupted*, thin streak of "the Coal Measures," is lying superincumbent to this Sandstone, it cannot belong to it, but to the Coal Measures the same as those of Virginia. The "rain marks" of this formation, so often spoken of, appear to be formed thus—at Belleville, Newark, and Patterson, where the Sandstone is quarried in a large way, the stratum lies nearly horizontal, or with but little dip; the thickness of each layer is from one inch to four feet and sometimes as thick as six feet; between each layer is a ferruginous chocolate brown or red clay, this clay lies between most of the layers, (I have seen it where it is quarried to 25 feet depth, passing through eight or ten, or more of those layers,) and if any person will take the trouble to examine the under surface of each layer, as well as the upper, they will find, that on both surfaces of these layers, the marks exist. At every certain deposit of the sand of more or less thickness, there was a deposit of

slimey, clayey argillaceous matter, highly charged with oxide of Iron, some of which deposit still remains between and separates each layer. All do or will admit, that this Sandstone, was once grains of sand, like the sand on our beaches, but by time and the natural chemical action which is always going on, it has become indurated and cemented. All bodies that can absorb water, swell, and as they loose it shrink, (on this principle "Wedgeworth's Pyrometer" is made,) by this expansion and contraction the seams were made, and as the clay or argillaceous deposits were not so prone to cement as the silicious, there the seams do still exist; clay when drying shrinks, as this clay dried, it adhered to the upper and under surfaces, and in time became indurated, and by its shrinking it naturally formed these impressions called "rain marks." If any one will take plastic clay, make it into a soft batter or paste and put some of it between two roof slates, the phenomenon will be partly explained by pulling them apart. Many writers on Geology, do not take into consideration, the great chemical, as well as the mechanical changes which are going on; the influence of heat and its negative cold, magnetism, wetting and drying, solution, attraction, deposition, and cohesion, all have a tendency to alter and

make different modifications; there are natural chemical changes always going on, as a proof of these changes, dip a brick in a solution of Muriate of Soda, (brine of common salt,) put some mason's mortar on each side, lay it between two other bricks and keep it in a damp place about a fortnight; a salt will crystalize at the sides of the one which had been diped in brine, but on the upper and under ones no crystalization will take place, these crystals will not be (Muriate of Soda) common salt, but will be changed to Carbonate of Soda an alkaline Carbonate. This process is going on, in all our brick walls, in new buildings,* where the bricks in transporting have been left at the landings and soaked by the tide-water, or where they have been exposed on the deck of the vessel to the salt spray.

4th Greenstone Slate.—(*See plate* 2, *fig*. 4.) This is an horizontal layer, between the Sandstone and the vertical trap, of which last it is a member. It is lammellar, and between its laminæ it has in many places, minute crystals of Datholite, and all the minerals of this formation. It is seen most beautifully at the shore under the bluff at Weehawken for more than half a mile, with its

* See Dr. J. C. Jay's Walls to Cabinet, 22 Bond Street.

dip towards the west, and from ten to twenty-five feet or more in thickness.

5th Trap.—(*See plate* 2, *fig.* 5.) This rock, viewed from a distance, has the appearance of an columnar structure on a large scale; but on a nearer approach, it is seen to be full of seams and fissures in all directions; with an uneven surface. When the excavations were making at Bergen hill for the railroad, three six-sided joints were exposed, similar to those of the Giant's Causeway, of Carraefergus, but in their horizontal seams, they were without those grooves of parting, which the Irish Basalt has. I have seen from three to seven sided pieces at this and many other places; at Weehawken in many parts and at one particular spot on the shore this rock takes the columnar form. The trap of the Palisades has a long range, beginning at the north end of Staten Island, (where it lies beneath the diluvium,) running from thence along the Hudson River to Vredideka hook, (which according to Captain Partridge, is 668 feet in height) to Harvestraw Bay, where it ends on the Hudson River, from thence it runs west. In this formation are found all the varieties of Trap, Basalt, Sienite, Greenstone, Porphyritic Greenstone, Greenstone Slate, Toadstone, Amygdaloid, &c., &c.

In every locality the Trap has a vertical appearance. For Minerals see Catalogue.

6th Diluvium.—(*See plate* 2, *fig*. 6.) Is the same as that on the Island of New York.

## DESCRIPTION OF SECTION.

*Plate* 3.

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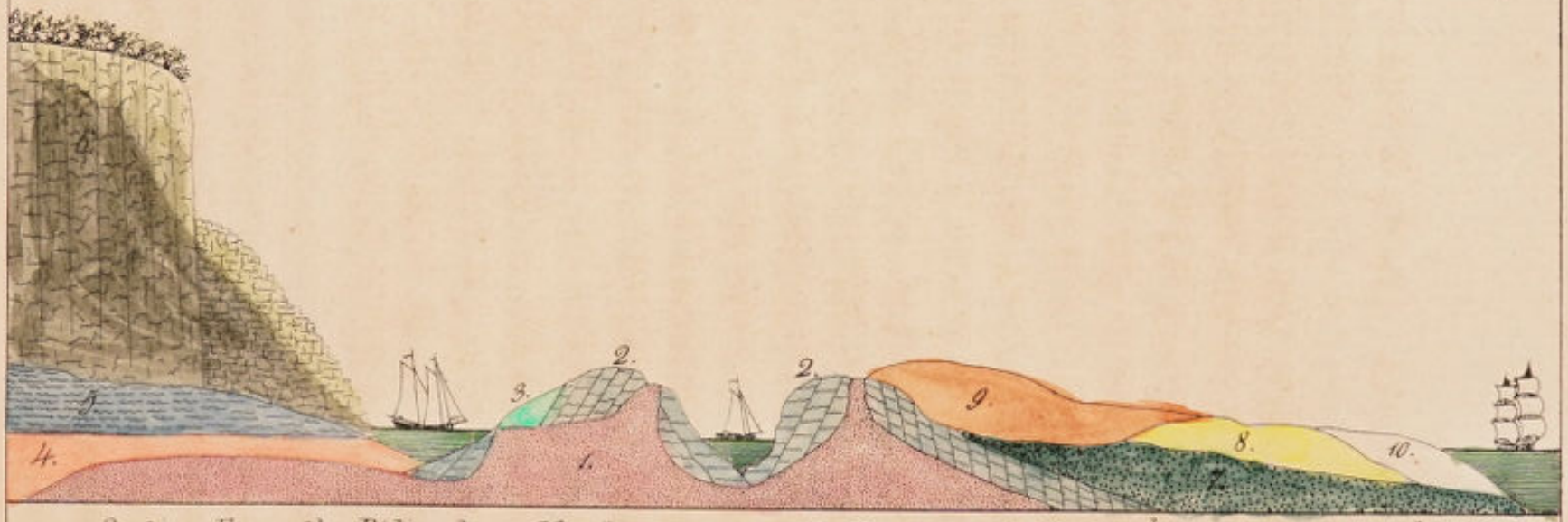
This section, it will be seen, commences at the Palisades of the Hudson River in New Jersey, runs across the Hudson River, the island of New York, the East River at Hellgate, and Long Island to the ocean, and has nine, and probably ten, distinct rocks or formations, in a stretch of 20 miles.

1st Granite.—(*Plate* 3, *fig*. 1.) Evidences enough of this rock have been seen and traced out to show that it underlies the Trap formation that borders the Hudson River, then opposite, on New York Island, it shows itself largely, as is mentioned in description of plate 1, fig. 1, marked 1, page 11; it is also seen at Sunswick, on Long Island, (now called Ravenswood,) near the seat of the late Col. G. Gibbs, in a quarry of Gneiss, crossing it in all directions, both in veins and in layers. For this fact I am indebted to Messrs. George and O. W. Gibbs, and I have since visited the locality and obtained fine specimens.

2nd Gneiss.—(*Plate* 3, *fig*. 2.) This rock has

Plate 3.




Section From the Palisadoes New Jersey across the Hudson New York Is.d Hell Gate Long Is.d to the main-Ocean
1 Granite, 2 Gneiss, 3 Serpentine, 4 Red Sandstone, 5 Green Stone Slate, 6 Trap, 7 Green Sand.
8 Tertiary, 9 Diluvium, 10 Beach Sand.

been quarried in many places. At Hallet's Cove, near the ferry, where it is beautifully striped, blue-black and white, (giving it a ribbon-like appearance,) it is a good building stone. At Ravenswood, which is a mile south, this rock does not quarry so well, having none of its seams so easily opened—at both localities its strata is vertical. This rock may be traced to the salt-marsh, one mile north of Williamsburgh.

3d Serpentine.—(*Plate* 3, *fig*. 3.)

4th Sandstone.—(*Plate* 3, *fig*. 4.)

5th Greenstone Slate.—(*Plate* 3, *fig*. 5.)

6th Trap.—(*Plate* 3, *fig*. 6.) The rocks of these four formations have been described already under their respective names.

7th Green Sand.—(*Plate* 3, *fig*. 7.) New Jersey Marl. It is more than probable that this member of the Cretaceous Group underlies Long Island and may be a continuation of the great range which begins at the south, in Virginia, and runs through New Jersey to the Neversink Hills, at which place it is last seen above the surface. Dr. J. C. Jay exhibited at the Lyceum of Natural History on Monday, December 19th, 1842, a large and beautiful specimen of the Exogyra Costata of Say, of the same age and formation as those of New Jersey. This specimen was given to him to

exhibit by Mr. Furman of Brooklyn, Long Island, and it was said to have been found (in digging a well) sixty feet below the surface; the specimen was very perfect, having both valves and some of the earthy matter of the Green Sand adhering to it—the only perceptible difference was, that the earthy matter was rather finer and had more shining specks of Mica than the Green Sand of New Jersey has—if this prove true, the establishment of Green Sand underlying Long Island is made out. It has been often said that quantities of large oyster shells have been taken from the bottom of deep wells on the island;* the Exogyra and Gryphæa so much resemble our common oyster that almost all persons who are not unacquainted with Conchology call them so.

8th Tertiary.—(*Plate* 3, *fig*. 8.) The Tertiary

* While I was writing on this subject, my friend, Dr. Samuel Akerly, came to my house, and after examining the fossil exhibited at the Lyceum, he confirmed the identity of the Green Sand on Long Island, by telling me that Dr. Samuel L. Mitchill had received the same fossil (Exogyra Costata) from Long Island, (between Brooklyn and Flatbush,) it was obtained from the bottom of a well which Mr. ——— was digging, many feet below the surface.

Dr. Swift, of the U. S. Navy, exhibited, as I understand from good authority, shells and pebbles of ancient sea-beach, taken from the bottom of a well dug on Long Island for the use of the United States Naval Hospital. What is remarkable, the workmen had to blast through a boulder in carrying on their operations. The shells were so weathered and water-worn that nothing could be determined as to their geological age.

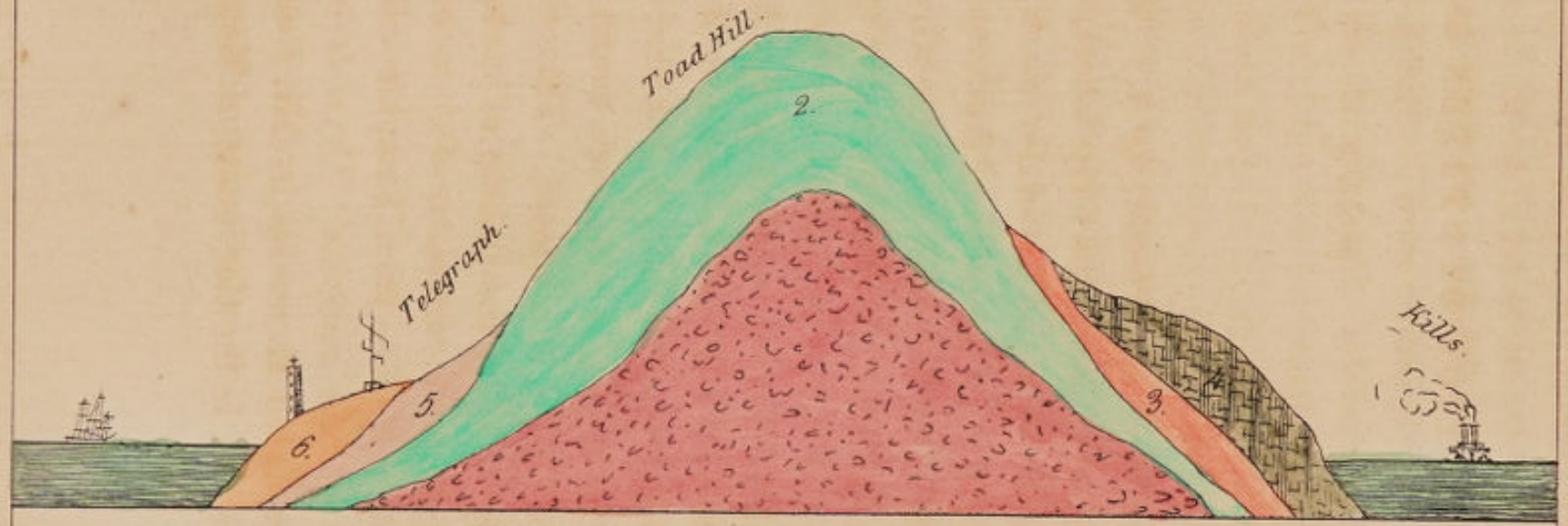
of Long Island, is a formation of White Quartz pebbles and sand, tinged yellowish with an oxide of Iron, and may be seen on the road as you go from Jamaica to Rockaway, and several other places. It is said that at "Lloyd's Neck," fine potter's clay in beds is found at tide-water mark. I once saw a waggon load of shell limestone that was brought from Long Island which had all the character of that rock which is found at Cape Fear, North Carolina; this was brought to New York to burn as a lime to be used for agricultural purposes. The late Dr. Samuel L. Mitchill had in his possession at one time, some oyster shells (Ostrea Canadensis) said to have been taken from a well on Long Island at the depth of thirty feet or more.

9th Diluvium.—(*Plate* 3, *fig*. 9.) The Diluvium of Long Island is on that range of hills which commences at Brooklyn Heights, and runs east through Harbour hill to the village of Norwich near Oyster Bay; on both sides and on the top of the ridge are all the varieties of boulder, gravel and sand, as in the Diluvium of New York Island, see page 18.

10th Beach Sand.—(*Plate* 3, *fig*. 10.) This is at the present time forming and altering its form, on the south shore of Long Island where the ocean

is rolling in its waves; and at all storms from the south and east, lobsters, crabs, shell-fish and other inhabitants of the deep, are thrown up from the bottom of the ocean. In a tremendous storm, about the first of March, 1839, on the beaches of this part of the island, was a wind-row of shells, from ten to twelve feet wide, and from two to three feet deep, that skirted the line of high-water for miles; these shells contained the living animals, and thousands of crows (Corvus Americanus) came here to feed on them—they were the beach clam or skimmer (Mactra gigantea) Natica heros and duplicata, and many other bivalves and univalves, with many species of crustacea, and one species of asterias. These shells, crabs, &c., were thrown in a layer or series, with the sand at their bottom and top, with a dip to the south similar to what we see in some members of ancient formations.

Plate 4.




Section of Staten Island from the Telegraph to the Kills.
1. Granite 2. Serpentine 3. Red Sandstone 4. Trap or Greenstone 5. Pea-iron-ore 6. Diluvium.

## SECTION OF STATEN ISLAND.

*Plate* 4.

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1st Granite.—(*Plate* 4, *fig.* 1.) This is seen at the south side of the ferry wharf, on the shore, between high and low-water mark at Tompkinsville, this rock differs from the New York Granite, and is what is called Graphic Granite, it has a large vein of white translucent quartz running through it; fine specimens may be obtained here.

2nd Serpentine.—(*Plate* 4, *fig.* 2.) This forms the highest hills on the island, it is similar to the Serpentine of Hoboken, but that no Hydrate of Magnesia has as yet been found, but abundant veins of the Carbonate. This Carbonate was brought up, by the sinking of a shaft (which was done by some dreamers after riches) in a valley, about four miles from Tompkinsville, on the south side of the turnpike. Crystals of the mineral since called Marmolite by Mr. Nuttal, were found imbedded in the Carbonate of Magnesia. It would

seem that the white silvery Talc of this locality took the place of the Hydrate of Magnesia.

3d Sandstone.—(*Plate* 4, *fig*. 3.) Indications of this rock shows itself, both on the south of the Island on the Richmond road, and on the north end, near the Trap; but it is supposed not to have been found in place as yet.

4th Trap or Greenstone.—(*Plate* 4, *fig*. 4.) This rock is the southernmost end of the Palisades of the Hudson River: it is generally a better kind to work or dress, than any further north of this locality, quarries have been opened, and large square blocks have been dressed, which show a beautiful and durable material for building, it is erroneously called "Staten Island Granite."

5th Beds of Pea Iron Ore.—(*Plate* 4, *fig*. 5.) These beds I think may be members of the Sandstone, they can be seen on both sides of the Island near the first corner, where the road runs from the Turnpike to New Brighton or "the Kills;" and on the road that leads from Tompkinsville to Richmond on the right hand, just before you come to the Moravian Meeting-house. This ore has been mined.

6th Diluvium.—(*Plate* 4, *fig*. 6.) This formation is mostly the same as that of New York and Long

Island; its greatest range is on the flats at the south side of the Island. At Stapleton, in digging down the hills, boulders of the "Catskill Mountain Limestone," were exposed containing Delthyris and other fossils. For Minerals see Catalogue.

## SECTION DONDERBERG.

*Plate* 5.

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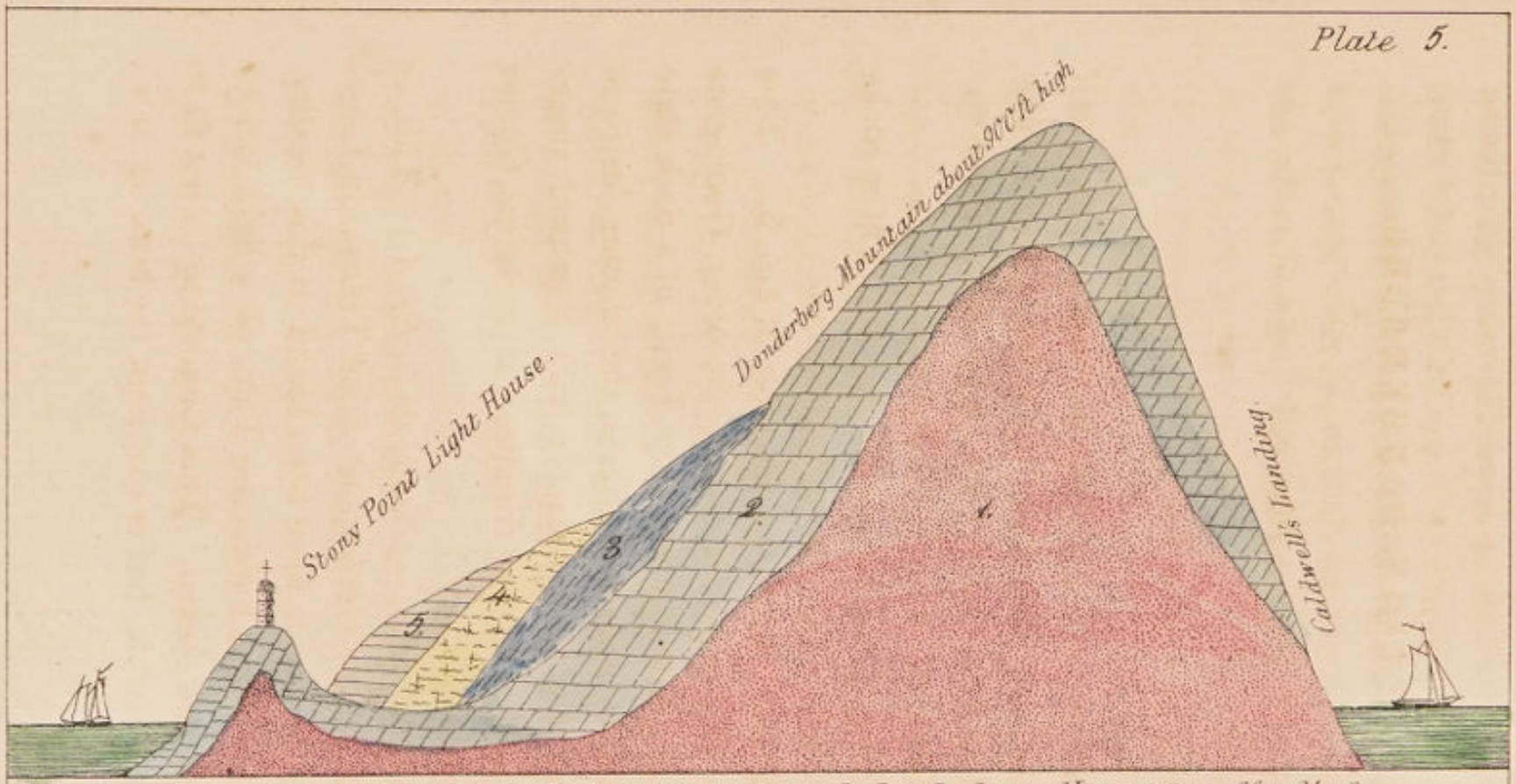
This commences at Stoney Point and ends half a mile beyond the turn of the river, above "Caldwell's Landing," on the west side of the Hudson.

1st Granite.—(*See plate* 5, *fig*. 1.)

2nd Gneiss.—(*See plate* 5, *fig*. 2.) These rocks are similar to those described before.

3d Talcose Slate.—(*See plate* 5, *fig*. 3.) This is one of the rocks which the older Geologists called Argillite; it is a slaty rock, of a dark slate blue colour, with sometimes, the shining lustre of talcy matter in its seams: with a natural rhomboidal and splintery fracture; it rests on Gneiss at this locality.

4th Limestone.—(*See plate* 5, *fig*. 4.) This is what the older Geologists called Transition Limestone; no fossils have been found at this locality. In the veins, is handsome Talc, of a light colour with a good lustre. This Limestone is not fit to use as a marble, but is excellent for burning lime;




Section from Stony Point on the Hudson river through Donderberg Mountain New York.
1 Granite 2 Gneiss 3 Talcose Slate 4 Transition Limestone 5 Brick Clay.

which lime is used in building and for agricultural purposes.

5th Brick Clay.—(*See plate* 5, *fig*. 5.) This is a *diluvium clay*, of two varieties of colour, the top is a light buff or dun colour, while the bottom is of a light slate blue, containing some black vegetable matter; large quantities of brick are made from a mixture of the two varieties of this clay: on the top of this clay, is a diluvium of gravel and sand, which is also used in the composition of the brick. This bed of clay is from eighty to one hundred feet thick.

## SECTION OF THE ROCKS OF THE ISLAND OF RHODE ISLAND.

*Plate* 6.

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1st Granite.—(*See plate* 6, *fig*. 1.) This rock shows itself, at the south end of this Island, and is a close-grained compound of Quartz, Mica and Feldspar, with occasionally some Hornblende ; one variety has small green specks resembling Serpentine.

It is not overlaid by Gneiss, as on the Island of New York, there is however one variety of the Graywacke, (which appears to run into Gneiss,) which has a small quantity of Mica in its composition.

2nd Serpentine.—(*See plate* 6, *fig*. 2.) The locality of this rock is between the town of Newport and Fort Adams, near the Granite ; it is a black variety of nearly the same quality as the Serpentine of New York Island.

3d Talcose Slate.—(*See plate* 6, *fig*. 3.) This rock, may be seen at Fort Adams, in the area of

Plate 6.

Section from Brenton's Reef to Portsmouth, Island of Rhode Island.

1. Granite 2 Serpentine 3 Talcose Slate 4 Varieties Graywacke 5 Shale 6 Coal.

that fortification; it is very similar to its brother rocks at Stoney Point; veins of Talc, Quartz and Carbonate of Iron run through this rock.

4th Graywacke.—(*See plate* 6, *fig.* 4.) There were many rocks called Graywacke by the older Geologists, the one which I have retained this name for, is a slaty conglomerate of pebbles and sand, cemented together, by a silicious cement, and without fossils. There are four or more distinct varieties of this rock on this Island, the most curious of which, are seen at the bluff that separates Easton's beach from Sachuest, at the south end of the Island; at this locality all the varieties may be seen, from the fine grain slaty sandstone or grit, to the coarse conglomerate; at this locality also, one variety has pebbles of a somewhat ovate form, which lie all in one direction, that is, they are longer than broad and lie side by side, and do not cross each other. Some varieties of this Graywacke run into the shale above it, and are so similar in appearance that they are difficult to distinguish. The kind used to make tombstones of, is an argillaceous slate, it is quarried near the Granite on the west side of "the Neck" near "Hog-hole."

At the above promontory* or bluff there is a remarkable chasm called "Purgatory," the opening of which faces the ocean and is about ten or twelve feet wide, and is open up to the top of the rock, and runs in from the sea about one hundred feet or more; this rock projects out in the ocean, and is some seventy or eighty feet higher than the level of the water, the top is covered with diluvium

* In the summer of 1840, I visited this romantic spot, and standing on the top, looked on the vast sheet of the ocean, which continually rolled in its boisterous waves, the sound of which gave a peculiar echo, like the dull ring of a metallic basin. There were some thousands of the white bellied swallow, (Hirundo Bicolor, of Audubon,) who after skimming the beach and ocean, would dart up and down, through this chasm, with swallow swiftness, while on the sod about the top, hundreds more sat perched, uttering their sharp note (wit, wit, wit,) the echo from the wave below, the bass roar of old ocean, the diamond brillancy of the spray sparkling in the sunshine, and the fresh breeze, all contributed to make this spot pleasingly sublime. Near this chasm, and on the top of the rock, are many irregularly shaped cavities, or impressions, filled with a dark blood red, argillaceous oxide of iron, these marks have a vermiform and confused appearance, and can be distorted in any form the imagination chooses, one of these is as large as a human body would occupy, of which a legend is told—It is said, that about the time the white man, first came to these parts, and long before Roger William's or William Coddington's days, that an Indian, who was jealous of his squaw, took her to this rock and there killed and left her, that the great spirit of the red people, was vexed at the act and opening this chasm threw in the murderer, and that the metallic, echoing, moaning sound has been ever since heard at the place. They who tell this story imagine they see the impression of the body, which is supposed to have decayed on the spot, and that the brownish red oxide of Iron is the congealed blood of the victim.

and sod, and is sloped in, making it funnel shaped; the bottom, is some twenty feet below the level of the ocean, and every rolling wave dashes in and throws its spray to the very top. How this opening in the rock was formed is somewhat problematic. The place in former times, might have been filled with softer materials, which were washed out by the waves of the ocean, continually dashing in—and yet no traces of any decomposable rock remain. The rock could not have been parted by any convulsion of nature, for the cavity is nearly as wide in its further end as at the mouth, and its sides are perpendicular; resembling an alley between two high buildings, with its back end closed up.

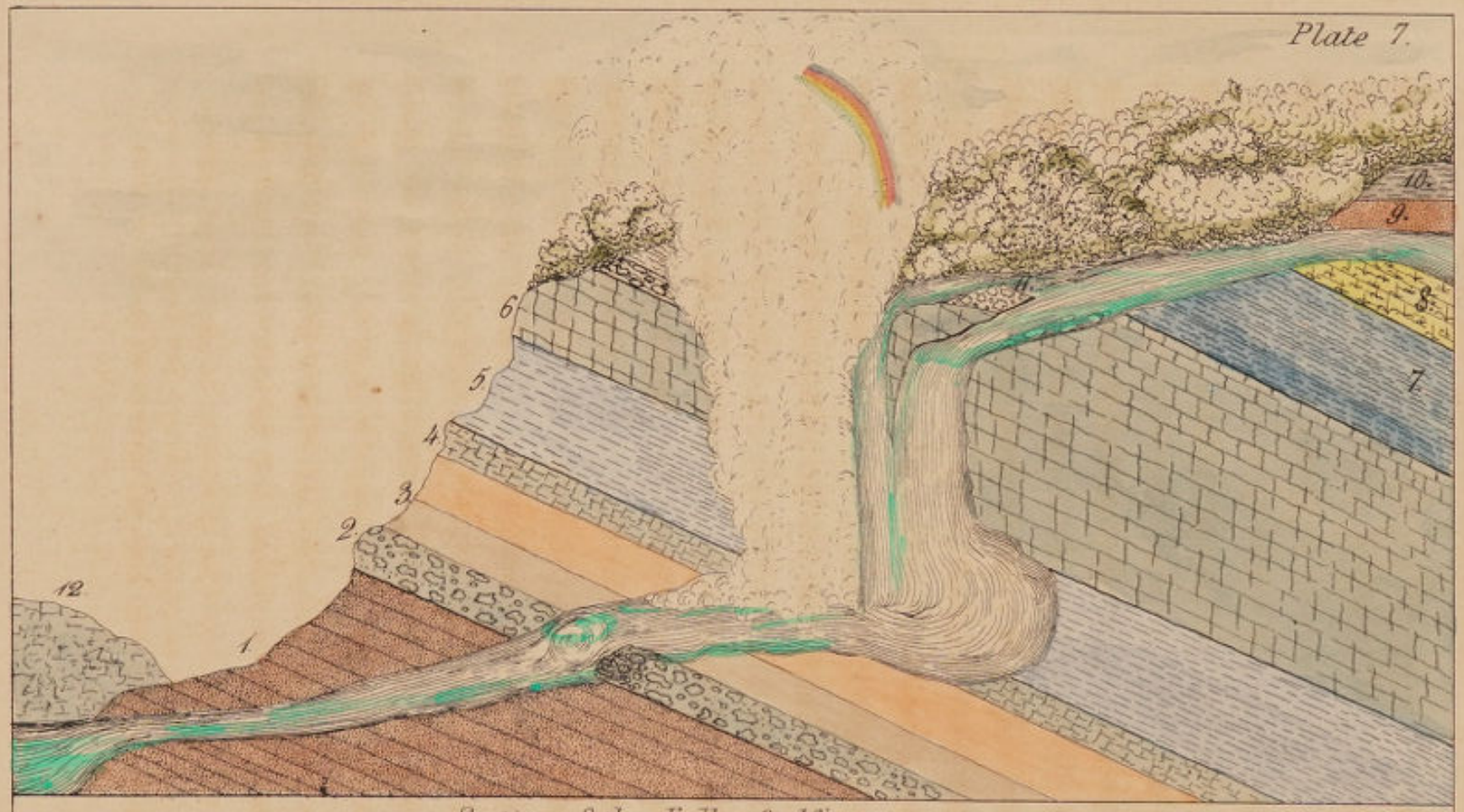
5th Black Shale.—(*See plate* 6, *fig.* 5.) This is a true coal shale, and commences at what are called "the Blue rocks," at the north end of the town, on the shore, below Fort Green. It runs interruptedly, all along the Island to the Portsmouth Coal Mines, which are about eight miles north of the town. In this shale is seen impressions of Lepidodendrons, Sagillaria and other fossil plants.

6th Rhode Island Coal.—(*See plate* 6, *fig.* 6.) This is an Anthracite of a lead blue colour, which is caused, by the diffusion of Plumbago, through

all its seams and crevices. The coal assumes sometimes after exposure a ferruginous rusty appearance. This coal is probably the oldest of all its kind for it has not only lost all its bitumen, (if it ever had any,) but is pervaded by seams of quartz, which are sometimes four or more inches in width; it has also seams of Asbestos and Amianthus. It is a very hard coal to kindle, but will make a very hot fire, if properly managed; it is economically used in the proportion of one-third with other coal, where much heat is wanted, for a long time, as for manufacturing purposes, &c.*

7th Diluvium. The Diluvium of the Island is a gravel of all its own rocks, covered with a somewhat stiff clay, and has a soil on top, which yields well by cultivation. There are none or very few boulders of any size, which have been transported from other localities, if we except some few, which lay on the shore below high water.

* When this coal was first discovered, a load was sent to a somewhat crusty old fellow, who had the old fashioned Liverpool coal grate, thinking that he would be the right person to try its properties, but in his grate which was of a wrong construction for burning this coal, and was particularly adapted for bituminous, the fire soon went out, which caused the old jockey to say, that if he wanted fire proof houses, he would certainly build them of this Rhode Island Coal, for it was the only material of the kind that would stand fire—we should not pronounce judgment too hastily. Rhode Island Coal would be invaluable if we had not a better quality in such large quantities.




Section of the Falls of Niagara
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, are Series of Rocks belonging to the Silurian.

## SECTION OF NIAGARA FALLS.

*Plate* 7.

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The rocks and formations at the Niagara Falls and River, are twelve in number, and are mostly described by Mr. James Hall, one of the Geologists of the State of New York.

1st Red Marl.—(*See plate* 7, *fig.* 1.) This is the lowest rock, the bottom of which lies below the level of Lake Ontario and is of a somewhat destructable kind.*

2nd Sandstone.—(*See plate* 7, *fig.* 2.) This Sandstone is said to be twenty-five feet thick, and is of the hardest kind, and not easily worn away by water. I suppose this Sandstone, which forms an irregular bar across the river,) by its hardness and its not being acted upon easily by the running water, its projection above the level of the marl which it overlies, and which is easily removed by the fierce stream, and by its crossing the river,) to cause, what is called the whirlpool; there is an

* In the Geological reports of the State of New York, all soft crumbling Rocks seem to be called Marl, and many of the Sandstones, Grits.

irregular bar similar to this across the Licking river in Kentucky, which at high-water shows all the same phenomena, but on a smaller scale.

3d Red Marl and Sandstone.—(*See plate* 7, *fig.* 3.) Seventy feet thick; of this it is said the upper layers only are hard.

4th Limestone.—(*See plate* 7, *fig.* 4.) Twenty feet thick.

5th Shale.*—(*See plate* 7, *fig.* 5.) Eighty feet thick. This shale is of much interest in a Geological point of view, as its softness causes it to be washed out of its bed from under the falls, leaving the Limestone (see 6th below) above, to hold up itself until a certain projection is formed, when by its vast weight it falls down in the abyss below. This debris is carried down the stream and is somewhat levelled on the bottom of the river. As the dip of this shale is descending towards Lake Erie, it must sink far below the influence of any water before it arrives at the boundaries of the Lake, so that Lake Erie will not be drained as soon as some of our very wise and flowery writers on Geology have imagined. I refer to those who write the romance of the science, prophecying miracles and making wonders as they go.

* This is another of these general names for any rock which has a slaty structure, and is not slate proper.

6th Limestone.—(*See plate* 7, *fig.* 6.) The Limestone of Niagara Falls is twenty feet thick at Lewistown, where it forms the top and peak of the bluff called Lewistown heights; and is eighty feet thick at the great pitch of the great fall and reposes on the shale described as 5th. This is the same rock as that at Lockport, and was called by Professor Eaton the "Geodiferous Lime Rock;" at that place the canal was cut through it at considerable depth and many beautiful minerals were obtained. If I understand things rightly, this is the main rock that forms the basin of Lake Erie, the level of whose waters is 334 feet higher than Lake Ontario. If the level at Lewistown is 9 feet higher than Lake Ontario, and there is a fall of 101 feet from the level of the great pitch, the great pitch being 164 feet and the fall at the rapids 40 feet, and 20 feet more from the rapids to the level of Lake Erie, then these sums added together give the whole height of the falls 334 feet, as stated above. Lake Ontario is said to be 222 feet above the level of the Atlantic Ocean, which added to the 334 feet, makes Lake Erie 556 feet higher than tide-water; now if a straight line be drawn from Buffalo to the Telegraph at Staten Island, which is the nearest point across the land to the

ocean,* it will be found to be about 300 miles, which is a rise of only about 100 feet, in every fifty-four miles, or thereabouts.

7th Shale.—(*See plate* 7, *fig.* 7.) This Shale belongs to the Onondaga salt group.

8th Corniferous Limestone.—(*See plate* 7, *fig.* 8.) This rock is a Limestone, with a large proportion of Hornstone, which is a silicious mineral, resembling flint in appearance, of the colour of horn, from which it takes its name, I have seen fossils in it completely silicated.

9th Pyritiferous Rock (of Eaton.)—(*See plate* 7, *fig.* 9.) This name seems to have been dropped by the state Geologists.

10th Shales of the Hamilton group.—(*See plate* 7, *fig.* 10.) See table.

11th Shells.—(*See plate* 7, *fig.* 11.) These beds of shells consist of Unio's, Anodonta's, Melania's and of other inhabitants of fresh water lakes and streams; they are found on top of the highest ridges of Lewistown heights and on Goat Island, and no doubt were left there when the level of Lake Erie was much higher than it now

* It is a great pity that the means could not be procured to build the Erie and New York Railroad, the distance in a straight line is so short; and I am of opinion that the land and property holders of this city stand greatly in their own light by not having the enterprize carried into effect.

is, and that they were carried there by the stream of the river when it runs over the top of these bluffs, for it is to be supposed that at some remote period the heights of Queenstown and Lewistown were joined and that the falls were as low down the river as that place, which is about seven miles from its present site.

12th Fragments of Sandstone and Limestones. —(*Plate* 7, *fig.* 12.) Mr. James Hall (State Geologist) says in his report "these fragments are thrown together in the greatest confusion, and bear conclusive evidence of the action of a powerful current."

Plate 8.

Fig. 2.

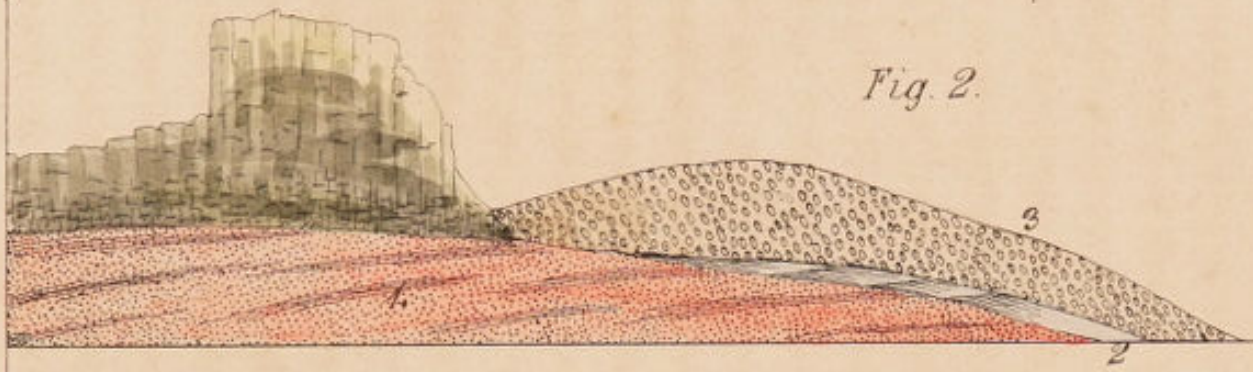
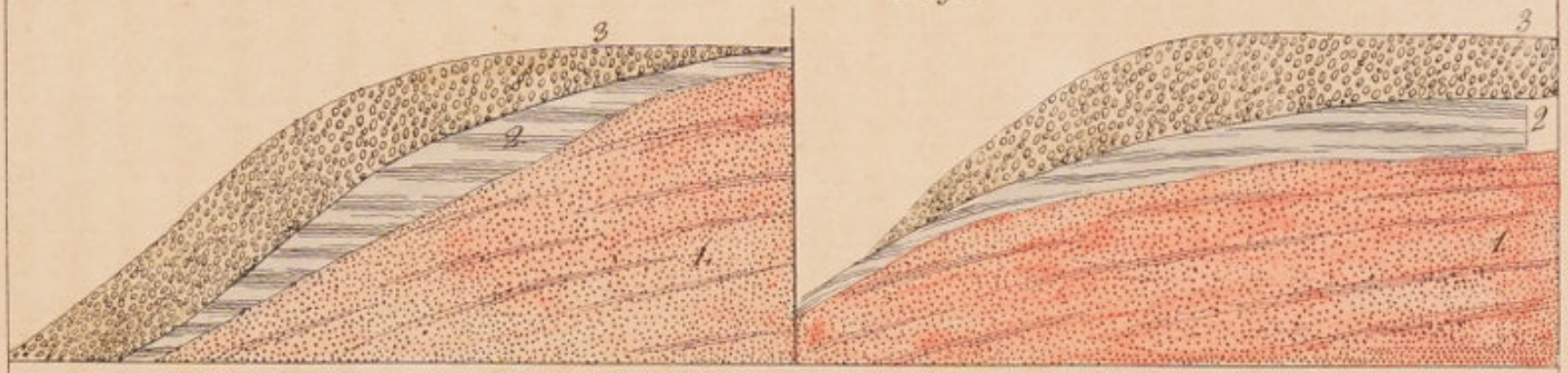



Fig. 1.




1 Old Red Sandstone 2 Shale with Fish 3 Conglomerate 4 Trap or Basalt

EXPLANATION of Plate 9. These Columns corresponding to the 7 Sections, Showing the different Rocks as they are found at the Localities they represent their figure and title corresponding with the Number of Each Plate.

### COLUMN of N. YORK Fig. 1.

- Diluvium. 8.
- Primitive Lime Stone 7.
- Serpentine. 6.
- * Quartz Rock. 5.
- * Hornblende Slate 4.
- * Gneiss. 3.
- Sienite. 2.
- Granite. 1.

* These 3 are at equal heights on our Island.

### COLUMN OF THE PALISADOES Fig. 2.

- Diluvium. 6.
- Basalt or Trap. 5.
- Green Stone Slate. 4.
- Red Sandstone. 3.
- Serpentine. 2.
- Granite. 1.

### COLUMN FROM THE HUDSON to the OCEAN. Fig. 3.

- Beach Sand. 10.
- Diluvium. 9.
- Tertiary. 8.
- Green Sand. 7.
- Trap. 6.
- Green Stone Slate. 5.
- Red Sandstone. 4.
- Serpentine. 3
- Gneiss. 2.
- Granite. 1.

### COLUMN of STATEN IS^D Fig. 4.

- Diluvium. 6.
- Pea-iron ore 5.
- Trap. 4.
- Red Sandstone. 3.
- Serpentine. 2.
- Granite. 1.

### COLUMN of DONDEBERG Fig. 5.

- Brick Clay. 5.
- Transition Limestone. 4.
- Talcose Slate. 3.
- Gneiss. 2.
- Granite. 1.

### COLUMN of RHODE IS^D Fig. 6.

- Coal & Shale. 5, 6, 7, 8.
- 4 Varieties of Graywacke. 4.
- Talcose Slate. 3.
- Serpentine. 2.
- Granite. 1.

### COLUMN of NIAGARA Fig. 7.

- Fresh Water Shells. 11.
- Shales of Hamilton Group. 10.
- Pyritiferous Rock of Eaton. 9.
- Corniferous Limestone. 8.
- Shale Belonging to the Salt Group. 7.
- Limestone. 6.
- Shale. 5.
- Limestone. 4.
- Red Marl & Sand-Stone. 3.
- Medina, Sandstone. 2
- Red Marl.

# CATALOGUE OF MINERALS.

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### LIST OF AGGREGATE OR COMPOUND MINERALS FOUND ON THE ISLAND OF NEW YORK IN PLACE.

Granite, Gneiss, Mica Slate, Hornblende Slate, Sienite, Primitive Limestone, Serpentine, Quartz Rock.

### LIST OF SIMPLE MINERALS FOUND IN PLACE ON NEW YORK ISLAND.

*Actinolite*, 60th Street, Hudson River.
*Anthophyllite*, " "
*Talc*, " "
" in Gneiss, Bellevue.
*Serpentine*, (Black,) 58th to 60th Street.
*Carbonate of Lime*, a vein in Serpentine, 58th Street.
*Quartz*, in all the veins of Gneiss and Granite.
" (Fetid,) in veins of Primitive Limestone, Kingsbridge.
" crystals in Granite, old Glass House Point.
" " " Bellevue.
*Feldspar*, in many veins in Granite and Gneiss.
" fetid in veins of Primitive Limestone, Kingsbridge.
" Adularia in veins of Gneiss, Bellevue.
*Mica*, in Granite and Gneiss.
" Green, (Dr. Torrey.)
" prismatic, in Granite, Bellevue.
*Hornblende Slate*, (Spuytenduyvel Creek.)

*Hornblende Slate*, Manhattanville.

" in Gneiss, Harlem Railroad.

*Tourmaline Black in Granite*, McGowan's Pass.

" " Gneiss, Fort Washington.

" " Fetid Feldspar, Kingsbridge.

" Brown or Brown Schorl in Primitive Limestone, Kingsbridge.

*Cyanite*, discovered by F. S. Cozzens near the Deaf and Dumb Institute.

*Tremolite*, Kingsbridge.

*White Augite*, "

*Titanium*, crystals of, Kingsbridge.

*Copper*, pyrites " "

*Iron*, " " "

" " in Gneiss, Hellgate Ferry.

*Sulphate of Iron*, Hellgate.

" " in the water of a well twenty-five feet below the surface, 8th Avenue near 28th Street.

*Sulphuric Acid*, an excess in Sulphate of Iron, Hellgate.

*Epidote*, New York and Harlem Railroad.

*Stilbite*, Red, " "

*Bog Iron Ore*, in many places in the low grounds between 8th Avenue on the west, and the old Kingsbridge road on the east, and between 6th Street on the south and 32nd Street on the north.

*Garnets*, coarse, in abundance in the Gneiss, Hopper's Point, Hudson River.

*Garnets*, small, in many places and at 32nd Street.

*Apatite*, or Asparagus Stone. (Dr. Torrey.)

*Sulphuret of Molybdena*, in Gneiss, R. R. Croton Water Works.

*Phosphate of Lime*, in crystals, Baron Lederer's Collection.

LIST OF MINERALS FOUND ON THE ISLAND OF NEW YORK IN BOULDERS, AGGREGATE COMPOUND.

*Granite*, many varieties.

*Gneiss*, " "

*Mica Slate.*

*Hornblende.*

*Primitive Limestone*, the same as that of Kingsbridge.

*Serpentine*, with all the varieties of Hoboken.

" Black, " " the Island.

*Sandstone*, all the varieties of New Jersey.

*Trap Basalt*, and Greenstone all the varieties of the Palisades.

*Delthyris Shale*, containing fossils.

*Transition Limestone*, same as that of Stoney Point (without fossils.)

*Limestone*, apparently the same as that which now is found above the Highlands ; containing fossil shells, corals, &c., &c.

*Argillaceous Slate*, the same as at Newburgh, Orange County, New York.

*North River Slate*, the same as that of Coeymans, New York.

*Hudson River Slate*, with veins of Quartz, the same as is found at Poughkeepsie.

*Graywacke or Grit*, the same as that from Kingston on the Hudson, which is used for flaggings in New York city.

*Talcose Slate*, same as at Peekskill and Stoney Point.

*Basanite*, (a kind of Lydian stone.)

*Anthophylite*, from the Serpentine locality of 60th Street.

LIST OF SIMPLE MINERALS FOUND IN THE DILUVIUM, AND OUT OF PLACE ON NEW YORK ISLAND.

*Actinolite*, Corlaer's Hook.
" 8th Avenue.
*Adularia*, Corlaer's Hook.
A mineral called Cleavelaudite in boulders of Trap, Corlaer's Hook and near 40th Street, North River.
*Amianthus*, in Serpentine boulders, Amity Street.
*Mountain Cork*, " "
*Amygdaloid*, Corlaer's Hook.
*Ligniform Asbestos*, " "
*Green Carbonate of Copper*, in coarse Jasper, Corlaer's Hook.
*Sulphuret of Copper*, in coarse Jasper, Corlaer's Hook.
*Cholorite Slate*, (green,) " "
*Epidote*, " "
*Garnets*, (Red) in Granite, " "
" (Brown) " "
*Micaceous Plumbago*, " "
*Hornstone*, " "
*Jasper*, coarse Red, " "
*Kaolin or decayed Feldspar*, old road three mile stone.
*Oxide of Manganese*, associated with Bog Iron Ore, 5th Avenue.
*Roe Stone*, a small round mass found by F. S. Cozzens, Corlaer's Hook.
*Quartz*, ferruginous, greasy, irised, milky, yellow, brown, red, &c., &c., and boulders all over the Island.
*Steatite*, or Soap Stone in boulders, 40th Street.
*Talc and Asbestos*, in a boulder of Serpentine, (Mathews.)
*Crichtonite*, in Smoky Quartz, found by (W. H. Pease.)

A boulder of "Verd Antique," near 24th Street and Union Square.

*Selenite*, in crystals in a Gneiss boulder, Harlem Common.

" " " " Corlaer's Hook.

FOSSILS FOUND ON THE ISLAND OF NEW YORK.

Delthyris, Orthis, Atrypa and other fossils found in Delthyris Shale. In some of these boulders all the Carbonate of Lime has gone, leaving the impressions of the shells in a porous Sandstone.

Madreporites, Cyathophyllum, &c., &c., were found by Dr. Alex. Anderson at Corlaer's Hook. The late M. Paff had in his possession a large boulder from Corlaer's Hook, which contained Coral and other fossil, which made when polished beautiful specimens.

The cellular part of a large bone, probably of the Mastodon, was found in digging the cellar of J. M. Bradhurst's house, about ten feet below the present surface, in Broadway near Franklin Street.

CATALOGUE OF MINERALS FOUND IN SECTION OF THE PALISADES, PLATE II.

In the Serpentine of Hoboken, are found Marmolite, Nemalite, Gurhofite, Conglomerate of pebbles, with a calcareous cement, Pulverulent Carbonate Magnesia, Chromate of Iron, Oxide of Iron, Native or Hydrate of Magnesia.

In the Trap or Greenstone, Calcareous Spar, Iron Pyrites, Pyritous Copper, Carbonate of Lime in veins, Stibbite, Prehnite, Datholite, Thomsonite, Mesotype, Iridescent Datholite, Rhombic crystals of Carbonate Lime, with faces resembling

Lenticular spar, Laumonite, a dyke of Green Trap. Iron Pyrites of a silvery hue, and Copper Pyrites of a golden hue, a mineral called Cleavelandite.

In the Sandstone, at Block House Point, Hudson River, Kaolin. —At Schuyler's Mine Calc. Spar, Pyritous Copper, Blue and Green Carbonate of Copper, Micaceous Oxide of Iron, &c.

### LIST OF MINERALS FOUND IN SECTION, PLATE III.

This cross section contains many of the minerals before mentioned in the Palisades and New York Island, the minerals peculiar to Long Island are round white Quartz pebbles, Limpid Quartz pebbles, Quartz pebbles coloured yellow with Oxide of Iron ; some few handsome Agates, Chalcedony and Jasper pebbles have been found associated with the Quartz pebbles.

A large bed of fine Potter's Clay is at Lloyd's neck, (Clarkson Crolius.)

Eagle Stone or nodular argillaceous Oxide of Iron, at Williamsburgh.

### LIST OF MINERALS IN SECTION, PLATE IV.

In the Serpentine of Staten Island are found

*Quartz*, gray, radiated with surface terminations.
" black, " " "
" green, " " "
" smoky small detached crystals.

Pulverulent Carbonate of Magnesia, Silvery Talc, Earthy Talc, Bronze crystals of Marmolite, Amianthus, Asbestos, Hematite, (brown,) many varieties, Chromate of Iron, Magnesite, Pea Iron Ore.

Fossils in the Diluvium, in a boulder Delthyris, Atrypa, &c.
In the Trap, south of New Brighton is found Laumonite.

### LIST OF MINERALS IN SECTION, PLATE V.

The minerals of Donderberg are the same as are in most Primitive Mountains with the exception that in the Transition Limestone there is a light olive green Talc.

### LIST OF MINERALS IN SECTION, PLATE VI.

On the Island of Rhode Island besides the minerals mentioned are Black Serpentine, Talc in Talcose Slate, at Fort Adams, small veins of Carbonate Iron, a peculiar kind of Staurotide in Argillaceous Graywacke, Asbestos, &c., in the Anthracite is Graphite, &c., &c.

### SECTION OF NIAGARA FALLS, PLATE VII.

Geodiferous Lime Rock, Swinestone, Calc. Spar, Snow white Gypsum, Selenite, Anhydrous Gypsum, Yellow Blende, Galena, Dog-tooth Spar, Bitter Spar, Lenticular Spar, Sulphate of Strontian, Iron Pyrites.

# GEOLOGICAL TABLES.

## EXPLANATIONS OF THE ABBREVIATIONS IN THE TABULAR COLUMNS.

### AUTHORS.

| | |
|---|---|
| B. Professor Buckland. | F. Professor Featherstonhaugh. |
| C. " Conrad. | L. " Lyell. |

| | | | | | |
|---|---|---|---|---|---|
| Br. | British Isles. | L. C. | Lower Canada. | Oh. | Ohio. |
| Con. | Connecticut. | Mam. | Mammalia. | Penn. | Pennsylvania. |
| Eng. | England. | Mass. | Massachusetts. | Rep. | Reptiles. |
| Eu. | Europe. | Mar. | Marine. | R. I. | Rhode Island. |
| Fr. | France. | Me. | Maine. | St. I. | Staten Island. |
| F. W. | Fresh Water. | N. Am. | North America. | Scot. | Scotland. |
| Ger. | Germany. | N. Eng. | New England. | S.Am. | South America. |
| Ire. | Ireland. | N. H. | New Hampshire. | Ten. | Tennessee. |
| Ky. | Kentucky. | N. J. | New Jersey. | Vt. | Vermont. |

## EXPLANATION OF THE TABULAR COLUMN.

Pages 81, 83, 85 & 87.

The next first four pages of Table I, form one column and is in an ascending series, beginning at the bottom of page 87, No. 1, Granite, (which was considered the lowest rock, by the older Geologists,) then going up the series and back to page 81 to the Diluvium, No. 53, which represents the top, the four pages taking in all the series and formations ; but it will be seen on page 85 there are numbers from 1a to 7a which is an innovation, I was forced to make to bring in the Silurian Rocks, for until lately these rocks were called Transition Limestone and Graywacke, (which are represented by 19 and 20, page 85,) and they were not divided into sections until Mr. Murchison undertook the task.

## *A Geological Column of Rocks, compiled from Professor Buckland and G. W. Featherstonhaugh.*

TABLE I.

| | No. | Organic Relics. | NAMES OF SERIES. | Material. | Locality. | Thickness. Depth in Feet. |
|---|---|---|---|---|---|---|
| Tertiary. | 53 | Mastodon, Megatherium, Megalonyx and other mam. | Diluvium. | A wash of sand-clay, grav., bould. &c. without the works of man. | Over the whole of the earth. | |
| | 52 | Land and F. W. Shells Larvæ of phryganae. | Upper Fresh Water. | Clay, Sand. | Auvergne in France. | 122 B. 60 F. |
| | 51 | Marine Shells. | Upper Marine. | Clay, Sand, Gypsum. | England, New York. Lower Canada. Maine. | 36 B. 160 F. |
| | 50 | Land and Fresh Water Shells. | Lower Fresh Water. | Clay, Sand, Gypsum. | England. | 63 B. 170 F. |
| | 49 | Mam. Rep. Fish, Shells and Wood. | London Clay. | Clay. | England. | 550 B. 110 F. |
| | 48 | Marine and Fresh Water Shells. | Plastic Clay. | Pipe Clay. | England. | 1131 B. |
| Cretaceous. | 47 | Fish, Shells, Echini, Zoophytes. | Chalk. | White Chalk with flints. | Europe. | Upper 320 / Lower 300 } B. 700 F. |
| | 46 | | Chalk Marl. | Chalk with clay. | England. | 200 B. 100 F. |
| | 45 | Fish, Shells, Echini, Zoophytes. | Upper Green Sand. | Clay and Sand. | England. | 150 B. |
| | 44 | | Gault. | | | |
| | 43 | Fish, Shells, Echini, Zoophytes. | Lower Green Sand. | | England, France, Germany, New Jersey. | 150 L. |
| Fresh Water. | 42 | Rep. Fish, Crustacea. Marine and F.W. Shells, Plants & Wood. | Weald Clay. | Clay and dirt beds, calcareous slate. | England. | 300 L. |
| | 41 | | Hastings or Iron Sand. | | England. New Jersey. | 500 B. 200 L. |
| | 40 | | Purbeck Limestone. | Clay. | England. | 400 B. |

*Continuation of Column No. 1.*

TABLE I.

| | No. | Organic Relics. | NAMES OF SERIES. | Material. | Locality. | Thickness. Depth in Feet. |
|---|---|---|---|---|---|---|
| Oolitic. | 39 | Saurians. Fish. Ammonites. | Portland Oolite. | Lime. | England. | 200 B. |
| | 38 | Nautilli Corals, Apiocrinites. | Kimmeridge Clay. | Clay. | England. | 600 B. |
| | 37 | Cidaris Belemnites. | Superior Oolite. | Lime. | England. | 40 B. |
| | 36 | Elytrum of Coleopterous Insects. | Coral Rag. | Lime and Sand. | England. | 30 B. 100. |
| | 35 | Scales of Fish. | Oxford Clay. | Clay. | England. | 200 B. |
| | 34 | | Cornbrash. | Sandy Lime. | England. | 10 B. |
| | 33 | | Forest Marble. | Lime. | England. | 60 B. |
| | 32 | | Bradford Clay. | Clay. | England. | 400 B. |
| | 31 | | Great Oolite. | Lime. | England. | 140 B. |
| | 30 | | Fuller's Earth. | Clay. | England. | 140 B. |
| | 29 | | Inferior Oolite. | Lime. Sand. | England. | |
| | 28 | Reptiles, Fish, and Shells. | Lias. | Clay and Limestone. | England, France. | 893 B. |
| Salt Group. | 27 | | Gypseous redsandstone | Sand, Clay, Gypsum, Salt. | England, Germany, France. | 1000 B. |
| | 26 | | Magnesian Limestone. | | England, Germany. | 300 B. |

*Continuation of Column No 1.*

TABLE I.

| | No. | Organic Relics. | NAMES OF SERIES. | Material. | Locality. | Thickness. Depth in Feet. |
|---|---|---|---|---|---|---|
| Coal Measures. | 25 | | Exeter Conglomerate. | | England, France, Germany. | |
| | 24 | | Coal Measures. | Anthracite and Bituminous coal. | Europe, North America. | 1000 F. |
| | 23 | Plants. | Millstone Grit & shale. | | Europe, North America. | 760 F. |
| | 22 | Shells. Zoophytes. | Carb'iferous Limestone. | | Europe, North America. | 850 F. |
| | 21 | Fish. | Old red Sandstone. | | Eng., Scot., N. York, N. Jersey, Pennsylvania, Connecticut. | 1500 F. |
| Silurian. | 7a | Trilobites, Graptolites, Shells & Corals | Black slate or Black shale. | | New York. | |
| | 6a | " | Corniferous Limestone. | Hornstone. Lime. | New York. Ohio, Kentucky, Tennesse. | |
| | 5a | " | Upper Fucoidal Sandstone. | | New York, Tennesse. | |
| | 4a | " | Hydraulic Limestone. | Lime, Clay, &c. | New York, | |
| | 3a | Fucoides and other Marine plants. | Lower Fucoidal Sandstone. | Sand and Oxide of Iron. | New York. | |
| | 2a | Trilobites, Marine Shells. | Mohawk Limestone. | Lime. | New York, Tennesse. | |
| | 1a | Sandstone. Lingula Ovata. | Potsdam Sandstone. | Sand and Lime. | New York. | |
| Transition. | 20 | Vermiform fossils resembling Annellides. | Graywacke. | Grits and Conglomerate. | Eng., Germany, Massachusetts, R. I., N. York, New Jersey. | 600 F. |
| | 19 | Lowest organic relics. | Transition Limestone. | Lime and Talc. | England. Stony Point, New York. | 350 F. |
| | 18 | All the rocks below this inclusive are Crystaline. | Alum Slate. | Pyrites and Native Alum. | British Isles. | 50 F. |
| | 17 | | Whetstone Slate. | | | 120 F. |
| | 16 | | Flinty Slate. | | Ireland. | 100 F. |

*Continuation of Column No 1.*

TABLE 1.

| | No. | Organic Remains | NAMES OF SERIES. | Minerals. | Localities. | Thickness. Depth in Feet. |
|---|---|---|---|---|---|---|
| Primitive. Magnesian Prim. | 15 | | Serpentine. | Silex and Magnesia colored by Iron and Chrome | New England, New Jersey, New York, Pennsylvania. | 150 F. |
| Primitive. Magnesian Prim. | 14 | | Diallage. | Silex and Magnesia with Lime. | New York Island Staten Island. | 70 F. |
| Primitive. Trappean. | 13 | | Green Stone | Hornblende. Feldspar. Quartz. | Scotland, Ireland, N. Y., Conn., New Jersey. | 100 F. |
| Primitive. Trappean. | 12 | | Green Stone Slate. | Hornblende and Feldspar. | New York, New Jersey, Connecticut. | 80 F. |
| Primitive. Primitive. | 11 | | Quartz rock. | Quartz in Grain with Mica. | British Isles, N. America, S. America. | 90 F. |
| Primitive. Primitive. | 10 | | Clay Slate. | | Cornwall, England. | 110 F. |
| Primitive. Magnesian Prim. | 9 | | Chlorite Slate. | Silex Magnesia and Alumine. | New York, Vermont, Pennsylvania. | 120 F. |
| Primitive. Magnesian Prim. | 8 | | Talcose Slate. | Argellite with Talc. | New York, Rhode Island, Virginia. | 150 F. |
| Primitive. Magnesian Prim. | 7 | | Steachist. | Soapstone. | Vermont. | 150 F. |
| Primitive. | 6 | | Hornblende. | Hornblende. | New Hampshire. New York. | 200 F. |
| Primitive. | 5 | | Hornblende Slate. | Hornblende and Quartz. | New York Island | 160 F. |
| Primitive. | 4 | | Primitive Limestone. | Marble and Dolomite. | New York, Vermont, Massachusetts, Pennsylvania. | 450 F. |
| Primitive. | 3 | | Mica Slate. | Mica and Quartz | Wales, New York, New England. | 300 F. |
| Primitive. | 2 | | Gneiss. | Mica, Quartz and Feldspar. | Europe, N. America. S. America. | 400 F. |
| Primitive. | 1 | | Granite. | Mica, Quartz, Feldspar. | Europe, N. America, S. America. | Depth unknown |

## EXPLANATION OF TABLE II.

Pages 89, 91, 93 & 95.

This table is in a descending order. The recent (No. 1) which I have added, is the uppermost and is of course placed at the top of the table—this is called by some Alluvium.

Mr. Lyell makes only two divisions in the older or Primitive Rocks, the stratified and the unstratified, but Granite is considered the lowest, see page 95.

## *A Geological Column of Rocks, after the manner of Mr. C. Lyell; with additions and remarks.*

TABLE II.

| | | | | |
|---|---|---|---|---|
| | | 1 | **Recent.**<br>1. Hoboken Meadows.<br>2. Gowannus "<br>3. Rockaway Beach. | Man and his cotemporaneous animalsand plants.<br>Psammobia fusca.—Ostrea borealis. |
| TERTIARY. | Super-Cretaceous. | 2 | **Newer Pliocene.** | This Newer Pliocene is the recent of Mr. Lyell, and contains fossil shells, &c., with relics of the works of man. |
| | | 3 | **Older Pliocene.**<br>1. Red Crag.<br>2. Coralline Crag. | Quartzose Sand and Shells, Fusus, Murex, Cypræa, Nassa, Astarte. Voluta Magellanica. |
| | | 4 | **Miocene.** | Land and fresh water shells—cylindrical cases of the Larvæ of Phryganea, coated with minute shells—at Auvergne, France, and Italy. This series is wanting in England. |
| | | 5 | **Eocene.**<br>1. London Clay. | Contains bones of Mammalia, Turtles, remains of Sword and Saw Fish, marine and fresh water shells. |
| SECONDARY. | Cretaceous Group. | 6 | **Chalk.**<br>1. White soft chalk with flints.<br>2. White hard chalk with few or no flints.<br>3. Chalk Marl. | This rock as Chalk, is not known on the Western Continent · but is abundant in Europe, particularly in England, and is characterized by the remains of Zoophytes, Shells, Shark's Teeth, palates of other Fish, Echini, &c., &c. |
| | | 7 | **Green Sand.**<br>1. Upper Green Sand.<br>2. Gault or Blue Marl.<br>3. Lower Green Sand.<br>4. Iron Sand.<br>5. with occasional Limestone. | There is in New Jersey at Mount Mitchill, Neversink Hills, and running south into the State of Virginia, a bed underlaying a ferrugineous sand called Marl, which appears to be by its organic remains an equivalent to the Green Sand of Europe—it contains vertebræ of the Whale, Shark's Teeth, Coprolites, Teeth of Monitors, and many fossil shells, &c. |
| | F. W. Group. | 8 | **Wealden.**<br>1. Weald Clay.<br>2. Hasting's Sand.<br>3. Purbeck Beds. | This contains what is called the Dirt Beds, and is remarkable for its fresh water and land fossils, its forests of stumps and trunks of trees—it contains the remains of Mammalia, Birds, Reptiles, Fish and Fresh Water Crustacea, (Cypris.) |

## *Continuation of Column No. 2.*

### TABLE II.

| | | | | |
|---|---|---|---|---|
| SECONDARY. | Oolitic Group. | 9 | **Upper Oolite.**<br>1. Portland Stone.<br>2. Kimmeridge Clay. | This group contains eleven or more series of strata, and is characterized by its Ammonites some of which are said to be as large as a coach-wheel, while others are of the size of a sixpence ; it does not cover a large area, but has many fossils, such as Reptilia, (some of which have been found eighteen or more feet in length, Icthyosaurus, Plesiosaurus, Amblyrhynchus, &c.) Bones of many kinds of Fish, as the Chimæra, Insects, Zoophytes, Radiata, Conchifera, Mollusca. |
| | | 10 | **Middle Oolite.**<br>1. Coral Rag.<br>2. Oxford Clay. | |
| | | 11 | **Lower Oolite.**<br>1. Cornbrash.<br>2. Forest Marble.<br>3. Great Oolite.<br>4. Fuller's Earth.<br>5. Inferior Oolite. | |
| | New Red Sandstone Group | 12 | **Lias.**<br>1. Blue Lias.<br>2. Striped "<br>3. White " | This section does not differ much from the rest of the Oolite, but in not containing the Oolite mineral called Roestone, and being the lowest of the group. |
| | | 13 | **Up. Red Sandstone.**<br>1. Keuper Sandstone.<br>2. Muschel-kalk Limestone.<br>3. Bunter Sandstein. | The fossils in this group consist of Swamp plants, Ammonites, Shells of the Posidonomya, Productus and Spirifer, Fish of the Genus Palæoniscus of Agassiz, Crinoidea or Stone Lillies, &c., &c., with large foot marks supposed to be of a gigantic Batrachian. |
| | | 14 | **Low. Red Sandstone.**<br>1. Magnesian Lime Stone. | |
| | Carboniferous G. | 15 | **Coal Measures.**<br>1. Coal.<br>2. Milistone Grit.<br>3. Mountain or Carboniferous Limestone. | This is characterized by its numerous species of Swamp Plants, such as Ferns, Sagillariæ, Calamites, Lepidodendron, &c., which appear to have grown in a warmer climate than the coal is now found in—there are also found a few fresh water and marine shells, teeth of fish of the Sauroid family of Agassiz. |
| | O. R. S. G.* | 16 | **Old Red Sandstone.**<br>1. Quartzose Conglomerate.<br>2. Cornstone and Marl.<br>3. Tilestone. | This rock is characterized by several species of cartilaginous fish with bony coverings, somewhat like the genus Loricaria of Lin, it contains also shells, &c. |

* Old Red Sandstone Group.

## *Continuation of Column No. 2.*

### TABLE II.

| | | | | |
|---|---|---|---|---|
| PRIMARY FOSSILIFEROUS ROCKS. | Ludlow Formation. | 17 | **Upper Silurian.**<br>1. Upper Ludlow, (micaceous gray sandstone.)<br>2. Aymestry Limestone, (argillaceous limestone.)<br>3. Lower Ludlow Shale with concretions of Limestone. | These rocks are what the older Geologists termed Transition and Graywacke, they contain numerous marine fossil shells, plants, Zoophytes, and Crustacea, (Trilobites,) but no remains of the higher order of animals have as yet been found. The Lingula Ovata of Conrad appears to be the oldest fossil known. |
| | Wenlock Forma. | | 1. Wenlock Limestone, (concretionary limestone.)<br>2. Wenlock Shale. (argillaceous shale.) | |
| | Caradoc Formation. | 18 | **Lower Silurian.**<br>1. Caradoc Sandstone, Flags and Shelly Limestone.<br>2. Sandstone thickly bedded.<br>3. White Freestone. | |
| | LlandeloForm. | 19 | **Llandelo Flags.**<br>1. Dark colored Calcareous Flags | ALL FOSSILS END HERE. |
| UNCONFORMABLE R'KS. | | 20 | **Volcanic Rocks.**<br>These are termed unconformable rocks and consist of :<br>1. Volcanic Ashes and Scoria.<br>2. Tuff.<br>3. Pumice Stone.<br>4. Lava.<br>5. Trap and Greenstone.<br>6. Basalt and Dykes.<br>7. Sienite.<br>8. Trachyte.<br>9. Porphyry.<br>10. Amygdaloid. | These rocks have many varieties of form and are generally vertical, (the Palisades of the Hudson River is one example,) they contain many minerals imbedded. Being thrown up by volcanic action they are found in all situations, sometimes above and sometimes below any of the others. |

## *Continuation of Column No. 2.*

TABLE II.

| | | | | |
|---|---|---|---|---|
| NON-FOSSILIFEROUS ROCKS. | Stratified Crys. | 21 | **Metamorphic Rocks.**<br>1. Argellite.<br>2. Talcose Slate.<br>3. Chlorite "<br>4. Mica "<br>5. Gneiss. | Stratified Primitive Rocks next above the oldest and containing the same veins and minerals as the oldest. |
| | Crystalline. | 22 | **Plutonic Rocks.**<br>1. Primitive Limestone.<br>2. Serpentine.<br>3. Diallage.<br>4. Steachist or Soapstone.<br>5. Hornblende.<br>6. Seinite.<br>7. Protogine.<br>8. Granite. | Lowest and oldest primitive Crystalline Rocks, contain viens with crystals, veins of ores, dykes and crystals of minerals disseminated through them, and are wholly crystalline. |

## EXPLANATION OF TABLE III.

Page 97.

Is a Column of the Silurian Rocks, in a descending series; the Rocks are divided by their fossils.

## *A Column of the* SILURIAN ROCKS *of the State of New York, from E. Conrad's Report of* 1841.

TABLE III.

### 1st or Upper Series.

| | Known Fossils. | |
|---|---|---|
| Oneonta Group, | Crustacea, | of Trilobites, 5 species. |
| Cazenovia Group, | Testacea, Bivalves, | of Avicula, 3 " |
| Tully Limestone, | | of Nuculites, 5 " |
| Sherburne Group, | | of Cypricardia, 10 " |
| Shales near Apulia, | Univalves, | of Bellerophon, 1 " |
| Black Slate, | Radiaria, | Euryale Annulatum, (De Kay,) |
| | Polyparia, | none. |
| | Marine Plants, | (none mentioned.) |

### 2nd or Middle Series.

| | Known Fossils. | |
|---|---|---|
| Onondaga Limestone, | Crustacea, | Trilobites, 15 species. |
| Corniferous " | Crinoidea, | |
| Grit Slate, (of Eaton,) | Testacea, Bivalves, | |
| Fucoidal Sandstone, | | Strophomena, 6 " |
| Oriskany Sandstone, | | Delthyris or Spirifer, 5 " |
| Crinoidal Sandstone, | | Atrypa, 5 " |
| Limestone and Shale, | | Pentamerus, 1 " |
| Pentamerus Galeatus Limestone, | Univalves, | - - - - - 14 " |
| Hydraulic Limestone, | Radiaria, | none. |
| Gypseous Shale, | Echinodermata, | - - - - - 1 species. |
| Rochester Shale, | Polyparia, | Coralline, 10 " |
| | Marine Plants, | Fucoides, Caudagalli 1 " |

### 3d or Lower Series.

| | Known Fossils. | |
|---|---|---|
| Pentamerus OblongusLimestone, | Crustacea, | Trilobites, 9 species. |
| Iron Ore and Green Slate, | Testacea, Bivalves, | |
| Red Sandstone, | | Strophomena, 7 " |
| Salmon River Shales, | | Orthis, 4 " |
| Trenton Limestone, | | Pentamerus, 1 " |
| Breccia, | Univalves, | |
| Sparry Limestone, | | Bellerophon, 2 " |
| Calciferous Sandstone, | | Trachus, 1 " |
| Potsdam Sandstone, | | Phragmolites, 1 " |
| | | Cyrtolites, 1 " |
| | Radiaria, | - - - - - - 1 " |
| | Crinoidea, | - - - - - - 3 " |
| | Polyparia, | Coralline, 4 " |
| | Marine Plants, | - - - - - - 3 " |
| | | Fuciodes Demissus. |
| | | " Harlani. |
| | | Dictuolites Beckii. |

## EXPLANATION OF TABLE IV.

Pages 99 & 101.

Are the same rocks as Table III, (divided and described by others of the New York State Geologists,) in a descending series from 1 to 13 ; on the top of which are two groups, viz., the Coal Measures and Old Red Sandstone or Catskill Group ; then at the bottom are placed the Volcanic, the Primitive Slaty or Striated, and the Primitive Crystalline, with the Granite, &c. at its base.

*A Column of the* SILURIAN ROCKS *of the State of New York, with the Old Red Sandstone of New York and Pennsylvania, and the Coal Measures of Pennsylvania above them (in a descending series,) as reported by Professor Emmons and Messrs. Hall & Vanuxem, in their Geological Reports of* 1840, *with additions, &c., &c.*

TABLE IV.

| | | Localities. |
|---|---|---|
| **Coal Measures,** | | |
| | Coal, | Pennsylvania. |
| | Conglomerate, | |
| **Catskill Group,** | | |
| | Old Red Sandstone, | Catskill Mountains, N. Y. |
| | Montrose Sandstone or Sandstone of Oneonta. | Blossburgh, Pennsylvania. |
| **1st of the Silurian Series.** | | |
| **Chemung Group,** | | |
| | Sherburne Flagstone, | |
| | Black Shale, | |
| **2nd Ithica Group,** | | |
| | Seneca Slate, | Seneca County. |
| **3d Portage Group,** | | |
| | Portage Sandstone, | |
| | Garden Flagstone, | |
| | Cashaqua Slate, | |
| | Genesee Slate, | |
| | Tully Limestone, | |
| | Moscow Shale. | |
| **4th Hamilton Group,** | | |
| | Marcellus Shale, | Seneca Co., Waterloo, Avon. |
| | Onondaga Limestone, | Vienna, Phelps. |
| | Schoharie Grit or Layers, | |
| | Caudigali-Grit, | Clarksville, Albany Co. |
| | Corniferous Limestone, | Black Rock, Erie Co., Helderberg. |
| | Oriskany Sandstone, | Phelps, Ont. co., Oriskany, Oneidaco. |
| | Catskill Shaly Limestone, | Helderberg Mts., Catskill Mts. |
| | Pentamerus Limestone, | |
| | Skeneateles Shale, | |
| | Seneca Limestone, | Seneca Falls. |
| | Scutella Limestone, | |
| | Delthyris Shaly Limestone, | |
| **5th Water Lime Group,** | | |
| | Magnesian Striations, (Lignilites of Eaton,) | Monroe Co. Helderberg Mts. |
| **6th Onondaga Salt Group.** | | |
| **7th Niagara Group,** | | |
| | Limestone and Shale. | |

## *Continuation of Column No. 4.*

### TABLE IV.

| | |
|---|---|
| **8th Clinton or Protean Group,** | |
| Limestone and Green Shale, | Rochester, Lockport. |
| Pentamerus Oblongus Limestone, | Rochester. |
| Oolitic Iron Ore, | " |
| Green Shale, | " |
| **9th Shawanjunk Group,** | Shawanjunk Mountains. |
| Oneida Conglomerate, | Oneida Lake. |
| Æsopus Millstone. | |
| **10th Hudson River Group,** | |
| Medina Sandstone, | Medina. |
| Salmon River Sandstone, | Turin. |
| Pulaski Shales, | |
| Frankfort Slate, | |
| Hudson River Slate, | Coeymans, Norman's Kill. |
| Fragmentary Limestone, | Opposite Albany. |
| **11th Black River Group,** | |
| Black Slate or Shale, | Albany, Cahoes Falls, Turin. |
| Utica Slate, | |
| Trenton Limestone, | Trenton Falls. |
| Bird's-Eye Limestone, | |
| Trenton Slate, | Turin, Trenton Falls. |
| **12th Champlain Group,** | |
| Mohawk Limestone, | Amsterdam, Glenn's Falls, Louisville, Saratoga. |
| Fucoides Layers, | |
| Calciferous Sand rock, | Noses on Mohawk R., Middleville. |
| **13th Potsdam Sandstone,** | Potsdam, Keesville. |
| **Volcanic Rocks,** | |
| Trap or Greenstone, | At Northfield, State nIsland. At and from Bergen Hill, New Jersey, to Harvestraw on the Hudson River, at Paterson, N. J., New Haven, Ct., Subterranean Wall, N. Car. |
| Basalt, | |
| Sienite, | |
| **Primitive Slaty Rocks,** | |
| Gneiss, | Island of New York, Westchester, Putnam and Rockland Counties, Highlands in Orange Co, Trenton, N. Jersey, Fair Mount, Philadel., most of the New England States. |
| Mica Slate, | |
| Hornblende Slate, | |
| Talcose Slate, | |
| **Primitive Crystalline Rocks,** | |
| Granite, | Underlays Staten Island and part of Long Island, at Hallet's Cove, Island of New York, Highlands, N. York, and in all the New England States. |
| Porphyry, | |
| Sienite, | |

## EXPLANATION OF TABLE V.

Pages 103, 105, 107, 109, & 111.

On the five following pages I have given a synopsis of the Rocks of North America in a descending order, from 1 at top to 25 at the bottom. It will be seen that at the top I have noticed many of the antiques, &c., of this continent, which I think should not be overlooked as they are interesting to the Geologist as well as to the Historian and Antiquarian.

*A Geological Column of the Rocks, &c., of North America; showing their different formations and positions, with their Localities; from the most recent and upper, to the lowest and most ancient; with observations on the same, by Issachar Cozzens, Jr.*

TABLE V.

| P. T.* | | |
|---|---|---|
| | | **Historic Age.** Man and his cotemporaries, with his works of art and science. |
| Antiques of the Aborigines and formations of the present age. | 1 | **Mounds** Containing human bones, fragments of rudely made pottery, utensils and ornaments worked from sea shells and native copper; pieces of wood and charcoal, &c., &c.; found at Cincinnatti, by J. Dorfeuille. In Montgomery Co., N. York, by Mr. Morris. At Constantia, L. Oneida, by myself. |
| | 2 | **Heaps of Oyster Shells,** With stone axes, rude pottery, arrow-heads, &c., &c. High banks on the Islands of New York and Long Island, and at Communipaw, N. J. |
| | 3 | **In Caves,** Are found dried human bodies, covered with robes made of Turkey's feathers and grass mats. Bones of the Megalonyx Jeffersonii. Virginia and Kentucky. |
| | 4 | **Salt Marshes and Sea Beaches,** Marine shells, Psammobia fusca, Ostrea borealis, &c., &c., at Hoboken, New Jersey Indian pipes. Sand, gravel and shells at Rockaway. |
| | 5 | **Peat Swamps and Lacustrine Deposit.** Bones of the Mastodon Giganteum, fresh water shells, Planorbis, Volvaria, Physa, and Infusoria at West Point, Orange Co., N. Y. |
| | 6 | **Big-bone Lick.** Bones of the Elephas Primogenias, Mastodon Giganteum, Megalonyx Jeffersonii,—three species of Bos. Stone arrow-heeds, &c., &c., Kentucky. (Megatherium Cuvieri, found at Skiddaway Island, Georgia.) |
| | 7 | **Coral Reefs.** Conglomerate of shells and coral. Florida, Bahama Banks, Bermudas. |
| | 8 | **Diluvium.** Boulders or Erratic blocks, sand, gravel, and the wash of all mountains and highlands. Country east of the Alleghanies, Atlantic coast from Maine to Staten Island. |

* Present Time.

## *Continuation of Column No. 5.*

TABLE V.

| | | | |
|---|---|---|---|
| Tertiary. | 9 | Pleistocene of Conrad, | This is 200 feet above the level of the sea. The Marine Shells, are Saxicava, Sanguinolaria, Modiola. In the Valley of Lake Champlain. Fifteen feet above the sea are the Ostrea, Virginiana, Venus mercenaria, Pyrula carica, Anomia, Astarte. In Maryland, Virginia and North Carolina. 100 feet above the level of the sea are found Nucula Portlandica, Mactra, Mya. Bangor, Maine. |
| | 10 | Post-Pliocene of Conrad, | 12 feet above the sea, Gnathadon cuneatus. Neuse Riv., N. Carolina, Potomac River, Maryland. |
| | 11 | Miocene of Conrad, | 100 feet above the level of the sea, 17 per cent. of recent shells, the rest are ancient, but none of this division are found in the Eocene below. Eastern counties of N. Carolina, Virginia, Maryland. |
| | 12 | Eocene of Conrad, | 200 feet, above the level of the sea. An equivalent to the "London and Paris Basins," no recent species. Clairbourne, Alabama; Natchez, Miss.; Wishita River, La.; Fort Washington, Piscataway and Upper Marlborough, and in Maryland. |
| Cretaceous. | 13 | Chalk. | This rock is wanting in North America. There is in the Lyceum of Natural History of New York, a gigantic shark's tooth, (Carcharias Megalodon,) from Cuba, presented by Mr. ———, this may belong to this series ? |
| | 14 | Green Sand or Jersey Marl. | This series contains the teeth and bones of Saurians, Sharks, &c., viz., Mososaurus, Geosaurus Mitchelii, Sphyræna, Lamna plicata, lanceolata, Mantelii, and acuneata. Shells: Gryphœa, Exogyra, Terebratula Sayii, Pecten quinque-costatus. Mt. Mitchill, Neversink Hills, N. J. |
| F. W.* | 15 | Wealden. | This series is not found in North America. |

* Fresh Water.

## *Continuation of Column No. 5.*

### TABLE V.

| | | | |
|---|---|---|---|
| Oolitic Rocks. | 16 | Oolite. | This rock has not as yet been found in North America, but Mr. Lea has described some fossils from New Grenada in South America, as belonging to the series.<br>The Oolite of Cumberland Mountains, described by Dr. Troost, I think is the same as the Roe Stone, which is very abundant in the upper part of Sussex County, New Jersey, and at Saratoga in the State of New York, and belongs to the rocks of the Silurian series. Mr. T. W. Storrow brought from Illinois, a specimen of Roe Stone which is very different from those brought from the above-mentioned localities. This may prove to be a true Oolite. |
| | 17 | Lias or Jura Formation. | None in North America. |
| New Red Sandstone. | 18 | Æsopus Millstone, | (Potomac Marble, of Rogers.) This is a coarse conglomerate, with a calcareous cement; it commences at Shawanjunk Mountains, New York State, running through Sussex Co. in New Jersey, and ending on the Potomac, where it is called "Potomac Marble." The nearest locality to the City of New York is at Ramapo River, near Pompton, New Jersey. See plate 8. |
| | 19 | Upper Red Sandstone. | This Sandstone is very abundant in the Western States, overlaying the Bituminous Coal.<br>At Cumberland Mountains, Little Rock Castle Creek, Kentucky, and in many other places it contains fossil vegetables, such as Palms, Ferns, &c. |

## *Continuation of Column No 5.*

### TABLE V.

| | | | |
|---|---|---|---|
| Carboniferous Group. | 20 | **Coal Measures.** | 1st. Bituminous Coal, abundant at Chesterfield, near Richmond in Virginia, (resting on Granite,) the upper layer of which contains fossil fish.<br>The Shales of Middletown, Connecticut, and of Pompton and Boontown, N. Jersey, are the same, and contain the same fossil fish as the above.<br>In the Ohio valley is the largest coal field in the world, this coal contains more Bitumen than common. The shales which accompany it abound with impressions of plants, such as Sagillaria, Calamites, and Lepidodendrons, &c., &c. At Pictou, in Nova Scotia, and at Newfoundland are also coal-fields.<br>2. Anthracite. The Black Anthracite Coal of Pennsylvania, is the largest bed of this variety of coal in the known world. The principal localities are Susquehanna, Lehigh, Schuylkill and Lackawanna.<br>It is accompanied by shale with impressions of plants, and rests on Argellite and roofing slate.<br>3. The Blue Anthracite of Portsmouth Rhode Island, is accompanied by Quartz and Asbestos and takes its color from Graphite or Plumbago. The shales are accompanied by the usual fossil plants, and it rests upon Graywacke and Talcose Slate.<br>4. The Worcester, Mass., Anthracite is nearly the same as the Rhode Island, but has a larger quantity of Graphite. |
| | 21 | **Carboniferous or Mountain Limestone.** | The localities of this series are in the valley of the Ohio. On the road near the Mount Vernon Post Office, in Kentucky, are many fossil Polyparia, measuring from 12 to 14 feet in diameter, and which project from the rock nearly one foot, the main rock having been worn from around them by time. |
| Old Red Sandstone. | 22 | **Old Red Sandstone.** | West side of the Hudson River, underlying the Palisades and other parts of New Jersey.<br>Underlying the Trap of East and West Rocks, New Haven, Connecticut.<br>These localities contain no fossils, but at Blossburgh in Pennsylvania, is found the Holoptychus Nobillissimus. |

## *Continuation of Column No. 5.*

### TABLE V.

| | | | |
|---|---|---|---|
| Primary Fossiliferous Rocks. | 23 | Silurian Rocks. | 1. Upper Silurian. This series contains more than four species of Trilobites, one Univalve, and some Radiata.<br>2. Middle Silurian, contains more than fifteen species of Trilobites, with Eurypterus remipes; ten species of Polyparia, one Fucoides, three Crinoidea, more than seventeen Bivalves, and fourteen Univalves.<br>3. Lower Silurian, contains about nine Trilobites, three Fucoides, two Polyparia, one Radiata, twelve Bivalves, five Univalves. This series is found west of the Alleghanies, extending from Canada, through New York, Pennsylvania, and Ohio to Kentucky; further to the southwest it has not yet been mentioned. |
| Unconformable. | 24 | Volcanic Rocks. | The principal localities are the Palisades, west side of the Hudson River, New Jersey; Passaic Falls, Patterson, New Jersey; East and West Rocks, New Haven, Connecticut; The Subterranean Wall, North Carolina. |
| Old Primary. | 25 | Metamorphic Rocks. | Eastern States. One ridge of the Alleghanies from New Hampshire to Alabama. |
| | | Plutonic Rocks. | Localities same as the Metamorphic Rocks. |

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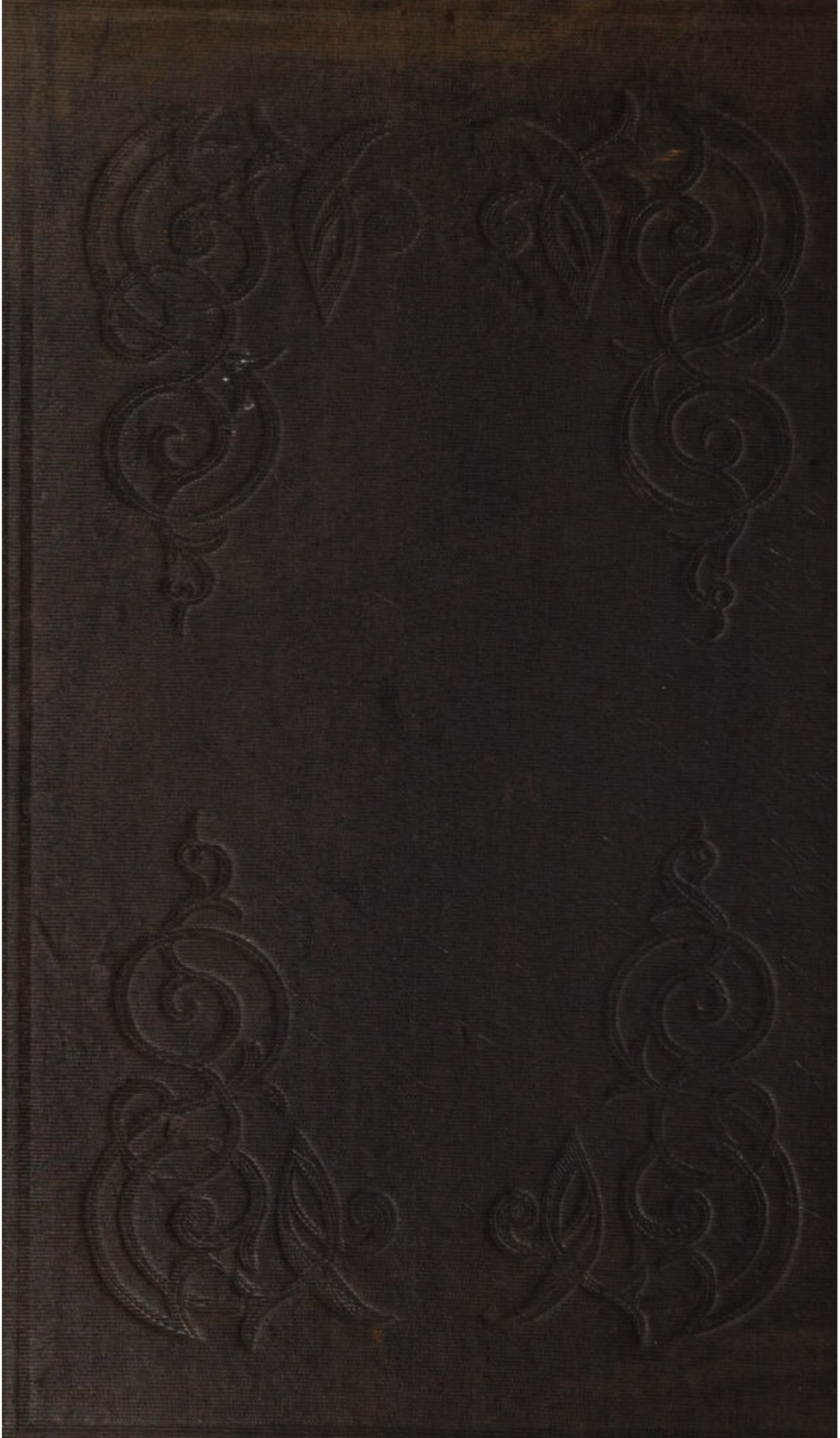
*New York, Feb.* 7, 1843.